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Knowledge Sharing Program

2022/23 KSP Policy Consultation Report

Jordan

Building Energy Efficiency Improvement

Ministry of Economy and Finance

kotra Korea Trade-Investment Promotion Agency

상명대학교산학협력단

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REPLUS

2022/23 KSP Policy Consultation Report

Project Title	Jordan Building Energy Efficiency Improvement
Prepared for	Ministry of Energy and Mineral Resources

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Prepared by	KOTRA(Korea Trade-Investment Agency)
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2022/23 KSP Policy Consultation Report

Building Energy Efficiency Improvement

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01

CHAPTER

Background

1) KSP promotion background and purpose
2) Jordan KSP promotion background

Attachment

Background

1) KSP promotion background and purpose

□ Korea's 'Knowledge Sharing Program (KSP)' is an international development cooperation project that utilizes Korea's development experience and knowledge to contribute to the economic and social development of partner countries while simultaneously building a friendly cooperation foundation with our country.

- Korea's 'Knowledge Sharing Program (KSP)' is an international development cooperation project that utilizes Korea's development experience and knowledge to contribute to the economic and social development of partner countries while simultaneously building a friendly cooperation foundation with our country.
- As the demand for sharing Korea's economic development experience increases among cooperative countries, the Ministry of Strategy and Finance has been implementing KSP since 2004 and provided policy advice on more than 1,200 projects for 80 countries until 2020.
  - Recently, there has been an increasing demand for utilizing KSP in the economic cooperation dimension, such as exports and overseas expansion of our companies, to create new growth engines in overseas markets.
  - Accordingly, while contributing to the sustainable growth of partner countries, the two countries seek to provide policy advice on promising industries, trade, investment, infrastructure, etc., and promote the possibility of linking follow-up projects.

□ Since 2014, KOTRA has been jointly overseeing and implementing KSP projects, specializing in the industry, trade, and investment sectors.

- KSP is being implemented to go beyond policy consulting and serve as a lever for substantive economic cooperation between Korean companies and cooperative countries.
- KOTRA aims to effectively carry out development consulting projects through institutions that can systematically and professionally implement KSP, and conducts commissioned projects to provide opportunities for participation in international development cooperation projects to public and private consulting firms and other related organizations.

2) Jordan KSP promotion background

□ Jordan, unlike the Middle East Gulf oil-producing countries, is a non-oil-producing country that relies on imports for about 92% of its energy sources.

- Energy consumption accounts for about 9% of GDP, and the demand for energy is increasing by 2.3% annually.
- The high dependence on energy imports is acting as a significant burden on the Jordanian government's finances, and it is necessary to reduce energy expenditure and improve energy efficiency.

□ The Jordan Ministry of Energy and Mineral Resources establishes the Jordan Energy Development Strategy for 2020-2030

- It suggests the main strategies such as breaking away from traditional energy sources and expanding renewable energy, reducing energy-related fiscal expenditures, and increasing energy efficiency.
- As a part of the energy development strategy, they are promoting energy efficiency in the private sector, and there is a need for legal and institutional mechanisms to establish an energy efficiency certification system for buildings.
- Although various projects have been carried out for energy efficiency, there are many challenges faced in building energy efficiency solutions, and in particular, increasing energy efficiency in residential areas is a major issue (accounting for 40% of total energy consumption).

- The Jordanian government evaluated that Korea had a successful development experience in the field of industrialization and energy efficiency, although it had a similar situation with Jordan in terms of insufficient natural resources and energy sources and requested sharing of policy establishment and implementation experiences through KSP.
  - The Jordanian government plans to utilize the results of this task for the 2020-2030 energy efficiency policy.

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CHAPTER

2022/23 Jordan KSP Building energy efficiency improvement project overview

2022/23 Jordan KSP Building energy efficiency improvement project overview

□ Project name: Jordan building energy efficiency improvement

□ Organization: Ministry of Energy and Mineral Resources in Jordan

<Table. Main task>

Classification	Contents
Policy advisory	**① Building Energy Efficiency Certification System Establishment Plan** - (Local analysis and knowledge sharing) Analyzing the status of Jordan's building energy efficiency certification system and providing experiences in Korea's building energy efficiency certification system - (Strategy derivation) Establishment of a certification system for new residential buildings suitable for the Jordanian situation
	② Establishment of laws and regulations enforcement plan to improve building energy efficiency - (Local analysis) Analysis of energy efficiency-related law enforcement procedures of agencies such as JNBC and RSS - (Knowledge sharing) Analysis and sharing of laws and support policies for improving energy efficiency of buildings in Korea, implementation plans and their effects, etc. - (Strategy derivation) Based on the results of local analysis in Jordan and Korea's experience, present a practical methodology for the implementation of laws and regulations related to building energy efficiency
	③ Building a database related to energy efficiency and establishing an analysis plan - (Local analysis and knowledge sharing) Analyzing the status of energy efficiency-related data in Jordan and analyzing and sharing cases of database establishment and operation in Korea - Data collection plan suitable for the current situation in Jordan and database utilization plan for energy efficiency improvement management supervision
Strengthening capacity	• **Conducted training in Korea by inviting Jordanian government officials** - Announcement of domestic interim report meeting research results and collection of opinions from the MEMR of Jordan - Invitational training for public officials and experts related to Jordan's MEMR and building energy efficiency - Field trips related to domestic building energy efficiency and meetings with related organizations - Meeting with domestic companies related to building energy efficiency (solar, heat pump, EMS, etc.)
Follow-up business	**(Plan 1) Implementation of a business-participation linked project that can contribute to building a foundation for public-private cooperation partnerships between the two countries in the field of domestic building energy efficiency.** **(Plan 2) Subsequent BEMS and HEMS business proposals to secure opportunities for domestic EMS companies to advance into Jordan**

03

CHAPTER

Project results

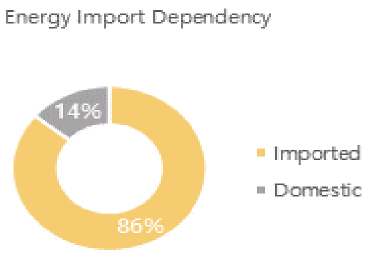
1) Status analysis
2) 2022/23 Jordan KSP Local seminar and Launching seminar
3) 2022/23 Jordan KSP Field survey and Local seminar
4) 2022/23 Jordan KSP Practitioners workshop and Interim seminar
5) 2022/23 Jordan KSP Local seminar and Final reporting seminar
6) Legal system analysis
7) Simulation (General)
8) Simulation (Passive measures)
9) Simulation (Active measures)
10) Building Energy Efficiency Improvement Roadmap

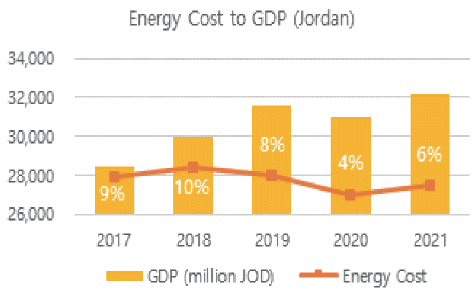
Project results

1) Status analysis

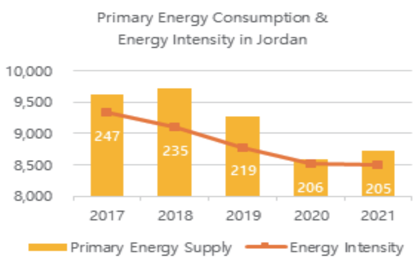
□ Energy supply and consumption

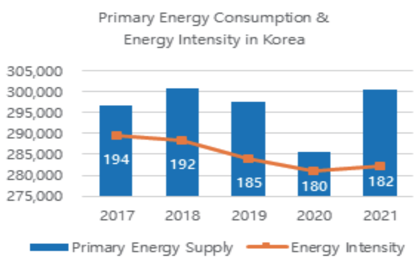
- "Jordan is a non-oil-producing country and heavily relies on energy imports like South Korea. Jordan's energy costs account for approximately 9% of its GDP."





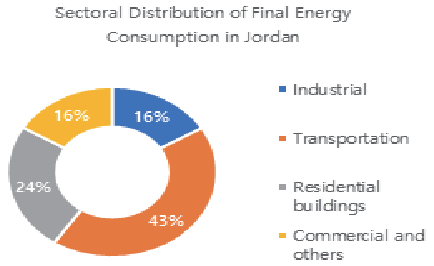
- Jordan and Korea showed similar energy intensities, the energy intensities showed a gradual decreasing trend.

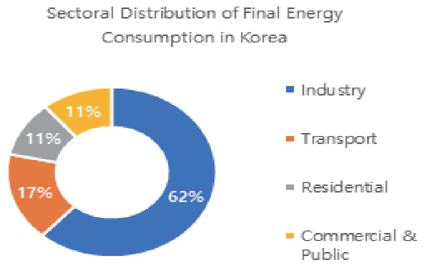




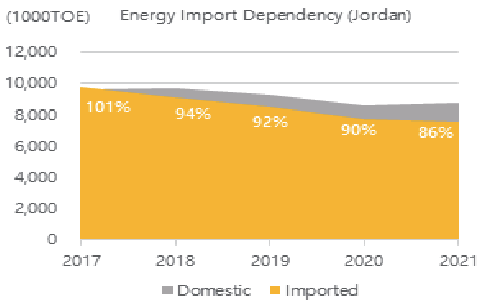
* Energy Intensity(kTOE/$1000):This indicator is the ratio between the gross inland consumption of energy and the gross domestic product (GDP)

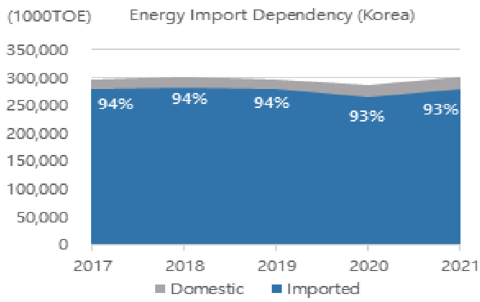
- Due to differences in industrial structure, with Jordan being service industry-oriented and South Korea being manufacturing-oriented, there is a difference in energy intensity across various industrial sectors.



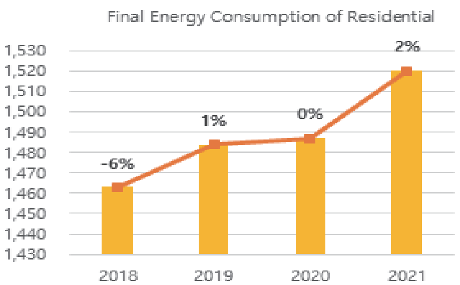


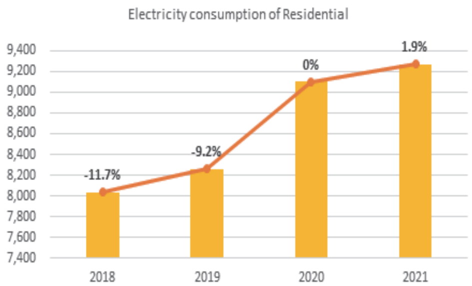
- Unlike Korea, Jordan showed a significant decrease in energy import dependency



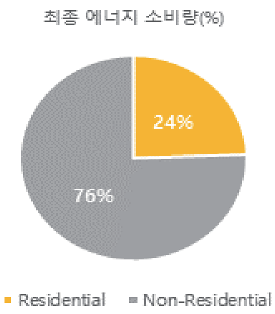


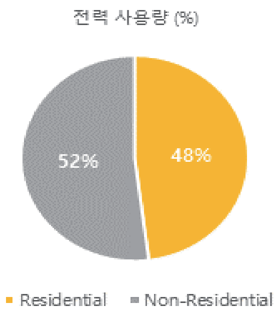
- By contrast, energy consumption in residential sector has been significantly increased.



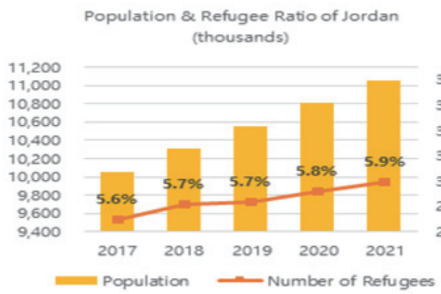


- Residential Buildings are major contributor to national energy consumption in Jordan which consumes 24% of final energy and 48% of electricity.





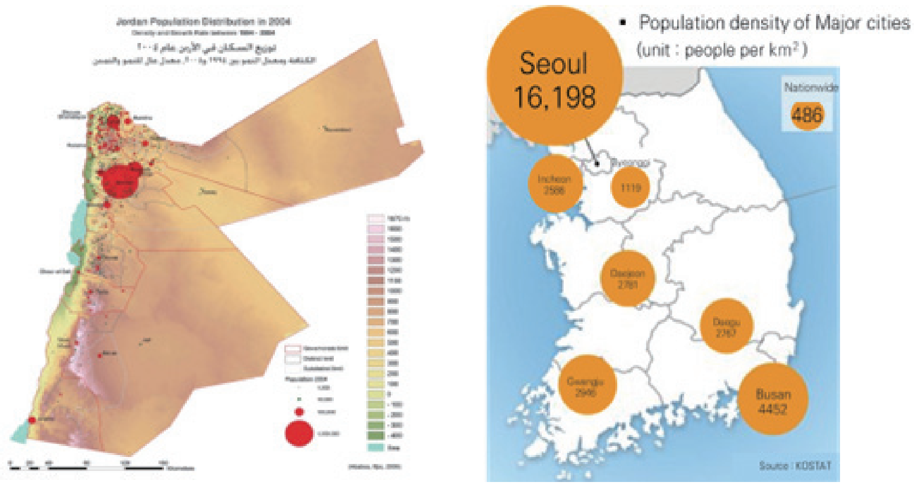
- Jordan’s population is rapidly increasing, and the influx of refugees due to geopolitical instability is expected to accelerate the growth of energy consumption in the residential sector.



□ Residential Sector

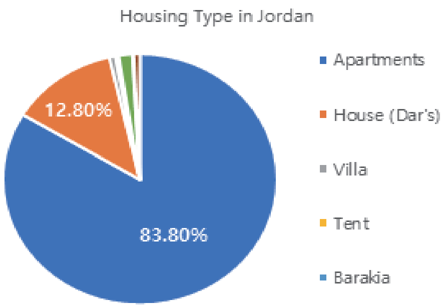
- Jordan is similar to Korea in that its population is concentrated in the metropolitan area.

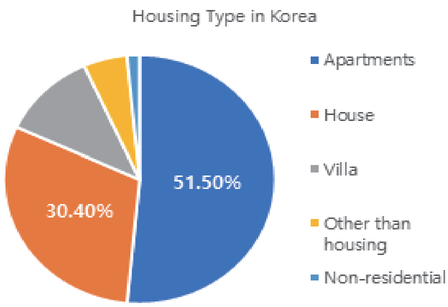
[Figure. Popular density in Jordan and Korea]



- 42% of population (113,020k from 4,744k) is concentrated in Amman (7,579km²) and 91.8% of population live in urban areas
- 50.3% of population (26,000k from 51,6000k) is concentrated in Capital Area(11,868km²) and 82.6% of population live in urban areas

• In the residential sector, the proportion of apartments in Jordan is 83.8%, South Korea, the share of multi-family housing, including apartments and villas equivalent to the Jordanian apartment format, is 84.1%, showing a similarity.



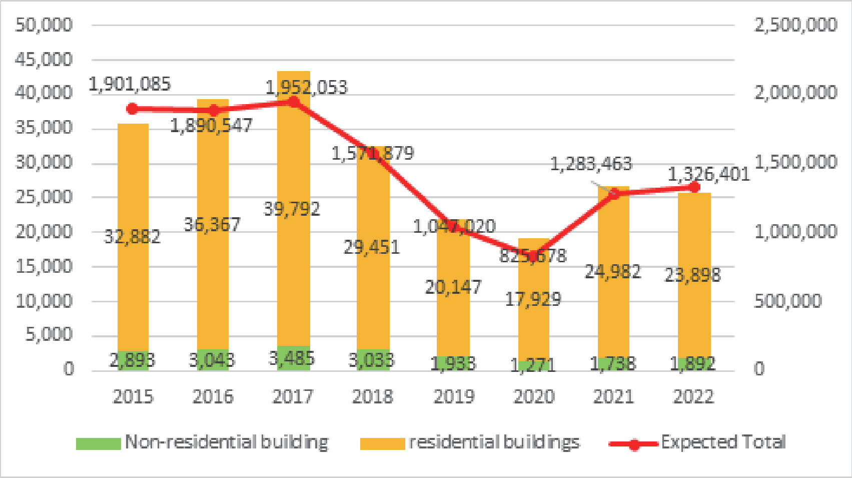


□ Construction activities

<Table. Number of permits for construction activities in Jordan>

Year	Non-residential building	residential building	Total	Estimated total amount (JOD)
2015	2,893	32,882	35,775	1,901,085
2016	3,043	36,367	39,410	1,890,547
2017	3,485	39,792	43,277	1,952,053
2018	3,033	29,451	32,484	1,571,879
2019	1,933	20,147	22,080	1,047,020
2020	1,271	17,929	19,200	825,678
2021	1,738	24,982	26,720	1,283,463
2022	1,892	23,898	25,790	1,326,401

[Figure. Number of permits for construction activities in Jordan and total estimated cost]



- Since 2015, construction activity in Jordan has decreased significantly due to the coronavirus, but is currently recovering again
- According to the Jordan Bureau of Statistics, the total number of building permit licenses in Jordan as of 2022 is 25,790 and the estimated total amount is 1,326,401 JOD.

2) 2022/23 Jordan KSP Local seminar and Launching seminar

□ 2023.02.20.(Mon) ~ 23.02.28.(Tue) / 5 nights and 7 days including departure and arrival days

□ Destination: Amman, Jordan

□ Purpose and major activities

- Detailed local fact-finding investigation
- Local Seminar
- Advisory Committee Selection
- Meeting with local institution officials and experts

□ Number of business travelers (total 3 people)

	Name	Affiliation	Position
1	Lee Soon Myung	Sangmyung University	PI
2	Hong Joonki	Sangmyung University	Researcher
3	Yoo Byungcheon	CEO of Replus	

<Table. Detailed schedule>

Date		Contents
2/20(Mon)	00:25~05:15	(Researchers, Jang Deok-Hwan, Kang Dong-Hun) Incheon → Doha
	06:15~09:30	(Researchers) Doha → Amman
	08:50~12:10	(Deok-Hwan Jang, Dong-Hoon Kang) Doha → Amman
	15:00~15:30	Arrival and check-in
	16:00~18:00	(Meeting 1) KOTRA Amman
2/21(Tue)	10:00~12:00	(Meeting 2) Ministry of Energy and Mineral Resources
	14:30~15:30	(Meeting 3) Southern Power
2/22(Wed)	10:00~12:00	(Meeting 4) German Jordan university
	16:00~18:00	(Meeting 5) Jordan University of Science and Technology
2/23(Thu)	10:00~12:00	(Meeting 6) JGBC
	14:00~16:00	(Meeting 7) JNBC of MoPWH
	16:00~18:00	(Meeting 8) CSBC of RSS
2/26(Sun)	09:00~10:30	(Meeting 9) Tour of Jordan's first LEED Gold-certified building
	10:30~12:00	(Meeting 10) Arab Technical Group
	14:00~15:00	(Meeting 11) Korean Embassy in Jordan
	16:00~18:00	rehearsal
2/27(Mon)	09:30~12:10	Launching seminar
	12:00~14:00	Lunch
	21:05~23:45	(Senior Advisor, KOTRA, Researchers) Amman → Doha
2/28(Tue)	02:15~16:55	(Senior Advisor, KOTRA, Researchers) Doha → Incheon

□ Summary of main activity results

Target	KOTRA Amman / Vice Director Chanyeol Kim, Deputy Director. Lee Ho-bin, Deputy Manager, Lee Jung-hyun, Team Leader
Date	Feb 20 (Mon) 16:00-17:00
Location	KOTRA Amman
Attendants	- KOTRA Development Cooperation Department Manager Jang Deok-hwan, Assistant Manager Kang Dong-hun - Sangmyung University Professor Lee Soon-myung, Hong Joon-ki
Purpose	- Understanding the overall background situation and points to keep in mind in Jordan - 22/23 Introduction of Jordan KSP project and understanding of expatriates' opinions
Contents	• Overview of Jordan's economic and trade situation and local conditions - Jordan served as a trade center in the Levant region, but its function is significantly paralyzed due to economic recession and geopolitical instability in the Levant region. - ODA from international organizations and foreign governments accounts for a significant portion of the economy, and various plans exist, but it is difficult to procure funds for them. - Domestic companies have entered Jordan, but business is being reduced. - Excessive labor regulations in Jordan act as an obstacle for foreign companies, including domestic companies, to enter Jordan. • 22/23 KSP project related status - Due to the lack of insulation in buildings in Jordan, local expatriates are also experiencing very high heating costs, so the topic of this project is considered an urgent issue. - Jordan charges high electricity bills, but electricity suppliers are running a deficit due to challenges - Jordan aims to export electricity to neighboring Levantine countries, but it is not enough due to geopolitical instability and the cost of building a power grid. • 22/23 KSP Project Opinions - Regarding the above-mentioned financing content, in this project, we will arrange a meeting with related ESCO companies that can finance the introduction of an incentive system that does not require any additional financial resources, and the training group's visit to Korea. - Excessive labor regulations in Jordan act as an obstacle for foreign companies, including domestic companies, to enter Jordan.

Photo of KOTRA Amman meeting	Photo of visit KOTRA Amman
	

Target	Jordan Southern Power / Kim-Youngjoo CFO, Kim Jin-beom Manager, Kim Kun-hee Technical Director
Date	Feb. 21st (Tue) 14:30-15:30
Location	Jordan Southern Power
Attendants	- KOTRA Development Cooperation Department Manager Jang Deok-hwan, Assistant Manager Kang Dong-hun, Amman Trade Center Nader Sawalha - Sangmyung University Professor Lee Soon-myung, Hong Joon-ki
Purpose	- 22/23 Introducing the contents of the Jordan KSP project and listening to the opinions of local expatriates - Consultation on the possibility of expanding domestic electric power company business in the future and requesting support
Contents	• Local situation related to KSP - The Jordanian government relies mostly on private companies for power generation and distribution, while NEPCO, a state-owned company, is only responsible for the transmission sector. - Jordan is experiencing difficulties in power system frequency management due to the increasing amount of renewable energy generation, and Southern Power is also focusing on flexible power supply. • Opinions of Korea South-East Power's expatriates regarding KSP project - Regarding building energy efficiency, energy saving in residential buildings is currently the most urgent issue in Jordan, so this KSP topic is satisfactory. - JNBC and RSS, which will be held in the future, are professional organizations directly related to the subject of the project, and it is believed that meetings with them will be key to the project. - High energy costs in the residential sector in Jordan are a serious burden on households, so it is hoped that this KSP project will solve these problems. • Suggestions and requests for support from researchers related to KSP project - Expansion of business in Jordan by parent company KEPCO, which is conducting metering business in Korea, regarding the challenges mentioned at the Amman Trade Center meeting and the Jordanian government's plan to introduce smart meters - Jordan is in an urgent situation of raising funds, and there is a possibility of entering the ESCO business in the residential sector in Jordan, where ESCO business is being carried out in Korea. - Support for Korea Southern Power, which advances into Jordan in advance, for meetings with domestic companies during the Jordan training team's visit to Korea, which will be held in the future

Photo of Southern Power meeting	Photo of visit
	

Target	Jordan Ministry of Energy and Mineral Resources / Eng. Yacob Marar, Director of RE&EE ant 8 others
Date	Feb. 21 (Tue) 10:00-12:00
Location	Jordan Ministry of Energy and Mineral Resources
Attendants	- KOTRA Development Cooperation Department Manager Jang Deok-hwan, Assistant Manager Kang Dong-hun, Amman Trade Center Nader Sawalha - Sangmyung University Professor Lee Soon-myung, Hong Joon-ki
Purpose	- 22/23 Introduction of Jordan KSP project and listening to the opinions of the ordering organization - Consultation with the ordering organization on the direction of future projects and details of cooperation
Contents	• Current situation in Jordan related to this KSP project - Currently, the influx of refugees is increasing due to geopolitical instability in the Levant, and these changes are affecting Jordan’s housing type and energy consumption patterns. - Energy consumption in the residential sector in Jordan is concentrated on heating, which is directly related to poor building insulation. • Opinions on KSP project - Jordan, as a tourism-oriented economy, is in a situation where the energy intensity needs to be much lower than that of Korea, which is an industry-oriented economy. Therefore, it is judged that there is a high possibility of improvement at this point. - Among the buildings, energy saving for residential buildings is currently the most urgent issue in Jordan, so this KSP topic is satisfactory. - JNBC and RSS, which will be held in the future, are professional organizations directly related to the subject of the project, and it is believed that meetings with them will be key to the project. - High energy costs in the residential sector in Jordan are a serious burden on households, so it is hoped that this KSP project will solve these problems. • Suggestions related to KSP project - Suggest an empirical study in connection with the Ministry of Finance of Jordan on the input costs and expected effects in relation to tax benefits for proposed green buildings - A proposal for a comprehensive improvement plan for the lack of human resources and supply chain in Jordan for the implementation of the proposed green building certification system - Eng. Arwa Abu Kashef took an interest in this project and decided to accompany him to a future meeting schedule.

Photos of MEMR meeting	Photo of visit
	

Target	German Jordanian University / Arch. Tala Samir Awadallah, Deans Assistant for Graduate Studies and 3 others
Date	Feb. 22 (Wed) 10:00-12:00
Location	German Jordanian University
Attendants	- KOTRA Development Cooperation Department Manager Jang Deok-hwan, Assistant Manager Kang Dong-hun, Amman Trade Center Nader Sawalha - Sangmyung University Professor Lee Soon-myung, Hong Joon-ki
Purpose	- 22/23 Introducing the contents of the Jordan KSP project and listening to local academic opinions - As a potential collaboration partner, discuss the intention and contents of future cooperation
Contents	• About GJU - GJU is an institution that conducts various programs related to building energy efficiency and is a research institution with expertise in the field. - Arch. Tala Samir Awadallah is the lead author of major laws related to Jordan and has a deep relationship with RSS, the legal development agency, and has excellent expertise. • Impressions related to this KSP theme - Among the mentioned regulations, the method of requiring higher standards for public buildings is similar to the building standards currently being newly developed in Jordan, so it is hoped that it will be able to benefit from the experience of Korea, a predecessor in this area. - In the case of Jordan, only the incentives for easing restrictions on gross floor area and height are granted, whereas Korea's institutional devices that can build a self-sustaining ecosystem through tax cuts and donation acceptance reductions are interesting and would like to receive help. • Cooperation intention and content of KSP project - Glad to about this project in Korea and willing to participate in this project together. - We are collecting data on the energy consumption model of residential buildings through interviews in relation to the database establishment mentioned in the future research plan, and we hope to cooperate and share in the collection process. - Jordan's related laws are provided only in Arabic, but we can provide an English version prepared in the course of a project with the EU. - In the TRNSYS simulation process mentioned in the future research plan, energy-efficient building data secured within GJU can be provided. • Opinions on KSP topic - Data on energy-efficient buildings in Jordan can be provided, but there are only a handful of energy-efficient buildings in Jordan, and data on general residential buildings are almost non-existent. - Due to the situation mentioned above, an urgent task in Jordan is the monitoring and measurement methodology for building energy consumption. Through the data collected in this way, it is expected to establish a benchmark for energy consumption of residential buildings in Jordan and develop an evaluation methodology based on this.

Photo of German Jordanian University meeting	**Photo of visit**
	

Target	German Jordanian University / Eng. Shefaa Al Khatatbah, Vice Chair of JGBC and 2 others
Date	Feb. 22 (Wed) 14:00-16:00
Location	Jordan Green Building Council
Attendants	- KOTRA Development Cooperation Department Manager Jang Deok-hwan, Assistant Manager Kang Dong-hun, Amman Trade Center Nader Sawalha - Sangmyung University Professor Lee Soon-myung, Hong Joon-ki
Purpose	- 22/23 Introducing the contents of the Jordan KSP project and listening to opinions from the local private sector
Contents	• About JGBC - JGBC is a non-profit organization affiliated with USGBC, the leading organization of LEED, the most widespread building energy certification system in Jordan, and is an alliance of local companies, engineers, and lawyers, as well as individuals and private companies. - JGBC carries out various projects such as building energy consumption models for residential buildings, establishing relevant certification systems, and constructing feasible eco-friendly houses. • Opinions related to this KSP project - Energy consumption in Jordan's residential sector acts as a major burden on households and the national economy. In the case of the introduced LEED, it is too complicated to spread and the absence of a benchmark is also a very serious problem. As a solution to this, establishing a certification system that the public can desire is very important. - There are existing building laws such as thermal transmittance standards, but they are not properly observed. In order to implement this, I think that an incentive method is more suitable than a regulatory method. - Along with the establishment of the system, it is necessary to share specific know-how on the implementation plan. From the perspective of local builders and developers, practical measures are needed on how to benefit them. - There is no interest from ESCO companies in Jordan about improving the energy efficiency of residential buildings. Stronger institutional support for businesses is needed to develop this into a profitable business sector. - In JGBC's opinion, it is necessary to spread energy-efficient buildings in the private sector, not led by the state.

Photo of JGBC meeting	Photo of visit
	

Target	Jordan University of Science & Technology / Prof. Anne Ghjaraibe, Act as the Dean of Architecture and 3 others
Date	Feb 23 (Thu), 09:30 - 12:00
Location	Jordan University of Science & Technology
Attendants	- KOTRA Development Cooperation Department Assistant Manager Kang Dong-hun - Sangmyung University Professor Lee Soon-myung, Hong Joon-ki
Purpose	- 22/23 Introducing the contents of the Jordan KSP project and listening to related academic opinions
Contents	• About Jordan University of Science & Technology - JUST is actively conducting research on economic and eco-friendly housing gap analysis and residential communities in Jordan, and is also conducting research on building industrial complexes in suburban areas using wind power generation. • Opinions on this KSP project - In the case of a quantified evaluation method such as Korea's energy performance index, it seems difficult to apply it in a situation where a building database to support it has not been established. - Areas other than Amman have lower income levels than Amman, so the residential culture is different. - In order to implement the aforementioned certification system in Korea, an empirical economic analysis that reflects the situation in Jordan is needed. - The most urgent task is to comply with the insulation standards for residential buildings in Jordan. We look forward to presenting a plan to implement this. - Unlike other countries, Jordan is a country with a very diverse climatic zone. - In the implementation of this certification system, the level of income is a very important issue, and the residential community should also be considered. In the future, I hope you will focus on 1. Society 2. Economy 3. Environment.

Photo of JGBC meeting	**Photo of visit**
	

Target	Jordan National Building Council / Dr. Jamal Qtaishat, Vice President and 2 others
Date	Feb 23rd (Thu), 14:00 - 15:30
Location	Jordan National Building Council
Attendants	- KOTRA Development Cooperation Department Assistant Manager Kang Dong-hun - Sangmyung University Professor Lee Soon-myung, Hong Joon-ki
Purpose	- 22/23 Introducing the contents of the Jordan KSP project and listening to opinions from related government agencies
Contents	• About JNBC - JNBC has a lot of interest in this project as an institution in charge of enacting and implementing laws related to building energy efficiency, such as thermal transmittance. • Q&A related to this KSP project Q1 : I am curious about the basis for the proposed thermal transmittance standard. A1 : In the case of Korea, a low thermal transmittance standard was set because of the cold and long winter. In addition, as a recent reversal phenomenon was observed, a new climate zone was set and classified according to altitude even in the same area. Q2 : I am curious about the management and supervision method in Korea for the quality of insulation materials that meet the aforementioned thermal transmittance. A2 : Regarding the quality control of insulation materials, in Korea, all building materials must obtain a nationally recognized test report. Also, during the construction process, necessary documents and evidence must be submitted to the relevant authorities. Q3 : I am curious about the specific details and economic feasibility of the incentive system you explained. A3 : If this is done through the reduction of floor area limits, height limits, donation acceptance standards, and tax cuts, etc., in the Korean environment where high-density development is common, the alleviation of floor area restrictions acts as a very strong incentive. • Opinions on this KSP project - In the case of Jordan, the lack of benchmarks for energy consumption of residential buildings is a major problem. In order to design a proper roadmap and establish an implementation plan, standards for this are needed first. - In Jordan, management of public and private buildings are separated. This creates more administrative costs - The Jordanian government has also developed standards for schools, hospitals, etc., and is currently making efforts to establish a system to improve energy efficiency in buildings. - In addition, it is necessary to establish systems and guidelines such as green material guideline, which are the basis for implementing these building standards.

Photo of JGBC meeting	**Photo of visit**
	

Target	Royal Scientific Society / Dr Adel Al-Assaf, Director of Building Research Centre and 4 others
Date	Feb 23 (Thu), 16:00 - 18:30
Location	Royal Scientific Society
Attendants	- KOTRA Development Cooperation Department Assistant Manager Kang Dong-hun - Sangmyung University Professor Lee Soon-myung, Hong Joon-ki
Purpose	- 22/23 Introducing the contents of the Jordan KSP project and listening to opinions from related government agencies - Consultation on future cooperation plans with related government agencies
Contents	• About RSS - RSS is a national key research institute directly under the royal family of Jordan - RSS is in charge of the actual 'certification' of Jordan's building energy certification system, energy audit, and technical development of the certification system. • Q&A on this KSP project Q1 : I would like to ask about the feasibility of this certification system in Jordan. If construction costs are increased for building certification, housing prices will also rise. A1 : The focus should be on increasing the total floor area by 15%. In Korea, a 15% increase in construction costs is generally expected to obtain such certification, and therefore additional incentives induce builders to voluntarily obtain certification. Q2 : Both real estate developers and investors in Jordan tend to focus on initial costs rather than future returns. This leads to a burden on households and the national economy due to low residential environment and rising energy rates. Efforts are being made to resolve this situation, but to no avail. A2 : In the case of Korea, it suffered similar difficulties. At the beginning of the introduction of the certification system, the performance was very poor, and the Korean government was also very anxious. The problem of stakeholders focusing on initial cost rather than life cycle cost in Korea has also been experienced, but it is now well established. Q3 : I am curious about the key factors that can lead to a significant increase in the number of certifications. Also, while the zero-energy certification is very impressive, it does not fit the current situation in Jordan. The challenge facing Jordan is compliance with insulation standards. A3 : As a side note, the purpose of zero energy building certification is not only to improve energy efficiency, but also to nurture related domestic industries such as PV, ESS, and BEMS. Therefore, as mentioned above, the purpose is to discover incentive factors that can attract building owners in accordance with Jordan's circumstances, and to discover related businesses that are necessary and feasible in Jordan. • Future cooperation plans related to this KSP project - RSS has currently submitted proposals for new building standards and ESCO project-related bills for residential buildings to the government and expects to share and discuss them. - RSS has a deep interest in residential building energy efficiency improvement and this project, and is willing to lead cooperation not only in this project but also in future related projects. In addition, there is a lot of interest in the entry of related Korean companies into Jordan. - RSS has a lot of data on gap analysis related to this and can provide it for this project. - Currently, the data of already certified energy efficient buildings in Jordan are not reliable. Most of these were provided by the client, and acted as an obstacle in empirical research. For these reasons, the importance of establishing a building energy database is particularly increased.

Photo of RSS meeting	Photo of visit
	

Target	Middle East Insurance Co. Building / Faris Bagaeen, Principal – Chief Architect, PMP
Date	Feb 26th (Thu), 09:30 - 10:30
Location	Middle East Insurance Co.
Attendants	- KOTRA Development Cooperation Department Manager Jang Deok-hwan - CEO of Replus Yoo Byung-cheon / Sangmyung University Professor Lee Soon-myung, Hong Joon-ki
Purpose	- Visiting buildings certified by the Building Energy Efficiency Certification System in Jordan - Listening to opinions from practitioners in Jordan
Contents	• About Middle East Insurance Co. Building and Faris Bagaeen - Middle East Insurance Co. is a building that received LEED Gold Level certification, a building energy certification system in 2008. - Faris Bagaeen, Principal is Jordan's preeminent architect and has managed one of a handful of LEED-certified building projects. • Listening to the opinions of current practitioners in Jordan - Most Jordanian clients are not interested in the building energy certification system. Middle East Insurance Co. In addition, it was possible to achieve a platinum level higher than the gold level, but the client wanted a shorter construction period. - There are no large construction companies in Jordan. It is a form in which small and small construction companies are crowded, and they do not use the proper level of insulation and do not know the proper design and construction method. - In Jordan, HVAC facilities are generally over-capacitated. The reason is that the building is not properly insulated, which leads to a vicious cycle that also leads to increased costs. - Education is the most important issue in improving the energy of residential buildings in Jordan. Colleges do not acquire knowledge about actual construction, and construction companies do not provide proper education, so the knowledge and experience of Jordanian architects and engineers are very lacking.

Photos from interview with Faris Bagaeen	Photo of visit
	

Target	Arab Technical Group / Eng. Lamees Abu Zneemeh, QS and Auditing Unit Manager
Date	Feb. 26 (Sun), 11:00 - 12:00
Location	Arab Technical Group
Attendants	- KOTRA Development Cooperation Department Manager Jang Deok-hwan - CEO of Replus Yoo Byung-cheon / Sangmyung University Professor Lee Soon-myung, Hong Joon-ki
Purpose	- Visiting buildings certified by the Building Energy Efficiency Certification System in Jordan - Listening to opinions from practitioners in Jordan
Contents	• About Arab Technical Group - Arab Technical Group is a Jordanian company that provides energy solutions for buildings, providing comprehensive solutions including HVAC facilities, water recycling, paint, insulation, and windows. - Arab Technical Group provides energy efficient interior solutions for commercial and residential buildings and has experience in implementing projects for existing buildings. • Listening to opinions from practitioners in Jordan - The Arab Technical Group headquarters building also received the LEED Arc Platinum level certification, but the Jordanian government's incentives for this were insignificant. - Arab Technical Group is a company that imports equipment and provides solutions. Currently, Japan's DAIKIN's products are mainly used for HVAC facilities and China's JINKO's products are used for PV panels, and there is a possibility that Korean companies will expand their entry.

Photos from Arab Technical Group interview	**Photo of visit**
	

□ 2022/23 Jordan KSP Launching Seminar

- Date: 2023.02.27. (Mon), 09:30-13:30 (including lunch)
- Venue: Jasmine Hall (B Floor), Grand Hyatt Amman
- Process: Face-to-face meeting (Korean-Arabic consecutive interpretation)
- Main attendees: 33 people (see attached for detailed list)
  - Korea : (Senior Advisor) Hong Young-pyo, Senior Advisor
    (Embassy of Jordan) Kim Dong-ki, Ambassador of the Republic of Korea to Jordan(KOTRA Development Cooperation Department) Director General Park Cheol-ho, Project Manager Jang Deok-hwan, Assistant Manager Kang Dong-Hoon
    (KOTRA Amman) Deputy Director Kim Chan-yeoul, Deputy Director Lee Ho-bin and 4 others
    (Researchers) CEO of Replus Yoo Byung-cheon / Sangmyung University Professor Lee Soon-myung, Hong Joon-ki
  - Jordan : (Government · Association) Jordan Ministry of Energy and Mineral Resources Secretary General Amani Al-Azzam and 33 others

<Table. Detailed program of Launching Seminar>

Time (Amman)	Program	note
09:30-09:50	Ceremony order and introduction of participants	Project Manager ang Deok-hwan (Jordan KSP PM)
	Opening address	(Kor) Senior Advisor
	Welcome speech	(Jor) MEMR Secretary General
	Congratulatory speech	(Kor) Korean Ambassador to Jordan
09:50-10:10	Introduction of KSP Project	PR video
10:10-10:30	Jordan Ministry of Energy and Mineral Resources Presentation of project request	Jordan Ministry of Energy and Mineral Resources
10:30-10:40	break time	
10:40-11:20	Subject 1: Jordan KSP Project Procedure Action Plan	Sangmyung University Professor Lee Soon-myung
11:20-11:50	Attendee discussion and Q&A	All attendees
11:50-12:10	Closing remarks / requests / photo	-
12:10-13:30	Lunch	-

- Main contents
  - (Jordan KSP Hong Young-pyo, Senior Advisor Opening address)
    KSP is a project that analyzes the policy difficulties faced by partner countries based on Korea's experience in economic development and provides customized policy advice. The case of Korea, which has a successful development experience, is expected to provide know-how to overcome the current situation of Jordan, which shares the limitations of a non-oil-producing country, and a driving force for policies to achieve national energy efficiency. Today's launch briefing is a place for Korean researchers to check the Jordanian government's demand and to discuss cooperation plans with Korean experts from the Jordan Ministry of Energy and Mineral Resources. I would like to ask for valuable opinions on whether the contents of the presentations by Korean experts well contain the policy demands of the Jordanian government.

  - (Amani Al-Azzam Jordan MEMR Secretary General Congratulatory speech)
    This project is part of an international effort to promote energy sustainability, which threatens humanity in various forms, while promoting friendship between Jordan and Korea. Jordan has excellent renewable energy resources and excellent human resources to utilize them. However, despite these efforts, Jordan's dependence on energy imports is still high, and improving energy efficiency in the consumer group is a major task to overcome this situation. The Jordanian government is making various efforts, such as creating JREEEF, and hopes to find opportunities to improve energy efficiency by sharing knowledge from both countries with this KSP project.

  - (Analysis of Jordan energy status)
    Jordan, as a non-oil producing country in the Middle East, shows high dependence on energy imports. This is a burden on Jordan's national economy and households, and factors such as attacks on Arab gas pipelines, which rely on most of its natural gas imports, and the increase in refugees due to geopolitical instability, have already caused a lot of damage to Jordan and are a continuing threat. . In terms of energy intensity, the two countries show similar movements, but unlike Korea, Jordan's share of renewable energy generation has increased. However, energy consumption is on the rise in the residential sector, which accounts for the majority of electricity consumption.

- (Analysis of energy status in the residential sector in Jordan)
  Jordan's residential sector accounts for 24% of final energy consumption and 48% of electricity consumption. Korea and Jordan share a similar population distribution. 42% and 50% of the population of Jordan and Korea, respectively, are concentrated in the metropolitan area, while 91% and 82% of the population live in urban areas. Also, in terms of housing type, 83% and 63% lived in apartments, which is a special commonality shared by both countries, unlike major developed countries where single-family homes are the majority. Next, both Jordan and Korea show similar residential energy consumption patterns despite different climatic zones, and both countries use 50% of the energy used in the residential sector for heating.

- (Analyzing related systems of both countries)
  In the case of regulatory devices, Jordan's Thermal Insulation Code, Energy Efficient Buildings Code, Korea's energy-saving design standards, heat loss prevention measures in the building sector, and energy-saving design standards are compulsory, so both countries are similar, but in Korea In addition, there is a total energy consumption limit system for individual buildings, which is more subdivided and has systematic regulatory devices such as energy performance index. In the classification of climatic zones for the thermal transmittance standard value of the insulation regulation, Jordan is classified into three climatic zones. In the case of Korea, three climatic zones were originally used, but recently, as a reversal phenomenon according to altitude was observed even within the same region, it was classified into four climatic zones. Korea has a building energy certification system for various purposes, such as energy consumption per unit area, energy self-sufficiency rate, and comprehensive eco-friendly evaluation index, and various incentives are being provided for its expansion. As a result of these efforts, we were able to achieve success in the building energy certification system.

- (Eng. Shefaa Al Khatatbah, Vice President, JGBC)
  First of all, thank you for conducting this research. In the case of the existing certification system in Jordan, factors such as lifestyle, income level and rental type of residents are included as well as energy consumption. In the case of Jordan, the income level is different from that of Korea, so there are parts where the case of Korea does not fit the situation in Jordan.

- (Prof. Lee Soon Myung)
  Of course, Korea is building an energy database of over 10 million residential buildings, and this is different from the situation in Jordan. However, in a situation where indoor residential thermal balance is not maintained, energy consumption is a very important factor. In the case of existing buildings, window replacement and green remodeling, and in the case of new buildings, it is considered necessary to propose new energy management standards.

- (Eng. Ahmad Bassam, JREEEF)
  Jordan's high energy costs pose a significant household burden to the poor, and it is hoped that it will be possible to establish energy efficiency measurement measures, benchmarks, and databases, which are insufficient in Jordan. This KSP project is a very valuable opportunity for Jordan, and we hope that Jordan's residential buildings will comply with insulation standards in the future.

- (Arch. Tala Awadallah, German Jordanian University)
  I think it would be very beneficial to receive policy consulting from Korea, which shares the special commonalities you mentioned, and I am very grateful for conducting such a project. We also hope that these opportunities for cooperation will expand in the future.

- (Jordan KSP Hong Young-pyo, Senior Advisor Opening address)
  It was an opportunity to confirm that the topic of this project is an urgent task that Jordan needs. I could sense that Jordan was also putting a lot of thought and effort into this, and I think that these capabilities provide good conditions for future business.

Jordan KSP Launching Seminar	Jordan KSP Launching Seminar
	

Jordan KSP Launching Seminar	Jordan KSP Launching Seminar
	

Jordan KSP Launching Seminar	Jordan KSP Launching Seminar
	

Jordan KSP Launching Seminar	Jordan KSP Launching Seminar
	

3) 2022/23 Jordan KSP Field survey and Local seminar

□ Period : 2023.04.29.(Sat)~23.05.8.(Sun)
(7 nights and 10 days including departure and arrival days)

□ Destination : Amman, Jordan

□ Purpose and major activity
- In-depth field survey
- Local seminar
- Interview with advisory committee
- Discuss future research plans
- Interview with local practitioners

□ Number of business travelers (total 4 people)

	Name	Affiliation	Position
1	Lee Soon-myung	Sangmyung University	PI
2	Kim Gil-jung	Sangmyung University	Researcher
3	Lee Sung-hyun	Sangmyung University	Researcher
4	Yoo Byeong-cheon	Replus CEO	

<Table. Detailed schedule>

Date	Contents	Note
April 29th (Sat)		
(Departure) 17:55 (Arrival) 22:40	Incheon → Abu Dhabi (Transfer)	EY0857
April 30th (Sun)		
(Departure) 10:10 (Arrival) 12:25	Abu Dhabi → Amman (Jordan)	EY0513
May 1st (Mon)		
10:30-13:00	**Visit GJU (German-Jordan University)** - Korea-Jordan Certification System and System Comparison Workshop - Discuss simulation plan - Discussion of on-site fact-finding	

17:00-18:00	**Visit KOTRA Amman** - Report on local seminars and field survey plans	
May 2nd (Tue)		
10:00-11:00	**Site 1 : House**	Field survey (Indoor comfort level/ cooling/heating energy/ energy cost/water supply/ sewerage/improvement requirements)
11:00-11:30	**Site 2 : House**	
11:50-12:30	**Site 3 : Apartment**	
13:00-13:30	**Site 4 : House**	
13:30-14:00	**Site 5 : Apartment**	
14:30-15:00	**Site 6 : House**	
15:30-16:30	**Site 7 : Apartment**	
16:30-17:00	**Site 8 : Villa**	
17:30-18:30	**Site 9 : Apartment**	
May 3rd (Wed)		
09:30-10:30	**Case sharing on green architecture** (Dr. Ayyoub Abu Dayyeh, King's Academy)	Online meeting
11:00-10:30	**Site 10 : Apartment**	Field survey (Indoor comfort level/ cooling/heating energy/ energy cost/water supply/ sewerage/improvement requirements)
18:00-1:00	**Site 11 : Apartment**	
May 4th (Thu)		
10:00-11:00	**Site 12 : Visit JGBC recommended site**	Field survey (Indoor comfort level/ cooling/heating energy/ energy cost/water supply/ sewerage/improvement requirements)
11:00-11:30	**Site 13 : Visit JGBC recommended site**	
12:00-16:00	**Local advisory seminar** - Korea-Jordan Certification System and System Comparison Workshop - Report on site investigation results - Discuss simulation plan	Location : Grand Hyatt Amman Conference Room MEMR (Jordan Ministry of Energy and Mineral Resources), GJU (Jordan-German University), Participated in Advisory Board
May 5th (Fri)		
11:00-12:00	**Site 14: Visit the house of Dr. Ayyoub Abu Dayyeh**	Field survey (Indoor comfort level/ cooling/heating energy/ energy cost/water supply/ sewerage/improvement requirements)

May 7th (Sun)		
12:00-13:00	**Visit MEMR (Jordan Ministry of Energy and Mineral Resources)** - Field survey and sharing of seminar contents	
(Departure) 14:20 (Arrival) 18:20	Amman (Jordan) → Abu Dhabi (Transfer)	EY0514
(7th Departure) 22:15 (8th Arrival) 11:40	Abu Dhabi → Incheon	EY0856

□ Summary of major activities

Local meeting	GJU, MEMR seminar	**Date**	May 1st (Mon) 10:30-13:00
		Location	GJU conference room
Attendants	KSP Researchers, Sondos (Interpreter), Tala Samir Awadallah, Farah Al-Atrash, Omaimah Ali Al-Arja, Arwa Abu kashef		
Purpose	Prior to field surveys and local seminars, to explain the progress of research and comparison of systems between the two countries. In addition, analysis of energy consumption and review of weaknesses through simulation		

Contents

- Modifications and consultations regarding the advisory committee contract
- Korea-Jordan Building Energy Efficiency System and Insulation Code Comparison Workshop
  - Comparing systems and codes between the two countries, grasping the current situation and facts, and discussing research collaboration on areas that need supplementation of data.
- Discuss simulation plan
  - Seeing simulation modeling and results, and receiving feedback on areas lacking. Through this, a new modeling was set up, and a more realistic simulation plan was established.
- Discussion of field survey
  - Discussed the overall flow and the areas to be focused on for the field survey to be carried out in the future, and revised the details of this question while looking at the questionnaire prepared in advance

Photo

<table>
<tr><th rowspan="2">Local meeting</th><td rowspan="2">KOTRA Amman</td><th>Date</th><td>May 1st (Mon) 17:00-18:00</td></tr>
<tr><th>Location</th><td>KOTRA Amman</td></tr>
<tr><th>Attendants</th><td colspan="3">KSP Researchers, (KOTRA Amman) Lee Young-hee Director General , Lee Jung-hyun Marketing Team Leader, Lee Ho-bin Deputy Manager</td></tr>
<tr><th>Purpose</th><td colspan="3">Report on the results of GJU workshops, field surveys and local seminar plans</td></tr>
<tr><th colspan="4">Contents</th></tr>
<tr><td colspan="4">• Sharing the results of GJU and MEMR seminars in the morning
- Confirmation of facts through comparison of the islands of Korea and Jordan and sharing of plans for future comparative research collaboration
- Share the overall plan for future on-site surveys and preparations for survey methods such as surveys
- Showing simulation modeling and results and discussing how to use them in future research

• Discussion of future plans and directions for project progress
- Discussion on the possibility of development and sharing of opinions on reaching the final goal, such as BTB meeting through assignments and listing of domestic companies</td></tr>
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<table>
<tr><td rowspan="2">Site 1</td><td rowspan="2">Site 1 : House</td><td>Date</td><td>May 2nd (Tue) 10:00-11:00</td></tr>
<tr><td>Location</td><td>Amman, Swileh</td></tr>
<tr><td>Attendants</td><td colspan="3">KSP Researchers, Sondos (Interpreter), Prof. Omaimah Ali, Dr. Farah Al-Atrash
Arch. Tala Samir Awadallah</td></tr>
<tr><td>Purpose</td><td colspan="3">Jordan Residential Building Site and Energy Consumption Survey and Resident Survey</td></tr>
<tr><td colspan="4">Contents</td></tr>
<tr><td colspan="4">• Visit residential building sites in Jordan to understand the living environment and inspect facilities
- Install blinds on windows
- About 75% of the water tax is subsidized by the government
- Equipped with both photovoltaic & solar heat facilities on the rooftop

• Surveys and interviews are conducted to conduct fact-finding surveys
- Monthly electricity bill : 7JD
- Dissatisfied part in the residential sector : high heating costs

• Identify deficiencies in building insulation and heating and cooling facilities</td></tr>
<tr><td colspan="4">Photo</td></tr>
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<table>
<tr><td rowspan="2">Site 2</td><td rowspan="2">Site 2 : House</td><td>Date</td><td>May 2nd (Tue) 11:00-11:30</td></tr>
<tr><td>Location</td><td>Amman, Swileh</td></tr>
<tr><td>Attendants</td><td colspan="3">KSP Researchers, Sondos (Interpreter), Prof. Omaimah Ali, Dr. Farah Al-Atrash
Arch. Tala Samir Awadallah</td></tr>
<tr><td>Purpose</td><td colspan="3">Jordan Residential Building Site and Energy Consumption Survey and Resident Survey</td></tr>
<tr><td colspan="4">Contents</td></tr>
<tr><td colspan="4">• Visit residential building sites in Jordan to understand the living environment and inspect facilities
- There is a ventilation culture, so it is necessary to ventilate for 1-2 hours in the morning.
- Heating using kerosene
- There is no floor heating, so all carpets are laid
• Surveys and interviews are conducted to conduct fact-finding surveys
- Monthly electricity bill : 11 JD
- Dissatisfied part in the residential sector : High cost for water supply
• Identify deficiencies in building insulation and heating and cooling facilities</td></tr>
<tr><td colspan="4">Photo</td></tr>
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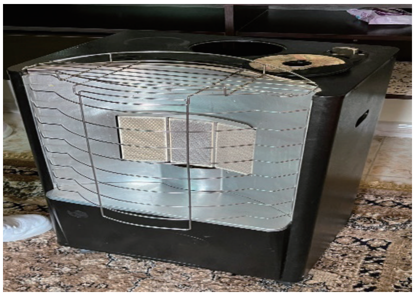
<tr><td colspan="2"></td><td colspan="2"></td></tr>
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Site 3	Site 3 : Apartment	Date	May 2nd (Tue) 11:50-12:30
		Location	Amman, tla Al Ali
Attendants	KSP Researchers, Sondos (Interpreter), Prof. Omaimah Ali, Dr. Farah Al-Atrash Arch. Tala Samir Awadallah		
Purpose	Jordan Residential Building Site and Energy Consumption Survey and Resident Survey		

Contents

- Visit residential building sites in Jordan to understand the living environment and inspect facilities
  - Cooling by using an air conditioner
  - Heating by using a stove
  - There is no separate manager in the apartment
- Surveys and interviews are conducted to conduct fact-finding surveys
  - Monthly electricity bill : 24JD
  - Dissatisfied part in the residential sector: frequent power outages
- Identify deficiencies in building insulation and heating and cooling facilities

Photo

	
	

Site 4	Site 4 : House	Date	May 2nd (Tue) 13:00-13:30
		Location	Amman, Airport road
Attendants	KSP Researchers, Sondos (Interpreter), Dr. Farah Al-Atrash, Arch. Tala Samir Awadallah		
Purpose	Jordan Residential Building Site and Energy Consumption Survey and Resident Survey		

Contents

- Visit residential building sites in Jordan to understand the living environment and inspect facilities
  - Cooling by using an air conditioner
  - Heating using a radiator
  - The first floor is used as a detached house and the lower floors are apartments.
- Surveys and interviews are conducted to conduct fact-finding surveys
  - Monthly electricity bill : 31JD
  - Dissatisfied part in the residential sector : The room is too cold. (Heating is not good)
- Identify deficiencies in building insulation and heating and cooling facilities

Photo

	
	

<table>
<tr><th rowspan="2">Site 5</th><td rowspan="2">Site 5 : Apartment</td><th>Date</th><td>May 2nd (Tue) 13:30-14:00</td></tr>
<tr><th>Location</th><td>Amman, Airport road</td></tr>
<tr><th>Attendants</th><td colspan="3">KSP Researchers, Sondos (Interpreter), Dr. Farah Al-Atrash, Arch. Tala Samir Awadallah</td></tr>
<tr><th>Purpose</th><td colspan="3">Jordan Residential Building Site and Energy Consumption Survey and Resident Survey</td></tr>
<tr><th colspan="4">Contents</th></tr>
<tr><td colspan="4">• Visit residential building sites in Jordan to understand the living environment and inspect facilities
- Cooling by using an air conditioner
- Heating using locally produced heating equipment
- Use general lighting without LED lighting

• Surveys and interviews are conducted to conduct fact-finding surveys
- Monthly electricity bill: 79JD
- Dissatisfied part in the residential sector : The room is too cold. (Heating is not good)

• Identify deficiencies in building insulation and heating and cooling facilities</td></tr>
<tr><th colspan="4">Photo</th></tr>
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Site 6	Site 6 : House	Date	May 2nd (Tue) 14:30-15:00
		Location	Amman, Naor
Attendants	KSP Researchers, Sondos (Interpreter), Dr. Farah Al-Atrash, Arch. Tala Samir Awadallah		
Purpose	Jordan Residential Building Site and Energy Consumption Survey and Resident Survey		

Contents

- Visit residential building sites in Jordan to understand the living environment and inspect facilities
  - Remove the air conditioner
  - Heating using locally produced heating equipment
  - The meter was not yet properly measured, so it was not possible to properly measure the fare
- Surveys and interviews are conducted to conduct fact-finding surveys
  - Monthly electricity bill : 176 JD
  - Dissatisfied part in the residential sector : The electricity bill is too high
- Identify deficiencies in building insulation and heating and cooling facilities

Photo

Site 7	Site 7 : Apartment	Date	May 2nd (Tue) 15:30-16:30
		Location	Marj Al-Hamman
Attendants	KSP Researchers, Sondos (Interpreter), Dr. Farah Al-Atrash, Arch. Tala Samir Awadallah		
Purpose	Jordan Residential Building Site and Energy Consumption Survey and Resident Survey		

Contents

- Visit residential building sites in Jordan to understand the living environment and inspect facilities
  - Possession of central heating system
  - Have gas facilities on the basement
  - Possession of electric vehicle charging facilities
- Surveys and interviews are conducted to conduct fact-finding surveys
  - Monthly electricity bill : 100 JD
  - Dissatisfied part in the residential sector : High price of Gas / Oil
- Identify deficiencies in building insulation and heating and cooling facilities

Photo

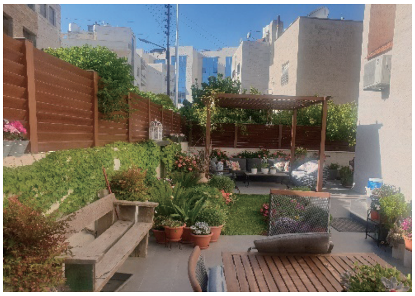



Site 8	Site 8 : Villa	Date	May 2nd (Tue) 16:30-17:00
		Location	Um alsummak mecca street
Attendants	KSP Researchers, Sondos (Interpreter), Dr. Farah Al-Atrash, Arch. Tala Samir Awadallah		
Purpose	Jordan Residential Building Site and Energy Consumption Survey and Resident Survey		

Contents

- Visit residential building sites in Jordan to understand the living environment and inspect facilities
  - Using a diesel boiler
  - Use a radiator for heating
  - Presence of front yard
- Surveys and interviews are conducted to conduct fact-finding surveys
  - Monthly electricity bill : 100 JD
  - Dissatisfied part in the residential sector : High price of Gas / Oil
- Identify deficiencies in building insulation and heating and cooling facilities

Photo

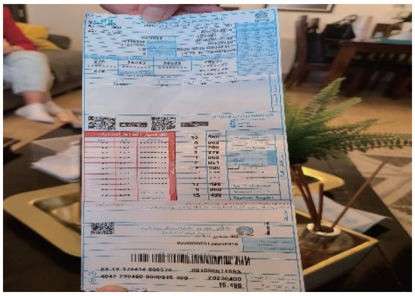


Site 9	Site 9 : Apartment	Date	May 2nd (Tue) 17:30-18:30
		Location	7th Circle
Attendants	KSP Researchers, Sondos (Interpreter), Dr. Farah Al-Atrash, Arch. Tala Samir Awadallah		
Purpose	Jordan Residential Building Site and Energy Consumption Survey and Resident Survey		

Contents

- Visit residential building sites in Jordan to understand the living environment and inspect facilities
  - Hot water supply facility using diesel boiler
  - Heating using electricity
  - Have heating using radiator
- Surveys and interviews are conducted to conduct fact-finding surveys
  - Monthly electricity bill : 14 JD
  - lack of water
- Identify deficiencies in building insulation and heating and cooling facilities

Photo

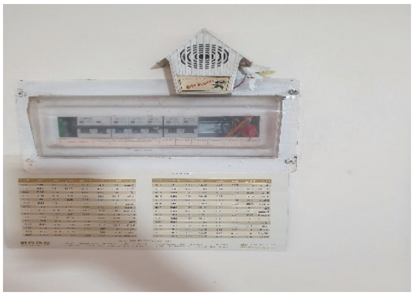


<table>
<tr><td rowspan="2">Site 10</td><td rowspan="2">Site 10 : Apartment</td><td>Date</td><td>May 3rd (Wed) 14:00-15:00</td></tr>
<tr><td>Location</td><td>Amman, Jubika</td></tr>
<tr><td>Attendants</td><td colspan="3">KSP Researchers, Sondos (Interpreter), Dr. Farah Al-Atrash, Arch. Tala Samir Awadallah</td></tr>
<tr><td>Purpose</td><td colspan="3">Jordan Residential Building Site and Energy Consumption Survey and Resident Survey</td></tr>
</table>

Contents

- Visit residential building sites in Jordan to understand the living environment and inspect facilities
  - Using an electric boiler
  - There is No air conditioning (only electric fan)
  - Representative residential apartment building in Jordan
- Surveys and interviews are conducted to conduct fact-finding surveys
  - Monthly electricity bill : 28 JD
  - Heating needs to be improved due to cold in the house
- Identify deficiencies in building insulation and heating and cooling facilities

Photo



Site 11	Site 11 : Apartment	Date	May 3rd (Wed) 18:00-19:00
		Location	suleiman Al-Assaf st. Amman
Attendants	KSP Researchers, Sondos (Interpreter), Dr. Farah Al-Atrash, Arch. Tala Samir Awadallah		
Purpose	Jordan Residential Building Site and Energy Consumption Survey and Resident Survey		

Contents

- Visit residential building sites in Jordan to understand the living environment and inspect facilities
  - Heating is not working effectively
  - Use a radiator
- Surveys and interviews are conducted to conduct fact-finding surveys
  - Monthly electricity bill : 124 JD
  - Heating needs to be improved due to cold in the house
- Identify deficiencies in building insulation and heating and cooling facilities

Photo

Site 12	Site 12 : House	Date	May 4th (Thu) 09:00-10:00
		Location	Der Ala
Attendants	Yoo Byung-cheon Replus CEO, Sondos (Interpreter), Ghayda’ Salame (JGBC)		
Purpose	Jordan Residential Building Site and Energy Consumption Survey and Resident Survey		

Contents

- Visit residential building sites in Jordan to understand the living environment and inspect facilities
  - Use of cooling is higher than heating
  - Possession of solar thermal facilities
  - Possession of gas equipment
- Surveys and interviews are conducted to conduct fact-finding surveys
  - Monthly electricity bill : Winter 18 JD, Summer 30 JD
  - Need to improve air-conditioning facilities due to the heat
- Identify deficiencies in building insulation and heating and cooling facilities

Photo

Site 13	Site 13: : House	Date	May 4th (Thu) 10:30-11:30
		Location	Der Ala
Attendants	Yoo Byung-cheon Replus CEO, Sondos (Interpreter), Ghayda’ Salame (JGBC)		
Purpose	Jordan Residential Building Site and Energy Consumption Survey and Resident Survey		

Contents

- Visit residential building sites in Jordan to understand the living environment and inspect facilities
  - No air conditioning (ventilator, ceiling fan)
  - Possession of solar thermal facilities
  - lack of insulation
- Surveys and interviews are conducted to conduct fact-finding surveys
  - Monthly electricity bill : 100 JD
  - Dissatisfied part in the residential sector : High price of Gas / Oil
- Identify deficiencies in building insulation and heating and cooling facilities

Photo

Local meeting	Local advisory seminar	Date	May 4th (Thu) 12:00-16:00
		Location	Grand Hyatt Amman conference room
Attendants	KSP Researchers, Sondos (Interpreter), MEMR (Jordan Ministry of Energy and Mineral Resources), GJU (Jordan-German University), Participated in Advisory Board		
Purpose	Prior to field surveys and local seminars, to explain the progress of research and comparison of systems between the two countries. In addition, analysis of energy consumption and review of weaknesses through simulation		

Contents

- Introduction of comparison of the systems of Korea and Jordan
  - Comparing the systems and codes of both Korea and Jordan, introducing differences and key points, and presenting plans to supplement data
- Sharing field survey results
  - Investigated the actual conditions of residential buildings in Jordan through a field survey, and presented detailed statistics on electricity, water, and gas bills and identified problems through a survey.
- Introduction of simulation results and future plans
  - Analysis of the results of the simulation for energy consumption analysis according to Jordan’s climatic zones was shared, and results similar to reality and supplementary plans for deficiencies were announced
- Q&A
  - Responding to questions from attendees, including realistic introduction of Korea’s systems related to building energy efficiency and plans to provide various solutions in the end

Photo

Site 14	Site 14 : House	Date	May 5th (Fri) 11:00-12:00
		Location	suleyman SR, Amman ,
Attendants	KSP Researchers, Sondos (Interpreter), Dr. Farah Al-Atrash, Arch. Tala Samir Awadallah		
Purpose	Jordan Residential Building Site and Energy Consumption Survey and Resident Survey		

Contents

- Visit residential building sites in Jordan to understand the living environment and inspect facilities
  - Exterior composition of the building (no windows on the west side)
  - Installation of opening and closing windows on the rooftop aisle
  - Possession of PV and solar thermal facilities
- Investigate the differences from the buildings visited earlier
  - Zero Energy Buildings
  - Possession of air conditioning system
  - Possession of rainwater use system

Photo

<table>
<tr><td rowspan="2">Local meeting</td><td rowspan="2">Visit MEMR</td><td>Date</td><td>May 7th (Sun)12:00-13:00</td></tr>
<tr><td>Location</td><td>MEMR</td></tr>
<tr><td>Attendants</td><td colspan="3">(KOTRA Amman)Lee Ho-bin Deputy Director, (MEMR) Eng. Yacoub Marar, Eng. Reem Al-Bzour 외</td></tr>
<tr><td>Purpose</td><td colspan="3">Prior to the field survey and local seminar, it was to explain the progress of research and the comparison of systems between the two countries. In addition, analysis of energy consumption and review of weaknesses through simulation</td></tr>
<tr><td colspan="4">Contents</td></tr>
<tr><td colspan="4">• Sharing field survey and local seminar contents
- Comparison of systems between Korea and Jordan, results of field investigations, and sharing of information related to simulation plans
• Decided to discuss policy practitioner’s workshop
- Decided to hold an online meeting about content at after next week</td></tr>
<tr><td colspan="4">Photo</td></tr>
<tr><td colspan="4"></td></tr>
</table>

4) 2022/23 Jordan KSP Practitioners workshop and Interim seminar

□ Date : 2023.07.10 (Mon) ~ 23.07.19 (Wed)
(Based on Jordan itinerary, 7 nights and 10 days including arrival and departure days)

□ Location : Seoul, Gyeonggi, Ulsan and Busan

□ Purpose and main activities

- Interim seminar
- Domestic company participation meeting
- Domestic policy stakeholder participation meeting
- Visit to relevant locations in Korea
- Discussion of future plans

□ Attendees(Jordan) (Total 10 people))

<Table. practitioner workshop attendees>

No.	Name	Affiliation	Position	Department
1	ZEYAD MUSADAG MOHAMMAD HAMMOUDEH	Ministry of Energy and Mineral Resources	Head of renewable energy and energy efficiency studies department	renewable energy and energyefficiency
2	REEM EMAD MOHAMMAD AL-BZOUR	Ministry of Energy and Mineral Resources	Engineer	renewable energy and energy efficiency
3	MARWA ALI SALEH ALMEFLEH	Ministry of Energy and Mineral Resources	Engineer	renewable energy and energy efficiency
4	AHMAD BASSAM HILMI IBRAHIM	Ministry of Energy and Mineral Resources	Sustainable Energy Advisor (Expert)	Jordan renewable energy and energy efficiency fund
5	NEDAL EMAN AHMAD JABER	Ministry of Energy and Mineral Resources	Engineer	Jordan renewable energy and energy efficiency fund
6	OMAR ABED HASAN BARQAWI	Ministry of Energy and Mineral Resources	Head of Innovation and Knowledge Management Department	planning and Organization development
7	KARAM MAHMOUD ABDEL HAFEZ ALMAKANIN	Ministry of Energy and Mineral Resources	Engineer	Jordan renewable energy and energy efficiency fund
8	WALEED NEDAL SAEED ABUJARADEH	Ministry of Energy and Mineral Resources	Head of Crisis Management Section	planning and Organization development
9	OMAR MAHMOUD HAMIDEH ALNAWAISHEH	Ministry of Energy and Mineral Resources	Engineer	Jordan renewable energy and energy efficiency fund

No.	Name	Affiliation	Position	Department
10	OMAIMAH A. M. AL-ARJA	German Jordan University	Dean of school of architecture and built environment, associate professor in buildings sciences	architecture and interior architecture

<Table. Detailed schedule>

Date	Contents	Note
07/10 (Mon)		
(departure) 14:20 (arrival) 18:20	Amman(Jordan) → Abu Dhabi	EY0514
07/11 (Thu)		
(departure) 22:25 (arrival) 11:40 +1	**Abu Dhabi → Incheon**	EY0856
17:30-19:00	**Welcome and schedule briefing**	- Hotel check-in - Welcome dinner
07/12 (Wed)		
09:30-12:00	**Site Visit 1 : KDI Global Knowledge Exchange & Development Center** **Meeting 1 : Seoul Metropolitan Government Officials**	- Introduction to Korean economic development history - Meeting with Korean policy officials (Seoul City Hall)
13:00-18:00	**Jordan KSP Interim seminar**	- Announcement of interim research results
07/13 (Thu)		
10:00-14:00	**Site Visit 2 : LG ThinQ Home** **Meeting 2 : LG Electronic**	- Visit Zero Energy House
14:30-16:00	**Site Visit 3 : Seoul Energy Dream Center**	- Visit Zero Energy Building
16:00-18:00	**Meeting 3 : Korea EMS Association** **Meeting 4 : LS Electric**	
07/14 (Fri)		
7:27-10:03	**Seoul → Busan (KTX)**	

11:00-12:00	**Site visit 4 : Busan Eco-delta Smart Village**	- Visit Smart Village
14:00-14:50	**Site Visit 5 : Ulsan Migratory Bird Promotion Center**	- Visit Zero Energy Building
15:00-17:00	**Site Visit 6 : Korea Energy Agency Meeting 5 : Korea Energy Agency**	- Visit Korea Energy Agency - Meeting with Korean policy practitioners
19:35-22:05	**Ulsan → Seoul (KTX)**	
07/17 (Mon)		
09:00-11:00	**Site Visit 7 : Lx housys R&D Research Field Site Visit 8 : LG Innovation Gallery**	- Lx housys R&D Research Field - Visit LG Science park - Visit LG Innovation Gallery
13:00-14:30	**Site Visit 9 : Nowon EZ Center**	- Visit Zero Energy Housing Complex
15:00-18:00	**Meeting 6 : KT Meeting 7 : Samsung Electronics**	
07/18 (Tue)		
09:30-10:30	**Meeting 8 : LG Energy Solutions**	
10:30-13:30	**Wrap - up Meeting**	- Announcement of policy worker training schedule and summary of mid-term briefing session contents - Discussion of the final report meeting
(departure) 17:55 (arrival) 22:40	**Incheon → Abu Dhabi**	EY0857
07/17 (Mon)		
(departure) 02:30 (arrival) 04:45	**Abu Dhabi → Amman (Jordan)**	EY0511

□ 22/23 Jordan KSP Interim seminar

- Date : 2023.07.12.(Wed) 13:00-17:30
- Venue : Lotte hotel seoul charlotte- suite room
- Progress : Face-to-face meeting (Korean-Arabic consecutive interpretation)
- Attendants : 27 in total (see attachment for detailed list)
- Korea : (Senior Advisor) Hong Young-pyo, Senior Advisor
  (KOTRA Development Cooperation Office) Park Chul-ho. Director General, Jang Duk-hwan. Project Manager, Kang Dong Hun Assistant manager
  (KOTRA Amman) Lee Young-hee. Director General, Lee Junghyun Marketing Team Leader
  (KSP Researcher) Lee Soon-myung. Professor, Yoo Byung-chun. Co. 9 people including
- Jordan : (Jordan Ministry of energy and mineral resources) Zeyad usadag Mohammad Hammoudeh Head of RE & EE studies department, 9 people including
  (German Jordanian University) Omaimah A. M. Al-Arja Professor

<Table. Detailed schedule of Interim seminar>

Time	Program	Note
13:00-13:30	Interim seminar Order and attendees introduction	Director Jang Deok-hwan of KOTRA (Jordan KSP PM)
	Opening Address	(Kor) Hong Young-pyo Senior Advisor
13:30-15:00	Luncheon	-
15:00-16:20	Announcement of interim research results	Lee Soon myung prof.
16:20-17:20	Discussion and Q&A	All attendees
17:20-17:30	Closing remarks / photo	-

□ Opening Address

- Hong Young-pyo Senior Advisor) First, I would like to express my deepest gratitude to the Jordanian delegation, including Ziyad Musadak Mohammad Hammudeh, Director of the Ministry of Energy and Mineral Resources, who came all the way from Jordan to attend today's interim report. In addition, I would like to thank Professor Soon-myung Lee of Sangmyung University, CEO Byeong-cheon Yoo of Replus, and other Jordan KSP researchers who are passionately carrying out their work, as well as executives and staff members, including Director Cheol-ho Park of KOTRA's Development Cooperation Office, who organized this event today. Jordan is in the center of the Middle East, nicknamed the Heart of the Arabs, and shares borders with Saudi Arabia and Israel, making it a gateway to exchange and cooperation in the Middle East. Additionally, as a country rich in solar energy sources, it has optimal conditions for increasing building energy efficiency, and as a member of the World Green Building Council, it has great potential for the growth of the solar energy industry. Jordan's Ministry of Energy and Mineral Resources hopes to achieve mid- to long-term building energy development by establishing a policy roadmap for building energy development as well as establishing a certification system through this KSP. Last February, our KSP delegation visited Jordan and held an inauguration briefing, and then conducted a detailed survey by researchers in May. Today's event is a valuable opportunity to share the researchers' interim research results and provide policy advice appropriate for Jordan's situation. The policy recommendations presented this time will be used as valuable data to lay the foundation for future energy development in Jordan's buildings. In any case, we would like to ask for the generous advice and opinions of attendees from both countries to see if there are any parts that need to be supplemented or overlooked in this interim report, or if there are any areas that need to be improved for building energy development and the establishment of a certification system. By reflecting your opinions today, we look forward to developing more advanced policy recommendations at the future final report. Once again, I would like to thank everyone in the building energy industry, including Director Ziyad of Jordan's Ministry of Energy and Mineral Resources, Director of KOTRA's Amman Trade Center, and all attendees for attending today's event.

□ Presentation of interim research results

- Answers to questions asked about building energy efficiency rating certification during the morning meeting with Seoul City Hall officials
  - First, we have prepared an English version of the Green Building Creation Support

Act, which is Korea's law related to energy efficiency in buildings, and plan to provide it upon our return. The answer to the question about building energy efficiency rating certification is that this certification is a must, and in Korea, all buildings are divided into two types: residential and non-residential, and the law includes all of them. To answer questions about the index, refer to the table of 10 levels in the data and determine how many kilowatts per square meter per year your new apartment building will use. Of the 10 grades, grade 7 is the lowest grade, but the government has established an incentive system in the data to encourage more people to receive higher grades. Providing incentives for property tax savings, tax abatements, and building floor space.

- Jordan KSP project overview and research progress
  - study is part of the KSP project mentioned earlier and falls under the Energy & Green growth area of the project conducted with KOTRA. Based on the requirements submitted by MEMR, the current progress is presented in a moon chart. First of all, the legal systems of Korea and Jordan have been completed with the help of GJU. Secondly, I will show you the content of the latter half of the simulation, but I will analyze how Korea's thermal transmittance rate and Jordan's thermal transmittance rate are applied in a passive system, and I will compare them and explain them. In addition, we determined the current situation of apartments in Jordan through the previous field survey. There were many questions about EMS, and I plan to visit the Ulsan Energy Complex to see for myself how much data is actually collected and managed. As shown, I will prepare and report to the final report on how to establish an energy management plan in Jordan in the future. expected. Through this workshop, we will be able to meet large companies in Korea, and we will review and complete this so that follow-up business connections can be made. It is expected that EMS-related questions or follow-up projects can be easily resolved by discussing with REPLUS.

- Interim report on research results
  - (Local and Launch seminar) Before the launching seminar, we held a meeting with the people listed in the table and requested collaboration in the KSP project. What I found interesting while comparing the energy consumption of Korea and Jordan during my first project was that Korea and Jordan have something in common: they absolutely import energy. It is also worth noting that both Korea and Jordan have the same high energy consumption in residential buildings, with the electricity consumption being the largest. There is a clear difference when comparing

residential and non-residential use in total electrical energy usage. Another thing in common is that Jordan's population is concentrated in Amman, and South Korea's population is concentrated in Seoul. The types of residential buildings themselves are similar, with 83.8% of people living in apartments in Jordan and 63.5% in Korea living in apartments. And looking at the purpose of energy use, we can see that 53% of energy is used for heating in Amman and 49.5% is used for heating in Seoul.

- (Comparison of systems) Comparison of building energy related legal systems is divided into regulatory system framework and certification system. Although the overall content is very similar, the detailed actual data confirms that there are many differences. For example, in Jordan, the entire climate region is divided into three zones and different insulation standards are applied depending on the climate zone, while in Korea, there are four climate zones. There are four insulation standards. If you look at the actual values in a table, you can see that Korea's heat transmittance rate is managed much lower than Jordan's heat transmittance standard value..

- (Regarding the Korean system) The table shows when Korea's systems were implemented. What I want to emphasize here is how to achieve zero energy buildings, and in Korea, the system was implemented 17 years after 2001. So, when referring to Korea's policy system, I think it should first refer to contents such as BEEC or energy-saving criteria in the beginning, and then evolve into a form like ZEB after going through this stage of applying it to 100% of newly constructed buildings. For example, the ZEB sites you will visit in the future have achieved ZEB certification after achieving the highest rating in building energy efficiency rating and the highest rating in energy saving design standards. You can see how many certifications such as building energy efficiency rating and green remodeling have been received through a cumulative graph. After the system was implemented, certification was received very slowly in the beginning, but over time, the number of certifications can be seen to increase rapidly at some point. It appears that policy practitioners will need to be patient and accumulate over a long period of time until the system is established. Likewise, if you look at the status of the ZEB certification system that has recently begun receiving certification, you can see that the number of certifications has increased rapidly since the start year. Both the building energy efficiency rating and ZEB certification are systems created independently by Korea.

- (Energy database system) The energy database, which was asked about this morning, has the following system. In order to receive ZEB certification, a BEMS system must be installed, so data is provided from the building, and data from newly constructed buildings related to licensing continues to flow in from the Korean Ministry of Land, Infrastructure and Transport. And in fact, data related to electricity consumption is collected by Korea Electric Power Corporation, and the National Building Database is managed by the Korea Energy Agency, an agency under the Ministry of Commerce, Industry and Energy of Korea, which corresponds to MEMR.

- (Field survey and launching seminar) Since we did not know much about Jordan, we conducted a local survey. We were able to confirm several things while visiting a total of 14 houses and conducting field trips. We investigate how much energy is used in actual homes and dissatisfaction issues related to housing. We also asked questions about the status of heating and cooling systems, hot water systems, and the building energy efficiency policy currently in progress in Jordan. Through this field survey, we were able to derive the pan-policy systems of both countries that were previously conducted and the contents of our simulations to be much more suitable for Jordan.

- (Simulation overview) The following information is used to create an actual simulation model while comparing the two countries. As for the weather data to be applied to the simulation, find out what value to apply for the heat transmittance rate of the exterior walls and windows of buildings in Jordan. The biggest difference institutionally is that the scope of contents that are mandatory to apply in Jordan is much smaller than in Korea. In Korea, it is considered mandatory to apply almost everything, including BEMS installation and Energy Performance Index. Based on these details, Jordan's standard medium apartment model was set as an apartment with 4 floors and 2 households on each floor as follows. By applying Jordan's standard values and matching the amount of energy used in this modeling with the energy usage surveyed in the field survey, we created the following monthly consumption model and conducted various analyses.

- (Passive method simulation) We selected 9 weather data available in Jordan and conducted a simulation using weather data from that region and weather data from 4 regions in Korea. For example, we apply Jordan's insulation standards to the model to see how usage changes in four regions of Korea. Of course it is possible to predict, but since Korea's heat transmittance standard is much tighter, it can be seen that energy consumption increases when Jordan's standard is used. Conversely, if the insulation standards of the four regions of Korea are applied to the

Jordanian climate, energy consumption can be seen to decrease because the thermal transmittance rate is much tighter. Looking at the simulation results, it is effective to apply the central 1 standard of Korea to Amman and the southern standard to Gor Safi and Hassan regions. The reason for conducting a simulation to determine which regions of Korea would benefit from applying the standard value was to create a table of regional heat transmittance rates to suggest how to apply the heat transmittance values for each region of Jordan in the future.

- (Active plan simulation) Until now it was a passive plan approach, and from now on it is an active plan approach. First, the specifications of PV were determined, and a simulation was conducted to ensure that all energy requirements found through simulation models and field visits could be used to meet cooling and heating usage with EHP. And the data is the result of deriving the production volume using Jordan's meteorological data to see how much power is generated when PV is applied by capacity to connect PV to EHP. During the field trip, we found that there were many solar thermal facilities, so we conducted a simulation to see how much heat gain could be achieved in 9 regions when applied. And each simulation was performed in various ways. First, the reason for the red box is because it can be seen that the energy converges to 0 when 15kw of PV is applied, that is, 2kw per household. Next, when EHP, PV, and solar power are combined, various cases are created by changing the capacity as a result. By applying EHP, 15kw of PV, and solar power, it can be seen that positive energy is applied for the first time in the Aqaba and Ghor safi regions. By conducting a simulation like this, we will define what heat transmittance rate should be applied to Amman or Ghor safi in the current combination's passive plan and report to the final report how many kW of PV should be applied to that area to maximize energy savings.

- (Policy practitioner workshop and final report plan) 10 people participated in this policy practitioner workshop, and the tour locations to be visited during the event are as follows. The part marked in red is the part that will be provided after this workshop, and the content in blue is the content that will be proposed at the final report meeting..

□ Q&A and discussion

Q. (Jordan MEMR) : Is BEMS not at risk of being hacked by hackers?

A. (Prof. Lee Soon-myung) : First of all, watt-hour meters, which are the basis of energy data collection, can be certified only when cyber security is applied. If you look at Korea's public data portal, cyber security is strengthened and operated enough to share energy data and building data of all citizens.

Q. (Jordan MEMR) : Are there specific figures such as specific capacity and efficiency of the equipment applied in relation to the active measures?

A. (Prof. Lee Soon-myung) : At the final reporting workshop, it will not be possible to draw results from all capacities or all manufacturers, but in the case of a representative case, we will provide an example so that you can analyze the ROI case.

Q. (Jordan MEMR) : Are there any plans for a field trip related to the passive measures?

A. (Prof. Lee Soon-myung) : Originally, We tried to visit the factory that makes windows at Lx Hausys in Ulsan, but the factory that produces windows is located in Cheongju, making it difficult to visit. However, after visiting the LG Science Park, we plan to visit the Lx Hausys showroom to tour passive materials such as windows and doors. For reference, Lx Hausys is a company that produces the largest passive materials in Korea.

Q. (Jordan MEMR) : Looking at the energy consumption according to the BEEC (Building Energy Efficiency Certification) standard, most of Jordan's houses seem to fall under the first grade. Is this correct?

A. (Prof. Lee Soon-myung) : Energy consumption according to Korea's BEEC standard refers to the total energy consumption consumed in buildings as well as electrical energy.

Q. (Jordan MEMR) : During the field survey, did you investigate the air conditioner including the inverter system? For the past three years, Jordan has increased the purchase rate of inverter systems, so I ask a question.

A. (Prof. Lee Soon-myung) : When field survey, We investigated the existence of a cooling system and if so, what kind and number of cooling systems exist. Some houses use inverter systems, and as you can see, there are far more houses without cooling systems and with only fans.

Q. (Jordan MEMR) : When remodeling, in order to have good insulation, the insulation wall must be thick. How do you adjust the existing interior space?

A. (Prof. Lee Soon-myung) : In fact, remodeling in Korea refers to removing all the interior materials and proceeding with a new one.

Q. (Hong Young-pyo Senior Advisor) : - It seems that you have thought about everything from the passive and active perspectives, and I believe that through this process, you will be the optimal choice related to energy efficiency. Looking at the different configurations by region from the active package point of view, isn't it just going according to the energy supply mix in Jordan in the mid- to long-term?

A. (Prof. Lee Soon-myung) : In Korea, late-night boilers are recommended when there is a lot of late-night power, and gas heat pumps are rather recommended when the peak power level is high. It also reflects Jordan's situation when seeking solutions to balance energy nationally. There was a lot of electricity produced in Jordan, and the reason why EHP was applied to the solution was the same point of view. In Jordan, it is correct that an electric heat pump is more suitable than a geothermal heat pump, and it reflects the current situation.

Q. (Hong Young-pyo Senior Advisor) : Looking at the role of Director Zeyad, he is in charge of energy efficiency, but he is also in charge of renewable energy, so I would like to ask you about the part related to energy supply. Last time I was in Jordan I heard that supply exceeds demand. It seems that there will be a dynamic change because the situation can change over time and there are neighboring countries that lack power. On the other hand, existing power generation has no choice but to change to renewable energy in the global trend, and Jordan seems to have very favorable conditions. From this point of view, it must be clear that the Jordanian government will have a transformation related to energy supply policy, and it seems to already be, is that correct? If the optimal plan related to energy efficiency is derived, the follow-up work is expected to induce enormous financial investment, If you think about that, I think the possibility of future cooperation between the two countries will increase. Is there any possibility of cooperation between the two countries in a different regarding follow-up measures?

A1. (MEMR Zeyad Musadag) : - In the last 10 to 20 years, there has been a time when electricity demand has been much higher than supply. In order to solve this problem, a total of 7 power plants were created as a policy, and IPP was brought in among them. So, in some power plants, the utilization rate is only 3%. As a result, the problem of how to utilize this power and how to raise renewable energy are the issues. There is a step-by-step plan to raise the percentage from 1% to 50% from 2020 to 2030. And there is a part that uses green hydrogen, and another part related to ESS requires another investment, so cooperation is needed. In the current situation, we are trying to adjust the surplus power in a way that it uses a lot at a specific time.

A2. (MEMR Ahmad Bassam) : - As power supply exceeds demand, we are trying to solve this problem through electric vehicles. Jordan has to pay a tariff of 98.5% for gasoline vehicles, but for electric vehicles and hybrid vehicles, tariffs of 15-30% are applied depending on the capacity.

Q. (Lee Young-hee. Director General) : I understand that Jordan is a water-scarce country. How is a policy related to green hydrogen possible?

A. (MEMR Zeyad Musadag) : Although research is in progress, plans to install a desalination facility or use recycled water in the Aqaba area are also being considered. Electric power to decompose hydrogen again is currently possible with electric power, but research is also in progress with solar power, but it appears to be possible.

Jordan KSP Interim seminar photo

□ Summary of major activity results

<table>
<tr><th rowspan="2">Site visit</th><td rowspan="2">KDI Global Knowledge Exchange & Development Center</td><th>Date</th><td>12th July (Wed) 09:30-10:30</td></tr>
<tr><th>Location</th><td>KDI Global Knowledge Exchange & Development Center Exhibition</td></tr>
<tr><th>Attendants</th><td colspan="3">KSP Researchers, Sung-Sook Lee(Interpreter), KOTRA Amman Junh-Hyun Lee Team Leader, Jordan Ministry of Energy and Mineral Resources (ZEYAD MUSADAG MOHAMMAD HAMMOUDEH other 8 people), German Jordan University OMAIMAH A. M. AL-ARJA Dean of school of architecture</td></tr>
<tr><th>Purpose</th><td colspan="3">Introduction of Korean economic development history</td></tr>
<tr><th colspan="4">Contents</th></tr>
<tr><td colspan="4">• Visit the exhibition at the Economic Development Hall
- Dividing the period from 1945 to the present into a total of 4 periods, we heard an exhibition and explanation of the main contents of the history of Korean economic development, and heard an explanation of what process the Korean economy went through.

• Visit the exhibition at the Industrial Development Hall
- Starting with the light industry in 1960, we watched an exhibition of Korea’s major industries that achieved rapid development, such as the heavy chemical industry and the electronics industry, and listened to an explanation of the history and contents of Korea’s industrial development.</td></tr>
<tr><th colspan="4">Photo</th></tr>
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<table>
<tr><th rowspan="2">Meeting</th><td rowspan="2">Meeting with Seoul Metropolitan Government Officials</td><th>Date</th><td>12th July (Wed) 11:00-12:00</td></tr>
<tr><th>Location</th><td>KDI Global Knowledge Exchange & Development Center Meeting room</td></tr>
<tr><th>Attendants</th><td colspan="3">KSP Researchers,j Sung-Sook Lee(Interpreter), KOTRA Amman Jung-Hyun Lee Team Leader, Jordan Ministry of Energy and Mineral Resources (ZEYAD MUSADAG MOHAMMAD HAMMOUDEH other 8 people), German Jordan University OMAIMAH A. M. AL-ARJA Dean of school of architecture</td></tr>
<tr><th>Purpose</th><td colspan="3">Policy practitioner meeting (Seoul city), To receive explanations on Seoul's building energy-related policies</td></tr>
<tr><th colspan="4">Contents</th></tr>
</table>

- Overview of Seoul's Building Greenhouse Gas Reduction Project
  - Since the building sector accounts for about 70% of Seoul's greenhouse gas emissions, management is required, and policies are being implemented to reduce it. Policy tasks are carried out in 5 areas and 10 key tasks: new buildings, public buildings, private buildings, promotion and institutional improvement, practice and follow-up management.

- Plans for implementing detailed tasks
  - (New building) In order to provide examples among new buildings, public buildings are certified first, and incentives are given to expand zero-energy buildings to promote ZEB certification.
  - (Public buildings) Mandatory installation of BEMS in city-owned buildings and public buildings such as schools and senior citizen centers, or conversion to low-carbon buildings by promoting green remodeling.
  - (Private buildings) As a method of converting to low-carbon buildings, we are preparing to introduce the total amount of greenhouse gas emissions for buildings, and we are developing a model to implement in 2026. The total amount of greenhouse gas emissions for buildings is a system that divides buildings into 12 types and regulates them so that they can meet standard emissions for each building. In energy-intensive buildings with energy consumption of 2000TOE or more, energy reduction cases are shared and rankings are released annually. For buildings with energy efficiency improvements, interest-free loans of up to KRW 2 billion for buildings and KRW 60 million for houses, and housing performance support subsidize up to KRW 3.4 million in energy efficiency improvement construction costs. In addition, simple construction such as windows is supported for the low-income class, and LED lights are replaced free of charge for the low-income class and welfare facilities. Lastly, we are replacing old public rental housing with high-efficiency equipment.
  - (Public Relations and System Improvement Section) To spread awareness, the low-carbon building certification system is implemented for buildings that have been converted to low-carbon buildings, and the low-carbon building support center is operated to help citizens. To provide on-site support, an energy doctor is being operated through the reorganization of existing energy design. In the system improvement sector, building energy efficiency rating certification is compulsory for existing buildings, and building energy evaluation reports are being obligated to be attached to real estate transactions.
  - (Practice and follow-up management) Introduced the eco-mileage system, a system that provides incentives through certification for building energy savings, and the greenhouse gas emission monitoring system technology.

- Q&A

  Q : How do you determine if a building consumes more than 2000TOE of energy?
  A : In Korea, it is compulsory to report buildings that use more than 2000TOE of energy.

  Q: : Then, is there any energy consumption data for buildings that consume less than 2000 TOE?
  A: Although the standard is 2000TOE or more, energy consumption for the building sector is being collected and provided by the Korea Real Estate Board.

  Q: Do both new and existing buildings have data in the same way?
  A: Yes. All buildings have and provide data.

  Q: Which agency is in charge of operating the Energy Doctor?
  A : It is operated by Seoul Metropolitan Government.

  Q: Where is the energy consumption figure managed and measured by which institution?
  A: It is managed by the system of the Energy Economics Institute.

Q: Jordan uses a lot of renewable energy solar panels to save on energy costs, but in practice they are not very efficient. Even in this situation, can such a building be called a zero-energy building just by installing solar panels?
A : Since Korea also increases energy efficiency itself, reduces consumption and produces renewable energy to set the total amount to zero, it seems to be practically impossible in buildings with poor efficiency and insulation.

Q: What percentage of efficiency and insulation must be increased to achieve ZEB?
A: It is difficult to provide exact figures, and looking at Korea's ZEB certification system, first of all, the energy self-sufficiency rate must be 20% or higher to obtain certification.

Photo	
	

<table>
<tr><td rowspan="2">Site visit</td><td rowspan="2">LG ThinQ Home</td><td>Date</td><td>13th July (Thu) 10:00-11:00</td></tr>
<tr><td>Location</td><td>LG ThinQ Home</td></tr>
<tr><td>Attendants</td><td colspan="3">KOTRA Amman Lee Jung-hyun Team Leader, KSP Researchers, Lee Seong-suk (Interpreter), Zeyad Musadag Mohammad Hammoudeh, Reem Emad Mohammad Al-Bzour, Marwa Ali Saleh Al-Mefleh, Ahmad Bassam Hilmi Ibrahim, Nedal Eman Ahmad Jaber, Omar Abed Hasan Barqawi, Karam Mahmoud Abdel Hafez Almakanin, Waleed Nedal Saeed Abujaradeh, Omar Mahmoud Hamideh Al-Nawaisheh, Omaimah A. M. Al Arja</td></tr>
<tr><td>Purpose</td><td colspan="3">To visit LG ThinQ Home, which achieved Korea’s first level 1 certification for zero energy buildings, and to share cases of zero energy, HEMS, PV panels, etc.</td></tr>
<tr><td colspan="4">Contents</td></tr>
<tr><td colspan="4">• Explanation of building energy efficiency rating, ZEB certification system, etc., and explanation of ThinQ Home case
- As the first building in Korea to achieve level 1 certification for zero-energy buildings, the standards for certifications ThinQ Home has acquired and the technologies applied to the house are explained.

• Experience various technologies applied to ThinQ Home
- It is progressed by directly seeing and experiencing various technologies applied to the house. Representative technologies include HEMS, BIPV, vehicle-to-home power supply (V2H), rollable TV, and smart mirrors, along with energy management and reduction technologies, as well as various technologies optimized for daily life.</td></tr>
<tr><td colspan="4">Photo</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td></tr>
</table>

Meeting	LG Electronics	Date	13th July (Thu) 11:00~12:00
		Location	LG ThinQ Home
Attendants	KOTRA Amman Lee Jung-hyun Team Leader, KSP Researchers, Lee Seong-suk (Interpreter), Zeyad Musadag Mohammad Hammoudeh, Reem Emad Mohammad Al-Bzour, Marwa Ali Saleh Al-Mefleh, Ahmad Bassam Hilmi Ibrahim, Nedal Eman Ahmad Jaber, Omar Abed Hasan Barqawi, Karam Mahmoud Abdel Hafez Almakanin, Waleed Nedal Saeed Abujaradeh, Omar Mahmoud Hamideh Al-Nawaisheh, Omaimah A. M. Al Arja		
Purpose	Description of LG Electronics products that can provide solutions suitable for the local situation in Jordan and sharing of cases in Korea about those products		

Contents

- Description of LG's representative main product, Multi V 5
  - It is a product that saves energy and provides comfortable and efficient heating and cooling. T.V.I. (Twin Vapor Injection) technology improves heating performance, and real-time automatic refrigerant amount control technology is introduced to increase cooling energy efficiency.
- A solution suitable for residential buildings (1)
  - As a case in Korea, most apartments use Multi V S. Compared to the multi-pipe system, the space occupied by the refrigerant pipe can be saved with the single pipe system, and long pipe design is possible.
- A solution suitable for residential buildings (2)
  - AWHP is an air water circulation heat pump. Various heat sources (air heat source, water heat source, geothermal source, etc.) can be used in conjunction with the heat pump. Therefore, it has excellent economic feasibility, high efficiency, and high-temperature water extraction is possible.

Photo

Site visit	Seoul Energy Dream Center	Date	13^{th} July (Thu) 14:30~15:40
		Location	Seoul Energy Dream Center
Attendants	KOTRA Amman Lee Jung-hyun Team Leader, KSP Researchers, Koo Jung-Hoon General Manager, Lee Seong-suk (Interpreter), Zeyad Musadag Mohammad Hammoudeh, Reem Emad Mohammad Al-Bzour, Marwa Ali Saleh Al-Mefleh, Ahmad Bassam Hilmi Ibrahim, Nedal Eman Ahmad Jaber, Omar Abed Hasan Barqawi, Karam Mahmoud Abdel Hafez Almakanin, Waleed Nedal Saeed Abujaradeh, Omar Mahmoud Hamideh Al-Nawaisheh, Omaimah A. M. Al Arja		
Purpose	By visiting the first zero-energy building certified building in Korea, sharing cases of applied technology and actual status		

Contents

- Background of Seoul Energy Dream Center
  - In accordance with the <Eco-friendly Energy Policy> established in April 2007, Seoul City proposes an advanced low-energy consumption building model to reduce energy in buildings, which account for 60% of total energy use, and to widely publicize the need to supply new and renewable energy sources for the city. 'Energy Zero House' was planned and built accordingly.
- Representative application technology (passive)
  - Minimize heat inflow in summer and heat loss in winter through triple-glazed windows
  - Block solar radiation before it enters the building through external automatic blinds
  - Minimize heat inflow and heat loss through high-efficiency insulation
- Representative application technology (active)
  - Energy management through automatic control after collecting and analyzing building energy information through BEMS
  - Saving heating and cooling energy through waste heat recovery ventilation system
  - Saving energy for heating and cooling by using a geothermal heating and cooling system
  - Install photovoltaic power generation facilities to generate electricity and supply it to buildings

Photo

Meeting	Korea EMS Association	Date	13th July (Thu) 16:00~17:00
		Location	Oil Tank Culture Park
Attendants	KOTRA Amman Lee Jung-hyun Team Leader, KSP Researchers, Koo Jung-Hoon General Manager, Lee Seong-suk (Interpreter), Zeyad Musadag Mohammad Hammoudeh, Reem Emad Mohammad Al-Bzour, Marwa Ali Saleh Al-Mefleh, Ahmad Bassam Hilmi Ibrahim, Nedal Eman Ahmad Jaber, Omar Abed Hasan Barqawi, Karam Mahmoud Abdel Hafez Almakanin, Waleed Nedal Saeed Abujaradeh, Omar Mahmoud Hamideh Al-Nawaisheh, Omaimah A. M. Al Arja		
Purpose	As a representative measure to improve the energy efficiency of buildings, information transmission and opinion sharing on the energy management system		

Contents

- Overview of EMS
  - The main tasks of the EMS Association include EMS market analysis, expert training, EMS industry support, and EMS research and development. EMS is to optimize the information (power, water, gas) used in buildings, factories, houses, etc. by newly analyzing interim monitoring data.

- Korea's institutional status and details
  - As of 2019, 38% of domestic greenhouse gas emissions are emitted from buildings. In addition, 54% of the energy consumption used in buildings is for heating and cooling. Accordingly, it is necessary to efficiently manage building energy consumption in order to reduce greenhouse gas emissions in the building sector. Therefore, the Ministry of Land, Infrastructure and Transport jointly announced the 4-year plan for green growth in 2014, and presented the BEMS vitalization policy.
    1. We are expanding the distribution of ZEB buildings to enhance the energy performance of new buildings.
    2. We are expanding projects such as green remodeling by expanding green construction of existing buildings.
    3. It is a capacity-building industry for the growth of the green building business, and various IOTs are applied.
    4. It is to form a green building culture in which the people participate, and the goal is to provide services that the people can experience.
    5. The goal is to provide incentives with the goal of expanding the green building market, and to support exports and nurture professionals through strengthening domestic cooperation.

    According to the above plan, the 6 detailed plans for BEMS expansion consist of KS standard establishment, BEMS certification system, R&D, training of experts, incentive payments, and entry into the global market. KS standards were divided into two categories. Part 1 established 9 standard criteria for function and BEMS operation. Part 2 presents standards for calculating energy savings through BEMS establishment reflection in control point compatibility data management and energy savings calculation. As for the incentive for BEMS installation, energy diagnosis is exempted once for buildings that use energy of 2000TOE or more if energy savings of about 4% to 5% are achieved after BEMS installation.

    As for the incentive for BEMS installation, energy diagnosis is exempted once for buildings that use energy of 2000TOE or more if energy savings of about 4% to 5% are achieved after BEMS installation.

- Future plans
  - The government aims to increase ZEB certification every year so that by 2050 all buildings will be certified. Among the evaluation items to obtain ZEB certification, there is BEMS installation, and if this is implemented, additional points are given to the score. In addition, the government supports about 80% of the installation cost when BEMS is installed for ZEB supply, and up to KRW 150 million per building can be supported. And the government aims to spread zero energy and green remodeling of new buildings based on building energy performance data. To this end, public buildings such as public rental housing and national day care centers are receiving ZEB certification, and active financial support is provided.

- Q&A

  Q : Is the subsidy provided for BEMS construction applied per household or per building?
  A : The subsidy is paid per building.

  Q : Are the certified buildings still well maintained?
  A : Buildings that have been certified must undergo performance verification. In the case of ZEB, performance verification is performed every five years and maintenance verification is performed. This is shown in the KS Part 2 performance verification section.

Q : Are there fines or penalties if the standards are not met in the performance verification conducted every 5 years? A : There are no fines or penalties, but the incentives provided (exemption from energy diagnosis) are limited.

Photo	
	

Meeting	LS Electric Meeting	Date	13th July (Thu) 17:00~18:00
		Location	Oil Tank Culture Park
Attendants	KOTRA Amman Lee Jung-hyun Team Leader, KSP Researchers, Koo Jung-Hoon General Manager, Lee Seong-suk (Interpreter), Zeyad Musadag Mohammad Hammoudeh, Reem Emad Mohammad Al-Bzour, Marwa Ali Saleh Al-Mefleh, Ahmad Bassam Hilmi Ibrahim, Nedal Eman Ahmad Jaber, Omar Abed Hasan Barqawi, Karam Mahmoud Abdel Hafez Almakanin, Waleed Nedal Saeed Abujaradeh, Omar Mahmoud Hamideh Al-Nawaisheh, Omaimah A. M. Al Arja		
Purpose	From a private company's point of view, actual companies related to BEMS explain how to apply them to their customers, and share LS Electric research lab's energy reduction achievements.		

Contents

- LS Electric Lab Energy Saving Construction Background
  - The R&D Campus has a total floor area of 5,000m^2 and is a 9-story building with 3 basement levels. If BEMS is defined from the point of view of a company in terms of whether an energy monitoring system has been built in an actual R&D campus, it can be seen as managing energy. Therefore, it is important to set which devices to manage, save energy, and monitor to be preceded. The R%D campus decided to manage heat, cooling and heating energy, electricity, and lighting in four major ways.

- Detailed information
  1. Energy management of freezers and boilers: manages temperature, pressure, power consumption, etc.
  2. HAVC: Manages temperature, humidity, pressure, etc. This is an item that employees working in the building can directly experience. The true meaning of BEMS is that it should be possible to save energy while not inconvenient in daily life.
  3. Electricity: It is the most important among energy consumption, and electricity consumption is also handled by BEMS.
  4. Lighting: It is designed to automatically control the lighting according to the sunlight and the brightness of the space, not the lighting of the same brightness every hour.

     The energy management screen of the R&D campus is set to monitor how much energy is saved, how well it is being saved, and how well it is managed. The part related to reduction is classified and operated as an advanced management item called smart grid. The actual R&D campus can save about 9% of energy. In addition, after storing the electricity produced through the solar power generation facility included in the building in the ESS, it is used during the time when the electricity rate is the most expensive to reduce the cost.

     With these technologies, LS R&D Campus is the first building to obtain BEMS certification from the Korea En ergy Agency.

Photo

<table>
<tr><th rowspan="2">Meeting</th><td rowspan="2">Eco-delta Smart Village</td><th>Date</th><td>14th July (Fri) 11:00~12:00</td></tr>
<tr><th>Location</th><td>Eco-delta Smart Village</td></tr>
<tr><th>Attendants</th><td colspan="3">KOTRA Amman Lee Young-hee Director General, KOTRA Amman Lee Jung-hyun Team Leader, KOTRA Jang Duk Hwan Manager, KOTRA Kang Dong Hun Assistant manager, KSP Researchers, Koo Jung-Hoon General Manager, Hyun Seung-yoon Team Leader, Lee Seong-suk (Interpreter), Zeyad Musadag Mohammad Hammoudeh, Reem Emad Mohammad Al-Bzour, Marwa Ali Saleh Al-Mefleh, Ahmad Bassam Hilmi Ibrahim, Nedal Eman Ahmad Jaber, Omar Abed Hasan Barqawi, Karam Mahmoud Abdel Hafez Almakanin, Waleed Nedal Saeed Abujaradeh, Omar Mahmoud Hamideh Al-Nawaisheh, Omaimah A. M. Al Arja</td></tr>
<tr><th>Purpose</th><td colspan="3">It is a smart village where various innovative technologies are introduced. Experience the life of a future city and explain applied technologies.</td></tr>
<tr><th colspan="4">Contents</th></tr>
<tr><td colspan="4">• Main role of Eco-delta Smart Village
- Demonstration complex of various innovative technologies: Demonstration of future smart technology complex in connection with national R&D.
- Living LAB: The citizen experience group lives directly and reduces and optimizes urban problems through feedback.
- Discovery of services and dissemination of results: Discovery of new technologies and dissemination of proven excellence through the ideas of the experience group.

• Status of smart innovative technology
- Platform Center: Building and operating a convergence data platform that combines real-time information, event-based information, and visualization information by linking smart solutions and various systems introduced in smart villages through IoT. Comprehensive control centered on the six core themes of the city. (energy, smart home, resident safety, transportation, daily health, water environment)
- Smart Home: Inside the household, a customized environment is built for various customers by linking IoT products and home network systems, and outside the household, remote smart home management services are provided in conjunction with various IT technologies.
- Smart Water: Creating a specialized complex for safe and clean water through innovative technologies such as water-friendly information platform, real-time water care, smart water management, smart irrigation system, smart water purification plant, and urban flood management based on high-precision rainfall radar.
- Korea’s first detached housing complex with energy efficiency rating of 1+++ and zero energy building rating of 1.</td></tr>
<tr><th colspan="4">Photo</th></tr>
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</table>

Site visit	Ulsan Migratory Bird Promotion Center	Date	14th July (Fri) 14:00~14:45
		Location	Ulsan Migratory Bird Promotion Center
Attendants	KOTRA Amman Lee Young-hee Director General, KOTRA Amman Lee Jung-hyun Team Leader, KOTRA Jang Duk Hwan Manager, KOTRA Kang Dong Hun Assistant manager, KSP Researchers, Koo Jung-Hoon General Manager, Hyun Seung-yoon Team Leader, Lee Seong-suk (Interpreter), Zeyad Musadag Mohammad Hammoudeh, Reem Emad Mohammad Al-Bzour, Marwa Ali Saleh Al-Mefleh, Ahmad Bassam Hilmi Ibrahim, Nedal Eman Ahmad Jaber, Omar Abed Hasan Barqawi, Karam Mahmoud Abdel Hafez Almakanin, Waleed Nedal Saeed Abujaradeh, Omar Mahmoud Hamideh Al-Nawaisheh, Omaimah A. M. Al Arja		
Purpose	Ulsan's Migratory Bird Promotion Center, which is transforming into a green smart ecotourism city, is a building certified as a zero-energy building, sharing technology.		

Contents

- Overview of Migratory Bird Publicity Center
  - A building with an area of 929.05m^2, 1 basement floor and 4 floors above ground.
  - Installation of solar power generation facilities
  - Installation of triple-glazed windows
  - Use of high-efficiency electric cooling and heating system
  - Energy efficiency grade 1+++ grade, zero energy building grade 1
  - The first public institution zero-energy building grade 1 building
- Solar power facility information
  - Facility Location: Rooftop, parking lot on the east side of Migratory Bird Promotion Center
  - Facility capacity: 108kW (East parking lot: 91.8kW, Rooftop: 16.2kW)
  - Operation start date: 20. 02. 10
  - Obtained zero energy building grade 1 certification: 21. 01. 06
    ※ Migratory Bird Promotion Center Energy self-reliance rate: 133.9%
- Electricity rate system
  - The Migratory Bird Publicity Hall does not incur usage fees due to offsetting transactions that reversely transmit surplus electricity produced through solar power generation facilities to KEPCO.
  - 2022 Migratory Bird Publicity Center Solar Power Generation Efficiency Status Solar power generation: 110,705 kWh / Power consumption: 93,986 kWh

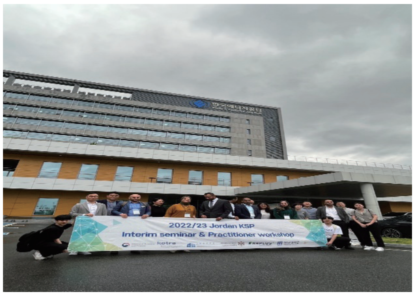
Photo

Site visit	Korea Energy Agency	Date	14th July (Fri) 15:00~16:00
		Location	Korea Energy Agency
Attendants	KOTRA Amman Lee Young-hee Director General, KOTRA Amman Lee Jung-hyun Team Leader, KOTRA Jang Duk Hwan Manager, KOTRA Kang Dong Hun Assistant manager, KSP Researchers, Koo Jung-Hoon General Manager, Hyun Seung-yoon Team Leader, Lee Seong-suk (Interpreter), Zeyad Musadag Mohammad Hammoudeh, Reem Emad Mohammad Al-Bzour, Marwa Ali Saleh Al-Mefleh, Ahmad Bassam Hilmi Ibrahim, Nedal Eman Ahmad Jaber, Omar Abed Hasan Barqawi, Karam Mahmoud Abdel Hafez Almakanin, Waleed Nedal Saeed Abujaradeh, Omar Mahmoud Hamideh Al-Nawaisheh, Omaimah A. M. Al Arja		
Purpose	Visit public institutions established in 1980 to rationalize energy use and supply new and renewable energy in Korea and share knowledge and cases such as Korea's energy-related history and policy status		

Contents

- Overview of Korea Energy Agency
  - Purpose of Establishment: Korea Energy Agency promotes rational and efficient energy use after the energy supply stage, promotes the supply of new and renewable energy, and induces greenhouse gas reduction and improves the quality of life of the people by activating industries
  - Total floor area of 24348.17m^2, 3 floors below ground and 8 floors above ground
  - Building energy efficiency grade 1++, green building certification highest grade, zero energy building grade 5
- Details of the building sector policy
  - Greenhouse Gas Target Management System in the Building Sector
  - Building energy efficiency rating certification
  - Zero energy building certification
  - Eco-friendly house performance evaluation
  - Activation of BEMS distribution
- Application technology
  - BEMS, ESS
  - Solar Panel / Capacity: 128.5kW
  - Solar and geothermal facilities
  - External electric awning and triple glazed windows

Photo



Meeting	Korea Energy Agency	Date	14th July (Fri) 16:00~17:00
		Location	Korea Energy Agency
Attendants	KOTRA Amman Lee Young-hee Director General, KOTRA Amman Lee Jung-hyun Team Leader, KOTRA Jang Duk Hwan Manager, KOTRA Kang Dong Hun Assistant manager, KSP Researchers, Koo Jung-Hoon General Manager, Hyun Seung-yoon Team Leader, Lee Seong-suk (Interpreter), Zeyad Musadag Mohammad Hammoudeh, Reem Emad Mohammad Al-Bzour, Marwa Ali Saleh Al-Mefleh, Ahmad Bassam Hilmi Ibrahim, Nedal Eman Ahmad Jaber, Omar Abed Hasan Barqawi, Karam Mahmoud Abdel Hafez Almakanin, Waleed Nedal Saeed Abujaradeh, Omar Mahmoud Hamideh Al-Nawaisheh, Omaimah A. M. Al Arja		
Purpose	Information on Korea's building-related policies and case sharing through Q&A with energy-related government agencies in Korea		

Contents

- Q&A

Q : How long is the design and construction period for this zero-energy building project?

A : Due to the characteristics of public institutions and various reasons, the project was stopped in the middle, so it took 7 years. If it goes well, it is expected to take about 3 years.

Q : When installing BEMS, you can get 80% subsidy, what is the procedure?

A : First of all, Korean buildings are targeted. In addition, the announcement of the 'BEMS infrastructure construction project' is opened for one year, and when applicants apply, subsidies are paid after selecting subsidy recipients through screening.

Q : Are BEMS installation subsidies cash payments or are there other forms of payment?

A : After confirming that the BEMS has been installed, checking the quotation to see if the cost is appropriate, and if it passes the screening, 80% of the installation cost is deposited in cash.

Q : What are the exact standards for zero-energy building certification methods?

A : Building energy efficiency rating certification must be obtained, and the energy self-sufficiency rate must be at least 20% to obtain ZEB certification. The implementation year of the ZEB certification system is 2020, and through the 'Green Building Construction Support Act', all public buildings with a total floor area of 1000m^2 or more are obliged to obtain ZEB certification.

Photo

Visit	Lx housys R&D Research Field	Date	17^{th} July (Mon) 09:00~10:00
		Location	Lx housys R&D Research Field
Attendants	KOTRA Amman Lee Jung-hyun Team Leader, KSP Researchers, Lee Seong-suk (Interpreter), Zeyad Musadag Mohammad Hammoudeh, Reem Emad Mohammad Al-Bzour, Marwa Ali Saleh Al-Mefleh, Ahmad Bassam Hilmi Ibrahim, Nedal Eman Ahmad Jaber, Omar Abed Hasan Barqawi, Karam Mahmoud Abdel Hafez Almakanin, Waleed Nedal Saeed Abujaradeh, Omar Mahmoud Hamideh Al-Nawaisheh, Omaimah A. M. Al Arja		
Purpose	Sharing application cases while looking at the products of Lx housys, which boasts the best performance in Korea, such as building materials, surface materials, automotive materials and parts, and CRD		

Contents

- Overview of Lx housys
  - It was founded in 1947, produced vinyl flooring for the first time in 1952, produced artificial marble in 1995, and in 2010, it became the world's best in applying Bio-PE. As such, it is a company that sells world-class products.
- Interior materials
  - Soom tile: Interior material with many pores on the surface to control indoor humidity
  - Hi-Max / Byterra: The pores are completely blocked, so it is hygienic and contains more than 90% quartz, so it has excellent strength.
- Insulation materials
  - Foamed semi-non-flammable high-performance insulation material is used (PF board insulation material)
  - With a closed cell structure of more than 90%, it has excellent insulation and maintains long-term durability.
  - Has a thermal transmittance of 0.020 W/m^2K.
- Windows & Glass
  - Outermost protective layer: Improved durability
  - New silver protection alloy: improved durability
  - Silver : Implementation of high insulation performance
  - It is a product that has achieved the 1st grade in energy consumption efficiency with a high-performance insulation block triple compression structure

Photo

<table>
<tr><td rowspan="2">Visit</td><td rowspan="2">LG Science park</td><td>Date</td><td>17th July (Mon) 10:00~11:00</td></tr>
<tr><td>Location</td><td>LG Science park</td></tr>
<tr><td>Attendants</td><td colspan="3">KOTRA Amman Lee Jung-hyun Team Leader, KSP Researchers, Lee Seong-suk (Interpreter), Zeyad Musadag Mohammad Hammoudeh, Reem Emad Mohammad Al-Bzour, Marwa Ali Saleh Al-Mefleh, Ahmad Bassam Hilmi Ibrahim, Nedal Eman Ahmad Jaber, Omar Abed Hasan Barqawi, Karam Mahmoud Abdel Hafez Almakanin, Waleed Nedal Saeed Abujaradeh, Omar Mahmoud Hamideh Al-Nawaisheh, Omaimah A. M. Al Arja</td></tr>
<tr><td>Purpose</td><td colspan="3">View various products that integrate LG's cutting-edge technologies, share examples of application cases, and share examples of energy-related technologies applied in LG Science Park</td></tr>
</table>

Contents

- CLOI Robot
  - Robots that perform various functions such as cleaning, cooking, serving, delivery, and exercise assistance
  - In particular, wheelchair robots for the elderly can be directly adjusted to suit the customer's body shape.
- Display (TV)
  - 8K OLED TV: TV production possible without a light source by using a self-luminous device
  - Curved TV: It can be used in a form that can be deformed according to the purpose. (games, watching TV)
- Energy
  - LG Science Park has various energy-related facilities.
  - Possess solar panel, capacity: 425 W
  - ESS
  - BEMS
  - HEMS
- Electric vehicle parts
  - Electric vehicle battery
  - Vehicle interface

Photo

Meeting	KT	Date	July 17th (Mon) 15:30-16:30
		Location	Insa Louge
Attendants	KSP Researchers, Sung-Sook Lee(Interpreter), KOTRA Amman Jung-Hyun Lee Team Leader, Jordan Ministry of Energy and Mineral Resources (ZEYAD MUSADAG MOHAMMAD HAMMOUDEH other 8 people), German Jordan University OMAIMAH A. M. AL-ARJA Dean of school of architecture		
Purpose	Meeting with Korean conglomerates		

Contents

- Overview of BEMS business
  - The definition of BEMS is a system that monitors and analyzes energy consumption by energy source in real time by interlocking sensors and measuring equipment with energy consumption facilities in buildings to control optimal energy consumption. Before introducing KT's BEMS, there are three major problems in domestic BEMS. The burden of expensive system construction cost due to mandatory BEMS and maintenance cost after installing BEMS is considerable. Lastly, there is a lack of professional manpower capable of practically operating BEMS. Next, I would like to talk about the direction of domestic BEMS policy. It can be divided into two broad categories: legal mandate and incentive system after BEMS installation. The government's BEMS-related building certification policies can be divided into new construction and existing building construction. Among many policies, only green building certification (remodeling) and green remodeling interest support projects are related to existing buildings, and the rest are all applicable to new buildings. The reason most new buildings are targeted is because it is difficult to secure economic feasibility in existing buildings, so the government is also implementing a mandatory policy for new buildings.

- KT Smart Building Service (BEMS)
  - In order to compensate for the problems mentioned above, the first is reducing the cost by using a local server to reduce the burden of construction cost. The second is securing stability and scalability by using the KT cloud BEMS of the KT group. Lastly, KT's experts have been supporting cloud BEMS services for 5 years.
  - The system construction diagram shows the BEMS installed at the KT Mokdong IDC Center and the integrated control center in Bundang. Through KT cloud and KT experts, it is possible to reduce construction or service costs by approximately 50%. There is a case where a KT building was remodeled and BEMS was applied to the Andaz Hotel in Gangnam, Seoul, and a Korean BEMS installation confirmation was obtained.
  - After establishment, contents related to operation will receive BEMS certification, and energy data will be stored and analyzed. Accumulate and analyze data for about a year, and provide consulting for optimal operation of buildings through professional personnel. After consulting, various events are managed by the control center and monthly reports are provided to the actual management team in the building.
  - As a case of KT smart building BEMS, cooling energy was reduced by 23% in the existing building. Savings vary by building. Consulting on electricity consumption reduction is also being carried out by systematizing the rate system in the KEPCO's bill.
  - Supplementation of contents uploaded to KT Cloud is proceeding without any problems. As an example of monthly operation report, consulting on reduction is provided twice a year.

- KT ESG main task
  - Last year, KT issued an ESG report, and Environment related to BEMS, so I introduced it. What is important in the environment is how much greenhouse gas is consumed by the building. Last year, in a carbon disclosure project called CDP (Carbon Disclosure Project), it achieved the platinum club for the 4th time in Korea and achieved the overall 1st place in the ESG category. Provides a greenhouse gas management system at the group level based on data from BEMS. Information obtained by converting data from BEMS into 6 types of greenhouse gases is disclosed to global financial companies. KT also declared RE100 last year and showed the status of power plants by region regarding the implementation status. The last one shows the amount of greenhouse gases emitted by KT group companies in an integrated manner.

• Q&A

Q : What is the IRR of this project?

A : not an investment but is provided like a communication service. Although the payback period is considered to be 5 years, it is difficult to discuss IRR or payback period because it is not important but a policy obligation.

Q : Can't you judge IRR even when you think economically?

A : In the case of new and renewable energy, the IRR is about 6-7%, and in the case of BEMS, the payback period is less than 5 years.

Q : Do experts continue to operate BEMS after 5 years?

A : If the contract extension proceeds, the operation will continue. There are 1 year units or 5 year units.

Q : How can you save 50% through the cloud?

A : Savings through reduction in hardware and standardization of software.

Q : If a client company managed by KT uses KT BEMS service, does it allow domestic BEMS certification and can Japan's CDP also receive certification?

A : Obtain domestic BEMS certification. It is only using BEMS to do CDP, not getting certification.

Q : How many customers use BEMS managed by KT?

A : All 400 office buildings are being used, but currently, other customers are not active.

Q : If KT does this kind of business, who will write the research or report?

A : KT estate proceeds with this.

Q : Is there anything certified when submitting data and reports?

A : Construction is carried out by the Korea Energy Agency, but there is no agency in charge of service-related certification.

Photo

Meeting	Samsung Electronics	Date	17th (Mon) 17:00~18:00
		Location	Insa Lounge
Attendants	KOTRA Amman Lee Jung-hyun Team Leader, KSP Researchers, Yoo Byung-cheon CEO, Lee Seong-suk (Interpreter), Zeyad Musadag Mohammad Hammoudeh, Reem Emad Mohammad Al-Bzour, Marwa Ali Saleh Al-Mefleh, Ahmad Bassam Hilmi Ibrahim, Nedal Eman Ahmad Jaber, Omar Abed Hasan Barqawi, Karam Mahmoud Abdel Hafez Almakanin, Waleed Nedal Saeed Abujaradeh, Omar Mahmoud Hamideh Al-Nawaisheh, Omaimah A. M. Al Arja		
Purpose	By holding a meeting with Samsung Electronics, one of Korea's leading companies, sharing knowledge and case studies on solutions using various displays		

Contents

- Samsung's B2B solution
  - resort
  - Retail
  - Entertainment
  - Arena
  - Splash Bay
- Hotel solution
  - Smart TV, Windless Air Conditioner, IoT AP, Galaxy Tab, Galaxy Home, etc.
- HVAC, Energy solution
  - Chiller, cooling tower, air heating unit, fan coil unit, solar PV, ESS, PCS, parking lot ventilation fan
- Q&A

  Q : Among Samsung's solutions, I'm curious about your views on ESS.

  A : ESS is one of the most important parts in Korea. Korea lacks space to install ESS outside buildings. Therefore, a new space must be created separately to install the ESS.

  Q : Is there a company called Samsung Energy Solutions?

  A : There is no company that has the name 'Samsung Energy Solutions'. However, there are two energy-related companies: Samsung SDI and Samsung SDS.

  Q : After building the BEMS, how can the figures of energy saved, increased efficiency, and reduced costs be converted into figures?

  A : First, the data is monitored through the smart controller. In addition, the amount of energy consumed previously and the amount of energy after reduction can be compared to calculate the value and efficiency. One of the things Korean customers focus most on is how much energy they have saved and how much money they have saved.

Photo

Meeting	LG energy solution	Date	18th (Tue) 09:30~10:20
		Location	Lotte hotel Seoul charlotte-suite room
Attendants	KSP Researchers, Sung-Sook Lee(Interpreter)KOTRA Amman Young–Hee Lee Director General, Jung-Hyun Lee Team Leader, Jordan Ministry of Energy and Mineral Resources (ZEYAD MUSADAG MOHAMMAD HAMMOUDEH other 8 people), German Jordan University OMAIMAH A. M. AL-ARJA Dean of school of architecture		
Purpose	By holding a meeting with LG energy solution, one of Korea's leading companies, sharing knowledge and case studies on solutions using various Battery		

Contents

The meeting with LG Energy Solutions was conducted as a Q & A meeting.

Q : Are there plans to produce electric cars in Jordan?

A : We are basically a battery manufacturing company, and our customers supply batteries to global electric vehicle companies such as Hyundai Motor Company and GM. Based on our investigation, we know that Chinese companies such as Changan and Ichi Motors have entered Jordan.

Q : Are there any plans to make Li batteries for solar systems smaller?

A : Our main proposal is not to make it smaller. Our main target market is the United States, as you know, the United States has a very large land and space. A large amount of energy poses a great explosion hazard when charging in a confined space. So we are building a container system, and energy can be stored in a container with a capacity of 2.86 MW.

Q : Have you ever exported batteries to Arab?

A : Not yet. However, I have analyzed the Indian market and there are many requests from there as well.

Q : Are LG Energy Solutions' batteries exported to Chinese electric vehicle manufacturers?

A : In China, the national standard is LFP battery, and the certification system is carried out by adjusting the regulation in favor to encourage the use of domestic company's battery. For that reason, we are not exporting to China. For example, Korea first utilized lithium ion as a material, while China utilized lithium, phosphoric acid, and iron.

Q : Jordan is currently in need of an ESS because it has a lot of surplus renewable energy production. Therefore, are you willing to conduct analysis and research on Big size & Small size ESS with Jordan?

A : I don't know the situation in Jordan, but right now I can't see Jordan as a specific market.

Q : Why can't Jordan be a specific market?

A : First of all, it is because there is no office of LG Energy Solutions in Jordan yet.

Q : As a question about the battery system, is there anything about recycling batteries?

A : Like GM company asking battery should be sold to using recycle material above 5% raw material. So our management also looking at that recycling is very important. because renewable is means environment friendly. we should keep this very important. So, we are collaborating not only with large companies that adhere to ESG standards, but also with companies that disassemble, reprocess, and extract in China or small companies. For the Japanese market, recycled batteries are also used in small ess systems.

Photo

Meeting	Wrap-up Meeting	Date	18th (Tue) 10:00~13:00
		Location	Lotte hotel seoul charlotte-suite room
Attendants	KOTRA Amman Lee Jung-hyun Team Leader, KSP Researchers, Lee Seong-suk (Interpreter), Zeyad Musadag Mohammad Hammoudeh, Reem Emad Mohammad Al-Bzour, Marwa Ali Saleh Al-Mefleh, Ahmad Bassam Hilmi Ibrahim, Nedal Eman Ahmad Jaber, Omar Abed Hasan Barqawi, Karam Mahmoud Abdel Hafez Almakanin, Waleed Nedal Saeed Abujaradeh, Omar Mahmoud Hamideh Al-Nawaisheh, Omaimah A. M. Al Arja		
Purpose	At the end of the interim briefing session and training event, sharing the places visited during the event, the organizations and companies that had meetings, and the photos taken, etc.		
Contents			

• Provide data on a total of 16 field trips and meeting details
- Numbering of 16 field trips and meeting details
 1. Visit the KDI Global Knowledge Cooperation Complex
 2. Meeting with Climate and Environment Headquarters in Seoul
 3. Interim Seminar
 4. Visit LG ThinQ Home
 5. LG Electronics Meeting
 6. Visit Seoul Energy Dream Center
 7. Korea EMS Association Meeting
 8. LS Electric Meeting
 9. Visit Busan Eco Delda Smart Village
 10. Visit Ulsan Migratory Bird Publicity Center
 11. Visit Korea Energy Agency
 12. Visit Lx housys
 13. Visit LG Science Park
 14. KT Meeting
 15. Samsung Electronics Meeting
 16. LG Energy Solution Meeting
 ※ 17. Wrap-up Meeting

- KDI Global Knowledge Cooperation Complex, LG ThinQ Home, Seoul Energy Dream Center, Busan Eco Delta Smart Village, Ulsan Migratory Bird Promotion Hall, Korea Energy Agency Headquarters, Lx hausys, LG Science park, Seoul Metropolitan Government, LG Electronics, Korea EMS Association, LS Industrial Systems , Energy Corporation, KT, Samsung Electronics, LG Energy Solutions, etc. Sharing the online homepage of the visit site
- Share meeting contents and Q&A contents such as Climate and Environment Headquarters in Seoul, LG Electronics, Korea EMS Association, LS Electrics, KT, Samsung Electronics, LG Energy Solutions, Interim Seminar, Wrap-up Meeting, etc.

• Zeyad Musadag Mohammad Hammoudeh
- Through this training event, I was able to directly experience energy efficiency in Korea, so I am really grateful to everyone who prepared it. Through this project, I think it will help to enact Jordan's laws or establish an economic system. thank you

• OMAIMAH A. M. AL-ARJA
- First of all, I would like to thank you on behalf of the University of Jordan, Germany. Thank you to everyone who prepared and prepared for this seminar, to those who provided each venue, and to those who took the time to hold presentations and meetings. We were able to learn a lot through this seminar, and I think we can handle a lot of work through this. Also, I feel like I've become more of an expert. thank you

Photo	
	

5) 2022/23 Jordan KSP Local seminar and Final reporting seminar

□ Date : 2023.09.10.(Sun) ~ 2023.09.19.(Tue)

□ Location : Jordan (Amman, Aqaba)

□ Purpose and major activities

- Local seminar before the final report
- Jordan KSP Final Reporting Workshop
- On-site investigation related to environmental certification and green buildings

□ Business trips attendees (4 in total)

	Name	Affiliation	position
1	Lee, Soonmyung	Sangmyung University	PI
2	Kim, Giljung	Sangmyung University	Researcher
3	Lee, Sunghyun	Sangmyung University	Researcher
4	Yoo, Byungchun	REPLUS Co., Ltd	

<Table. Detailed schedule of business trip>

Date	Contents	Note
09/10 (Sun)		
(departure) 13:35 (arrival) 16:30	**Incheon → Hong Kong**	QR5829
09/11 (Mon)		
(departure) 00:25 (arrival) 04:05	**Hong Kong → Doha**	QR0815
(departure) 06:35 (arrival) 09:30	**Doha → Amman (Jordan)**	RJ0651
16:00-18:00	**Visit to KOTRA Amman Trade Center**	- Report Local seminar and final reporting workshop contents
09/12 (Tue)		
10:00-12:00	**Visit to GJU (German-Jordanian University)**	- Seminar related to the contents of the final reporting workshop
09/13 (Wed)		
10:00-14:00	**Visit to MEMR (Jordan Ministry of Energy and Mineral Resources)**	- Seminar related to the contents of the final reporting workshop
09/14 (Thu)		
09:30-14:00	**Jordan KSP Final Reporting Workshop**	- Jordan KSP Final Reporting Workshop
14:00-16:00	**REPLUS B2B Meeting**	- Meeting Izzat Marji Group - Meeting ETA-max
09/17 (Sun)		
09:00-11:00	**Site visit 1: Kempinski Hotel**	- Visit to an eco-certified hotel in Jordan
13:00-14:30	**Site visit 2: Energy Efficient Residential Buildings**	- Visit to energy efficient residential buildings in Jordan
09/18 (Mon)		
(departure) 02:25 (arrival) 05:05	**Amman (Jordan) → Doha**	QR0405
(departure) 08:25 (arrival) 21:35	**Doha → Hong Kong**	QR0816
09/19(Thu)		
(departure) 00:30 (arrival) 05:10	**Hong Kong → Incheon**	OZ0746

□ 2022/23 Jordan KSP Final Reporting Seminar

- Date : 2023.09.14.(Thu) 09:30-14:00)
- Venue : Grand Hyatt Amman Iris Hall (B Floor)
- Progress : Face-to-face meeting (Korean-Arabic consecutive interpretation)
- Korea : (Senior Advisor) Hong Young-pyo, Senior Advisor
  Embassy of the Republic of Korea) Kim Dong-gi Ambassador and 2 people including.
  (KOTRA Development Cooperation Office) Park Chul-ho. Director General, Jang Duk-hwan. Project Manager 3 people including.
  (KOTRA Amman) Lee Young-hee. Director General, Kim Chan-youl. Deputy Director General 6 people including.
  (KSP Researchers) Lee Soon-myung. Professor, Yoo Byung-chun. Co. 4 people including
- Jordan : (Government · Association) Mr. Rasmi Hamza (Executive Dir ector Jordan Renewable Energy and Energy Efficiency Fund) and 25 people including

<Table. Detailed program of Final Reporting Seminar>

Time	Program	Note
09:30-09:50	Final Reporting Workshop Order and attendees introduction	Director Jang Deok-hwan of KOTRA (Jordan KSP PM)
	Opening Address	(Kor) Senior Advisor
09:50-10:00	welcome address	(Jor) Executive Director Jordan Renewable Energy and Energy Efficiency Fund
10:00-10:10	congratulatory speech	(Kor) Ambassador of Korea
10:10-11:10	Jordan KSP Final Reporting Workshop	Lee Soon myung prof.
11:10-11:50	Discussion and Q&A	All attendees
11:50-12:00	Closing remarks / photo	-
12:00-14:00	Luncheon	-

□ Opening Address

- (Hong Young-pyo Jordan KSP Senior Advisor) Nice to meet you all. My name is Hong Young-pyo, and I am the senior advisor for the 2022/23 Jordan KSP project. First, I would like to express my deepest gratitude to Rasmi Hamza, General Director of the Green Energy Development Fund (JREEEF), and all Jordanian officials who attended the KSP final report today. I would also like to express my deepest gratitude to Ambassador Kim Dong-gi of the Embassy of the Republic of Korea in Jordan who attended today's event. In addition, we would like to thank all the Korean officials, including Director Park Cheol-ho of KOTRA's Development Cooperation Office, KOTRA Amman Trade Center Director Lee Young-hee, Sangmyung University Professor Lee Soon-myung, and Replus CEO Yoo Byeong-cheon for organizing today's event. The Jordan KSP project began with a launching seminar in February of this year, and has been promoting the energy efficiency improvement project for buildings in Jordan in close cooperation with Korean experts and officials from the Jordan Ministry of Energy and Mineral Resources through a practitioner workshop to Korea and an interim Seminar in July. Today's final report is an opportunity to present research results and policy recommendations to the Ministry of Energy and Mineral Resources and share opinions. Researchers have been working to establish a policy roadmap for building energy development as well as establishing a certification system. We hope that the research results presented at today's final report will be helpful in implementing Jordan's 2020-2030 energy efficiency policy. We would like to ask for your valuable opinion on whether the content presented by Korean experts in a moment contains analysis and content appropriate to the Jordanian government's policy needs and local context. thank you.

- (Rasmi Hamza Executive Director Jordan Renewable Energy and Energy Efficiency Fund) First of all, we would like to thank the KSP Project and the Korea Trade-Investment Promotion Agency (KOTRA), which prepared this workshop to present the final research results for improving the energy efficiency of Jordanian buildings, and all the efforts made by the research team appointed for this purpose. In addition to the benefits achieved in the building energy efficiency sector, this program has certainly contributed to strengthening the strong and long-term relationship between Jordan and Korea. Securing all forms of energy sources creates the need to take all possible measures to rationalize energy consumption and increase the efficiency of energy use in various sectors. The most important of these is the building sector, which includes both residential and public sector buildings. Electrical energy consumption in the building sector in Jordan amounts to 48% of total electrical energy consumption.

This is the highest percentage, and herein lies the importance of this study and project. I appreciate the great benefits gained through this program by learning and sharing Korea's experience during training visits and workshops held in Korea with Jordanian officials in attendance to see Korea's achievements. It was an opportunity to exchange opinions in terms of building energy efficiency and management, and to exchange experiences in the field of energy efficiency applications. Lastly, I wish the success of this final reporting meeting. In the future, new horizons will be opened for cooperation between Korea and Jordan.

□ Presentation of research results

- (Final Report Workshop Table of Contents and KSP Guide) The presentation content is divided into five tables of contents. The first to third are about the process of carrying out the 2022/23 Jordan KSP project, and the fourth and fifth are about research results and policy recommendations. Currently, Jordan KSP is an industry area hosted by KOTRA and falls under the Energy Green Growth area among a total of 11 KSP topics. The 2022/23 Jordan KSP consists of three areas: policy recommendations, capacity building, and follow-up projects targeting MEMR, a partner organization.

- (Summary of 2022/23 Jordan KSP project progress status) In relation to book recommendations and capacity building, the laws and systems of Jordan and Korea were analyzed. In addition, Korea's building energy efficiency-related laws were translated into English and delivered to MEMR for reference in establishing future systems. And during the training visit to Korea in July, we conducted a field trip to understand how the relevant laws and institutional systems are actually applied in the field in Korea. Regarding the follow-up project, we held meetings with various Korean companies and organizations during the training visit to Korea, and we plan to continue to follow up on the project content needed in Jordan with Replus, which is conducting research together.

- (Comparison of energy status of Korea and Jordan) Jordan and Korea have an absolutely high energy import ratio. Additionally, most of the population lives concentrated in cities. About 50% of the population lives in the Amman area in Jordan and in the Seoul area in Korea. It is also similar in that the proportion of apartments is the highest among residential types, and heating energy is the highest among energy consumption. However, the residential sector accounts for a higher proportion of total energy use in Jordan than in Korea. Therefore, Jordan must continue to promote energy efficiency in the residential area at a national level, more so than Korea.

- (Comparison of regional classification, laws, and systems of Korea and Jordan) Currently, Jordan is divided into three regions based on altitude, and Korea is divided into four regions based on climate. Regarding building energy efficiency, Jordan currently has its own JGBG, and Korea has a green building certification system called G-SEED with the same concept. In addition, Korea has a building energy efficiency rating certification system, green building certification system, and zero energy building certification, and is showing a high number of applications beyond the initial stage of introduction.

- (Summary of Jordan Field survey and Practitioners workshop) In the Jordan Field Survey conducted in May, a total of 14 apartments and houses were visited and surveys and field surveys were conducted. I will briefly mention some of the results. The most dissatisfying part of each house is the high energy bills. Among the heating equipment used in each house, oil boilers were the most common, among hot water equipment, electric boilers were the most common, and among cooling equipment, fans and air conditioners were the most common. In addition, in relation to the government's building energy efficiency policy, there was recognition that policies for existing and new construction were needed. During the policy practitioner training and training visit to Korea held last July, a total of 9 field visits and meetings with a total of 8 Korean organizations and companies were conducted.

- Summary of Korean law and system analysis) Korea's building energy efficiency-related system begins with establishing and managing energy efficiency-related standards. In the case of Korea, mandatory provisions are set for the architectural sector, mechanical equipment sector, and electrical equipment sector, and permits for new buildings can be obtained only when a score higher than the standard is obtained. In addition, depending on the region and use, the indoor cooling and heating temperature of the building is presented as a standard value to calculate the capacity of energy-using facilities or the building's energy requirements. Both Jordan and Korea establish and manage insulation standards, but Korea applies lower standards. In the case of windows, Korea also proposes more stringent standards and various types of standard values than Jordan. Additionally, in Korea, it is mandatory to install BEMS in buildings that exceed the standard.

- (Simulation – Overview) An apartment consisting of a total of 8 households on the 4th floor was selected as a simulation model, and the cooling standard was set at 20 degrees and the heating standard was set at 30 degrees. In addition, we analyzed the energy load trend for one year as of April, when the field survey in Jordan was conducted. Since winter and summer show the highest energy load throughout the year, apartments in urban areas that are cooled with air conditioners were used as the standard. . Additionally, energy simulations were performed based on meteorological data from nine regions in Jordan. The limitation of the current weather data is that it is obtained from areas outside the city center, such as airports, air force bases, and ports.

- (Simulation – Regional classification) As a result of analyzing meteorological data, climate environmental characteristics can be broadly divided into three categories. The three regional divisions are similar to those classified by JNBC in 2012 to apply insulation standards. It is meaningful in that it is similar to the results of clustering climate data such as temperature, humidity, solar radiation, and wind speed using Python, and is similar to areas previously classified based on altitude.

- (Simulation – Comparison of energy requirements in both countries) First of all, if Jordan's insulation standards are applied to Korea, the energy requirement will be higher than that of Korea. Next, when the insulation standards of the four regions of Korea are applied to Amman, Jordan, energy consumption is lower than when Jordan's insulation standards are applied, with Korea's central region 1 showing the lowest value. On the other hand, if the same method is applied to the Ghor safi area, there is no significant difference compared to when Jordan's insulation standards are applied. Among them, the southern region shows the lowest value. Also, if the same method is applied to the Irbid region, the southern region of Korea shows the lowest value.

- (Simulation – u-value standard) Simulation was performed by changing the u-value for each part of 5 buildings in 9 regions of Redan, from the current insulation standards in Jordan to the insulation standards in 4 regions in Korea. As an example, in the case of Amman's External Roof, it can be seen that energy consumption decreases when the u-value is strengthened. In the case of Ma'an's External Wall, it can be seen that energy consumption decreases when the u-value is strengthened. In the case of Ruwaished's Adjacent Wall, energy requirements do not change significantly even if the u-value is changed. In other words, it can be confirmed that strengthening insulation has no effect. In the case of Irbid's Ground Floor, the energy requirement is minimum when the u-value is 0.8 ($W/m^2 \cdot K$) and increases before and after. In other words, it can be seen that strengthening insulation has no effect. In the the case of Aqaba›s Ground Floor, strengthening the u-value actually increases energy consumption, so it is effective to relax the current insulation standards. In the case of Ghor›s Adjacent Ceiling, the energy requirement does not change significantly even if the u-value is changed. In other words, it can be confirmed that strengthening insulation has no effect. Through these various combinations, we propose u-values for 5 building parts in 9 regions of Jordan.

- (Simulation – Windows)We conducted a simulation using a similar approach, and currently, Jordan is divided into five regions where the g-value can be maintained, including Amman, Ruwaished, Ma'an, Irbid, and Hussein. Additionally, there are four regions, namely Hasan, Wadi, Aqaba, and Ghor, where we need to strengthen the g-value criteria. In the case of Amman, the annual energy requirement was almost the same even if the g-value applied to the window was changed with various u-values. In other words, the g-value of the window does not have a significant effect on the change in energy requirements. On the other hand, in the case of Aqaba, when the g-value applied to the window was changed with various u-values, the annual energy requirement was found to be lower when a lower g-value was applied.

- (Simulation – Active facility) Simulations were performed by increasing the capacity of solar power generation facilities from 3kW to 15kW, and simulations were performed by installing solar power facilities and using them for heating. It was assumed that the nine regions of Jordan calculated earlier would meet their annual energy requirements with EHP. Additionally, information from Seoul is included as comparative data. As a result of the simulation, all regions of Jordan have an advantage over Seoul in both solar power generation and solar power facilities. It can be seen that when EHP and 12kW solar power generation facilities are installed, production exceeds energy consumption in Amman, Irbid, and Hussein regions. It can be seen that when solar power generation facility capacity is increased to 15 kW, production in the Wadi and Ma'an regions will be greater than energy consumption. When EHP, 9kW solar power generation equipment, and solar power equipment are installed together, Irbid and Ruwaished areas are the first to see energy production exceeding energy consumption. When solar power generation facilities are increased to 12kW, production in Amman, Wadi, and Ma'an regions will additionally exceed energy consumption. When solar power generation facilities are increased to 15kW, production exceeds energy consumption in all of Jordan's nine regions except Aqaba and Ghor.

- (Roadmap) First, many of the systems implemented in Korea were organized in the form of a roadmap and appeared in the following form. The roadmap strategy consists of first improving building-related laws and systems, then strengthening education and incentives, then promoting technological development such as building equipment along with building materials, and finally generalizing BEMS. Jordan should also use a similar strategy to Korea. At present, it is judged that Jordan must first improve its building-related laws and systems, and strengthen education and incentives. For the future, I believe that we must promote the development of technologies such as building materials and heating and cooling equipment, and foster businesses within Jordan.

□ Q&A and discussion

- (Q&A)

Q : What are the current requirements for improving energy efficiency in existing buildings in Jordan?

A : Strengthening the insulation standards of new buildings is easy to change and manage the figures in laws and regulations. However, insulation of existing buildings is more difficult because it must be carried out directly by the residents living in the building. Taking Korea as an example, Korea is strengthening insulation standards for existing buildings in two aspects. The first is the green remodeling project, which is a system in which the government directly raises funds and supplies costs to green remodeling retrofit users. Second, manufacturers provide low-cost materials that residents of existing buildings can easily purchase. For example, they sell films that can be applied to windows to enhance g-value, or low-cost finishing materials that can close the gap between windows and walls to enhance insulation.

Q : What exactly is the content of the simulation shown before the simulation for insulation standards?

A : It can be seen that the stage is divided into two stages. The first step was to first apply various u-values from four regions in Korea to find a suitable u-value for Irbid, for example. In this way, it was confirmed that among the four insulation standards, the southern region's insulation standard was the most effective. The next step was to find specific appropriate u-value values for each of Irbid's five building parts. As such, different insulation standards must be adopted for each of Jordan's nine regions.

Q : How did you set the window size and ratio of the simulation model?

A : The size of the window was set to 2 meters wide and 0.75 meters tall. And the area ratio is 11%.

Q : How does Korea manage standards for windows?

A : In Korea, there are various types of windows, such as double-glazed windows, triple-glazed windows, quadruple-glazed windows, and frame types. In addition, we manage not only the u-value and g-value related to the window, but also the window frame. In addition, after designing which window to use, licensing is only granted if it complies with the heat transmittance rate and energy performance standards set by the relevant agency.

Q : Why is Korea's certification system performing so well? And is there any change in house prices due to Korea's energy efficiency-related rating certification?

A : First of all, Korea's building energy efficiency rating certification system is a certification system that must be followed unconditionally. In the case of buildings that use a lot of national energy or that require good management of energy usage, permits are granted only if they receive a high rating. And the ZEB certification system has a differential where high incentives are paid for high grades, and low incentives are paid for low grades. In other words, some certification systems are mandatory, and some other certification systems implement a system that provides differential incentives depending on the grade. Additionally, incentives include relaxation of building floor area ratio and reduction of property and acquisition taxes. And there is no change in house prices depending on the certification level.

Q : All 14 locations where field surveys were conducted are located west of Amman. There are differences between the west and east of Amman, and there are differences by region, so why did you only investigate buildings that exist only in the west of Amman?

A : In reality, the survey of these 14 areas required showing the house in which the person lives, and revealing the house so that we could conduct the survey. Since the houses of those currently participating in this seminar occupy a large portion of the area, There was a limit to this.

Q : How are Korea's policies regarding the installation of solar power generation facilities progressing?

A : Korea sets up a fund every year to receive subsidies when installing new and renewable facilities. At the beginning of the year, buildings that plan to proceed with construction that year apply for the fund and, if selected, receive support for the costs of installing new and renewable energy facilities. Second, ZEB certification is mandatory for new buildings, requiring buildings to produce more than 20% of their energy use from renewable energy. In this way, the number of cases where new and renewable facilities are applied to new buildings through applications and permits is increasing.

Q : Was economic analysis also conducted during this study?

A : This study did not conduct an economic analysis of installation costs for PV systems, insulation, and windows

Q : Is the active solution proposed in this seminar a globally accepted solution?

A : This solution is not available globally. This is because the climates of regions around the world are different, the heating and cooling set points are different in each climate zone, and the climates of the nine regions within Jordan are different. Jordan's residential type is generally 4-story, 8-unit buildings, so it is a very suitable form for reducing energy consumption through solar power facilities. Therefore, I think we need to find locally appropriate solutions.

□ Closing remarks

- (Hong Young-pyo Jordan KSP Senior Advisor) Today, we had a meaningful conversation and had a valuable time sharing the final results of the Jordan Building Energy KSP project. The matters discussed here today will be supplemented by the research team in the future and completed in the form of a final report. I hope that today's briefing session will provide an opportunity for Korea's technology and know-how to help Jordan develop building energy and systematize its certification system. Once again, I would like to express my deepest gratitude to Green Energy Development Fund General Director Razmi Hamza, Ambassador Kim Dong-gi of the Embassy of the Republic of Korea in Jordan, and everyone else who attended today's final briefing. thank you

Jordan KSP Final Reporting Workshop


Jordan KSP Final Reporting Workshop


Jordan KSP Final Reporting Workshop


Jordan KSP Final Reporting Workshop


□ Summary of major activity results

Meeting	KOTRA Amman	**Date**	09.11(Mon) 16:00-18:00
		Location	KOTRA Amman
Attendant	KSP Researcher, KOTRA Amman Lee Young hee (Director General), Kim Chan youl (Deputy Director General), Lee Jung hyun (Head of Mardeting Team),, Lee Ho bin (Deputy Director), Wala Yassen, Esraa Alkurdi		
Purpose	Local seminar and final briefing session schedule and plan report		

Contents

- Check and discuss the schedule for the business trip and the plan for the day of the final briefing
  - Share schedule during business trip
  - Check confirmations and modifications related to the final briefing event

- Sharing the contents of the final report presentation materials and answering questions
  - Up to page 59, the detailed progress of the task is pointed out one by one and explained in chronological order, and from page 60 onwards, the content aimed at conveying actual knowledge consists of the content conveyed by accumulating and connoting the previous content.
  - We plan to review revisions and supplements to the roadmap contents and reflect them in the final report at the end of October.

  Q: Incentives are key, but are they included?

  A: Information about Korea's incentives, such as property tax reduction, was included and delivered in the materials. It is difficult to make a proposal considering Jordan's financial situation.

  Q: How does thermal transmittance approval in Korea proceed?

  A: In accordance with the design conditions, the ECO-2 program calculated values are used at the design stage and material test reports or certificates are submitted. After that, we proceed with the actual measurement.

Photo

Meeting	GJU Seminar	Date	09.12(Tue) 10:00-12:00
		Location	German-Jordan University
Attendant	KSP Researcher, Sondos (interpreter), German-Jordan University Dr.Omaimah Ali Al-Arja, Dr.Farah Al-Atrash, Arch.Tala Samir Awadallah		
Purpose	Share content and discuss modifications before final reporting meeting		

Contents

- Share the presentation before the final report meeting
  - KSP Background Summary
  - Launching Seminar Summary
  - Comparison of countries and energy usage in both countries
  - Comparison of laws and systems of both countries
  - Summary of field survey details
  - Reporting of simulation results
  - Present roadmap
- Check the presentation content and discuss modifications
  - Check clustering results for climate zone classification
  - The standard weather data was modified to display the data name as the correct local name
  - Comparison of simulation results and actual local content
  - In the simulation part, it is proposed to include or replace the four regional divisions for Korean region names.

Photo

<table>
<tr><td rowspan="2">Meeting</td><td rowspan="2">MEMR Meeting</td><td>Date</td><td>09.13(Wed) 10:00-12:00</td></tr>
<tr><td>Location</td><td>Jordan Ministry of Energy and Mineral Resources</td></tr>
<tr><td>Attendant</td><td colspan="3">KSP Researcher, Sondos (interpreter), MEMR Mr. Rasmi Hamzeh, Eng. Nedal Jaber, Eng. Reem Al-Bzour, Eng. Marwa Al-Mefleh, Eng. Karam Ajarmeh, Jasmin</td></tr>
<tr><td>Purpose</td><td colspan="3">Share the presentation before the final report meeting</td></tr>
<tr><td colspan="4">Contents</td></tr>
<tr><td colspan="4">
• Share the presentation before the final report meeting KSP 백그라운드 요약
- KSP Background Summary
- Launching Seminar Summary
- Comparison of countries and energy usage in both countries
- Comparison of laws and systems of both countries
- Summary of field survey details
- Reporting of simulation results
- Present roadmap

• Q & A
Q : Among Korea’s certification systems, are the certification systems for new and existing buildings different?
A : Korea has two certification systems. There is a ZEB certification system for new buildings and a green remodeling certification system for existing buildings.
Q : In the field survey, there is a story that energy bills are expensive. Compared to which place did you say that energy bills are expensive?
A : This is not a comparison with other countries, but rather a story about what the residents themselves felt.
Q : Is there a list of insulation materials for insulation standards at this report?
A : At this stage, we are talking about numbers to strengthen insulation, and what type of insulation material to use is a matter of economic feasibility.
</td></tr>
<tr><td colspan="4">Photo</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td></tr>
</table>

Site visit (1)	Aqaba Kempinski Hotel	Date	09.17(Mon) 09:30-10:20
		Location	Aqaba kempinski hotel
Attendant	KSP Researcher, Hong Young pyo (Senior Advisor), KOTRA Amman Lee Young hee (Director General), Lee Jung hyun (Head of Mardeting Team), KOTRA Development Cooperation Office Park Chul ho (Director General), Jang Duk hwan (Project Manager), Chung Yoon jae (Assistant Manager)		
Purpose	Visit an environmentally certified hotel		

Contents

- Visit an environmentally certified hotel
  - Last April, we achieved the bronze benchmark certification rating of Earth check, an environmental certification in the travel and tourism industry, and silver certification in early September.
  - Earth check certified hotels actively monitor and report the environmental and social impacts of their operations, including indicators such as energy and water consumption, carbon emissions, waste generation, community engagement, etc. Hotels are encouraged to increase efficiency, maximize guest experience, and Aim to minimize environmental impact

Photo

<table>
<tr><td rowspan="2">Site visit (2)</td><td rowspan="2">Aqaba Residence Energy Efficiency Building</td><td>Date</td><td>09.17(Mon) 10:30-11:30</td></tr>
<tr><td>Location</td><td>Aqaba Residence Energy Efficiency Building</td></tr>
<tr><td>Attendant</td><td colspan="3">KSP Researcher, Hong Young pyo (Senior Advisor), KOTRA Amman Lee Young hee (Director General), Lee Jung hyun (Head of Mardeting Team), KOTRA
Development Cooperation Office Park Chul ho (Director General), Jang Duk hwan (Project Manager), Chung Yoon jae (Assistant Manager)</td></tr>
<tr><td>Purpose</td><td colspan="3">Survey of energy efficient residential buildings in Jordan</td></tr>
<tr><td colspan="4">Contents</td></tr>
<tr><td colspan="4">• Survey of energy efficient residential buildings in Jordan
- Field trip to residential buildings built as a pilot project for energy efficient buildings in Aqaba, Jordan

• On-site investigation details
- Large window to the southwest for winter heating
- Install solar cooling panel on the rooftop
- Arrange bedrooms to face north and east, considering the direction of solar radiation
- The sizes of the windows are set differently depending on the direction, and Venetian-style shutters allow for light shading and ventilation
- Insulating materials are selected considering thermal transmittance
- Designed for night ventilation in summer</td></tr>
<tr><td colspan="4">Photo</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td></tr>
</table>

6) Legal system analysis

□ Building energy certification system

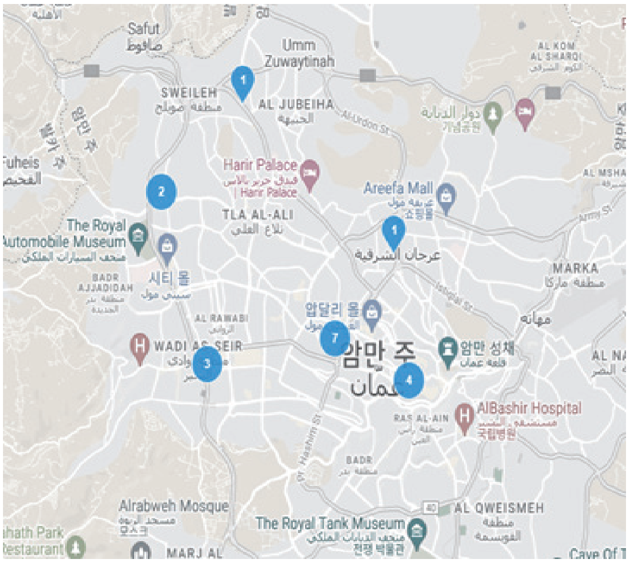
Jordan	Korea
Jordan Green Building Guide	G-SEED
LEED	Building energy efficiency rating certification
EDGE	Zero Energy Building certification

□ Jordan Building Energy Efficiency Certification System

certification	LEED		JGBG	
Introduced year	1998		2013	
Agency	US Green Building Council (USA, non-profit organization)		CSBC of RSS (Jordan, government agency)	
Assessment Methods	Categorized into 4 levels according to score • CERTIFIED : 40-90 • SILVER : 50-95 • GOLD : 60-79 • PLATINUM : 80+		Categorized into 4 levels according to score • Level A(achieving 80% of the total score) • Level B(achieving 70-79% of total score) • Level C(achieving 60-69% of total score) • Level D(achieving 50-59% of total score)	
Evaluation items	• Sustainable Sites	24%	• Site Sustainability	8%
	• Water Efficiency	9%	• Water Efficiency	35%
	• Energy and Atmosphere	32%	• Energy Efficiency	33%
	• Indoor environmental quality	14%	• Healthy Indoor Environment	8%
	• Materials and Resources	13%	• Materials and Resources	10%
	• Innovation	9%	• Green Building Management	6%
number of certifications	13		in construction	

- LEED
  - LEED (Leadership in Energy and Environmental Design) is a green building certification system developed by the U.S. Green Building Council (USGBC), and LEED is the most widely used in the world.
  - LEED grades buildings according to established standards for the entire life cycle of a building and grants certification from the highest rating, Platinum Certified Building, to Certified Building, which meets the minimum requirements.
  - In Jordan, after a surge in energy prices in 2008, an energy crisis occurred in Jordan. Afterwards, interest in energy consumption increased, building managers began to enforce energy-related local building codes, and since 2009, LEED registered buildings have appeared in Jordan. Started
  - Currently, as of 2023, a total of 13 certifications have been received: 3 platinum level, 7 gold level, and 3 silver level, but it is not currently widely distributed regionally in Jordan.

[Figure. Jordan LEED certified building distribution map]



<Table. List of LEED certified buildings in Jordan>

building name	LEED Rating	score
Dutch Embassy in Amman, Jordan	SILVER	34
Aramex Warehouse- Amman	SILVER	50
OMNITRADE New Offices	SILVER	57
World Health Organization Building	GOLD	42
The Edgo Atrium	GOLD	61
Middle East Insurance Building	GOLD	66
Jordan Kuwait Bank HQ	GOLD	66
U.S. Embassy Amman Jordan NOX	GOLD	62
Hikma Headquarters	GOLD	63
Ministry Of Interior Conference Hall	GOLD	65
ABS Randa Kawar IB College Building	PLATINUM	80
Izzat Marji Group Headquarters	PLATINUM	82
ATG Head Quarter	PLATINUM	84

- There are a total of 13 buildings that have obtained LEED certification in Jordan to date, and a total of 55 buildings including registered buildings. However, most of the certified and registered buildings are concentrated in the metropolitan area (Amman). ATG Head Quarter was re-certified from GOLD level to PLATINUM level, with 2 certified items.

- JGBG (Jordan Green Building Guide)
  - RSS (Royal Scientific Society) referred to LEED, BREEAM, ESTIDAMA, Dubai green building rating system, QSAS, etc. in 2013 due to the need for its own building energy efficiency certification system suited to Jordan's climate, resources, related systems, and building technology. , developed by Jordan Green Building Guide
  - The JGBG contains parameters and credits appropriate for Jordan's climate, resources, laws, policies and policy instruments, building technologies and strategies, and is attached to a voluntary rating system linked to an incentive scheme provided by the government.
  - JGBG standards announced and available in 2013, incentive system based on JGBG grade approved in 2015, effective September 3, buildings that meet JGBG requirements are under construction as of August 2021

- Unlike LEED, JGBG currently only has an evaluation model for new buildings, and an evaluation model for existing buildings is under development.

• EDGE (Excellence in Design for Greater Efficiencies) certification

Introduced year	2014
Agency	EDGE /IFC (International Finance Corporation)
SUBJECT	New and existing buildings
Authentication method	Save at least 20% in water and energy using the EDGE app, then select an energy savings goal that matches one of the following goal levels:
Certification level	• Level 1 : EDGE Certified
	Energy, water, and embodied energy savings of more than 20%
	• Level 2 : EDGE Advanced
	On-site energy savings of over 40%
	• Level 3 : EDGE Zero Carbon
	Achieve 100% by using 100% renewable energy on-site or off-site or by purchasing carbon offsets
number of certifications	3

- EDGE (Excellence in Design for Greater Efficiencies) certification is a green building certification system to make buildings more resource efficient.
- There are currently three Level 2: EDGE Advanced certifications in Jordan.

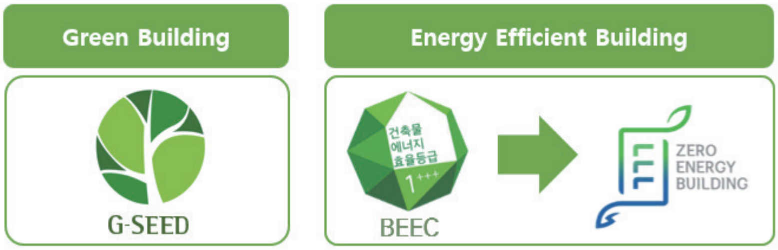
<Table. List of EDGE certified buildings in Jordan>

project name	EDGE Level
King Hussein Business Park Infill (office)	ADVANCED
King Hussein Business Park (Office)	ADVANCED
Dabouq (5) Project (home)	ADVANCED

- There are currently three Level 2: EDGE Advanced certifications in Jordan. There are a total of three buildings that have obtained EDGE certification in Jordan, all of which are located in Amman.

□ Korean building energy efficiency certification system

[Figure. Overview of Korean building energy certification system]



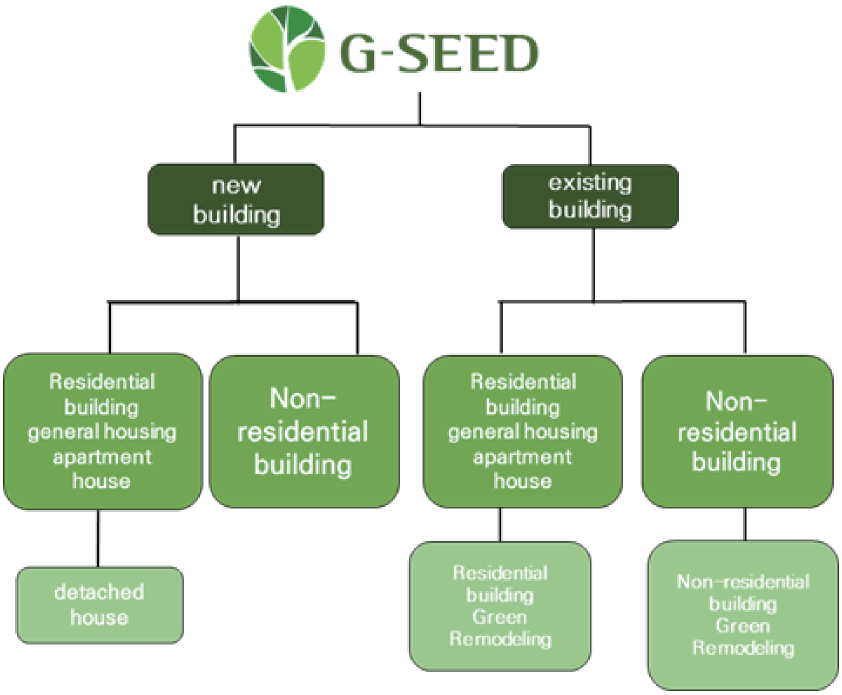
• G-SEED

- A system that certifies the environmental performance of buildings through evaluation of factors that affect the environment throughout the entire life cycle of the building, including location, materials and construction, maintenance, and disposal.
- It is the only evaluation system in Korea that comprehensively evaluates the eco-friendliness of buildings, and the government and local governments have made it mandatory for public buildings to obtain certification. Additionally, support policies are discovered and incentives are provided to certified green buildings.
- In the overseas certification project, green building excellence grade certification was granted to buildings of the Vietnam-Korea Institute of Science and Technology (2016) and the Kenya Institute of Science and Technology (2020), and the detailed review criteria for green building certification of diplomatic missions abroad (new business use, green remodeling) was enacted (December 2021). We are also supporting and cooperating with the Ministry of Foreign Affairs' overseas embassy

green smart project promotion.

- Green building certification targets: apartment complexes, general houses, business buildings, school facilities, lodging facilities, sales facilities, general buildings (buildings in accordance with Article 2, Paragraph 1, Subparagraph 2 of the Building Act)
- Obligatory subjects of green building certification: Public buildings with a total floor area of 3,000 square meters or more (Article 11-3 of the Enforcement Decree of the Green Building Construction Support Act), apartment complexes with more than 500 households subject to business plan approval under Article 16 of the 「Housing Act」

[Figure. Category of G-SEED certification targets]



- Assessment Methods

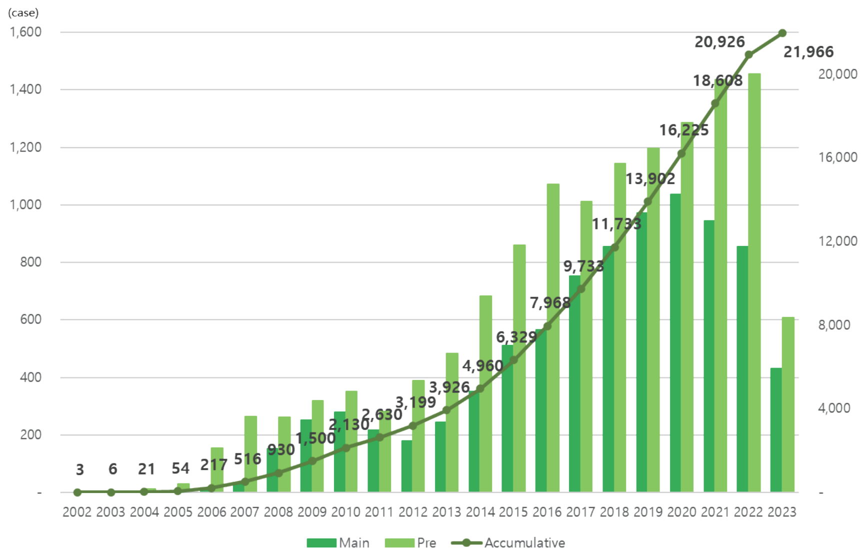
<Table. Weight by specialty>

Classification		Land use and transportation	Energy and environmental pollution	materials and resources	Water cycle management	Maintenance	ecological environment	indoor environment
new building	residential	10	25	18	10	7	10	20
	House	15	25	15	10	5	10	20
	Non-residential use	10	30	15	10	7	10	18
existing building	residential	10	27	15	10	15	10	13
	Non-residential use	10	25	15	10	15	10	15
green remodeling	residential	-	60	10	10	10	-	10
	Non-residential use	-	60	10	10	10	-	10

<Table. Score criteria for each certification level>

Classification		Best (Green Grade 1)	Excellent (Green Grade 2)	Excellent (green grade 3)	General (Green Grade 4)
new building	Residential	74 points or more	6 points or more	58 points or more	50 points or more
	House	74 points or more	66 points or more	58 points or more	50 points or more
	Non-residential use	80 points or more	70 points or more	60 points or more	50 points or more
existing building	residential	69 points or more	61 points or more	53 points or more	45 points or more
	Non-residential use	75 points or more	65 points or more	55 points or more	45 points or more
green remodeling	residential	69 points or more	61 points or more	53 points or more	45 points or more
	Non-residential use	75 points or more	65 points or more	55 points or more	45 points or more

[Figure. Green building certification status by year (as of May 2023)]



- Building energy efficiency rating certification
  - A rating system to expand demand for buildings with high energy performance and induce awareness of effective building energy management by providing quantitative and objective information on building energy performance.

<Table. Mandatory Certification Subject>

Classification	Subject	Building energy efficiency rating
Public institutions	New construction and extension of a separate building with a total floor area of 3,000m^2 or more	Grade 1 or higher
	Apartment complex/officetel	Level 2 or higher
Market/quasi-market public enterprise	New construction and extension of a separate building with a total floor area of 3,000m^2 or more	Grade 1++ or higher

<Table. Certification criteria>

Rating	Annual primary energy consumption per unit area of residential buildings (kWh/m^2year)	Annual primary energy consumption per unit area of buildings other than residential (kWh/m^2year)
1+++	less than 60	less than 80
1++	More than 60 but less than 90	Above 80 but below 140
1+	More than 90 but less than 120	140 or more but less than 200
1	120 or more but less than 150	200 or more but less than 260

Rating	Annual primary energy consumption per unit area of residential buildings (kWh/m²year)	Annual primary energy consumption per unit area of buildings other than residential (kWh/m²year)
2	Above 150 but below 190	260 or more but less than 260
3	Above 190 but below 230	Above 320 but below 380
4	Above 230 but below 270	Above 380 but below 450
5	Above 270 but below 320	Above 450 but below 520
6	Above 320 but below 370	Above 520 but below 610
7	Above 370 but below 420	Above 610 but below 700

- Incentive

<Table. Property tax: 5 years after certification (Article 47-2 of the Local Tax Restriction Act)>

classification	Green Building Certification Excellent (Green 1)	Green Building Certification Excellent (Green 2)
Building energy efficiency1+ grade	10%	7%
Building energy efficiency1st grade	7%	3%

<Table. Acquisition tax (Article 47-2 of the Local Tax Restriction Act)>

classification	Green Building Certification Excellent (Green 1)	Green Building Certification Excellent (Green 2)
Building energy efficiency1+ grade	10%	5%

<Table. Relaxation of building standards (Article 16 (Relaxation Standards) Annex 9 of Energy Saving Design Standards for Buildings)>

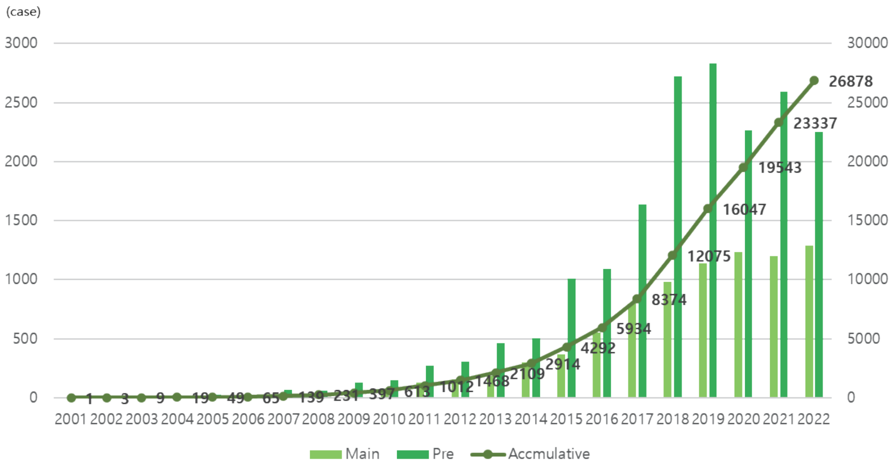
classification	Green Building Certification Excellent (Green 1)	Green Building Certification Excellent (Green 2)
Building energy efficiency1+ grade	9%	6%
Building energy efficiency1st grade	6%	3%

- Mitigation targets: floor area ratio, building height restrictions

<Table. Reduction of donation and collection of infrastructure for housing construction projects (Section 2 of operating standards for donation and collection of infrastructure for housing construction)>

classification	Green Building Certification Excellent (Green 1)	Green Building Certification Excellent (Green 2)
Building energy efficiency1st grade	10%	2%
Building energy efficiency 2nd grade	7%	5%

[Figure. Number of building energy efficiency rating certifications by year]



- Zero energy building certification
  - It is a green building that minimizes the energy load required for the building and minimizes energy consumption by utilizing new and renewable energy, and is a system that grants zero energy building certification from grades 1 to 5 depending on the energy independence rate.
  - Certification target: Among the building energy efficiency rating certification targets, it includes buildings for most purposes, such as buildings for which the owner applies for zero energy building certification, single-family and apartment houses, office facilities, and neighborhood living facilities.
  - Obligation for certification: Public buildings subject to submission of an energy saving plan with a total floor area of 1,000m^2 or more that are newly built, rebuilt, or expanded as a separate building on the site of an existing building are buildings subject to mandatory certification labeling. (* However, apartment complexes and dormitories specified in subparagraph 2, item d of Table 1 of the Enforcement Decree of the Building Act are excluded)

- ZEB mandatory roadmap

<ZEB Mandatory Roadmap (2050 Land, Infrastructure and Transport Carbon Neutral Roadmap, December 2021)>

	'20	'23	'24	'25	'30
public	more than 1,000m^2 (Grade 5)	more than 500m^2 More than 30 households of public sale/rental apartment (Grade 5)		Level of 4 grade (use/scale undecided)	Level of 3 grade (use/scale undecided)
private	-		More than 30 households for private sale/rental apartment (Level of Grade 5)	more than 1,000m^2 (Level of Grade 5)	more than 500m^2 (Level of Grade 5)

- Certification criteria: Certification is granted by grade according to energy independence rate for buildings that meet all three conditions below.
- Building energy efficiency rating of 1++ or higher, energy independence rate of 20% or higher, installation of BEMS or remote electronic meter reading

<Table. ZEB rating>

ZEB level	energy independence rate
Grade 1	energy self-sufficiency rate more than 100%
Grade 2	energy self-sufficiency rate: 80% to less than 100%
Grade 3	energy self-sufficiency rate: 60% to less than 80%
Grade 4	energy independence rate: 40% to less than 60%
Grade 5	energy independence rate: 20% to less than 40%

- Incentive

<Table. Relaxation of building standards (Article 15 of the Green Building Construction Support Act and Article 11 of the Enforcement Decree of the same Act, Energy-saving Design Standards for Buildings [Appendix 9])>

Certification level	ZEB 1	ZEB 2	ZEB 3	ZEB 4	ZEB 5
relaxation rate	15%	14%	13%	12%	11%

- Funding support for energy use rationalization: When investing in energy efficiency-related facilities in buildings (excluding apartment complexes) that have obtained preliminary certification as a zero energy building, a portion of the investment cost is supported at low interest rates over a long period of time (funding guidelines for the 2020 energy use rationalization project [Appendix. 1)
- Financial support (「2020 Housing and Urban Fund Operation Plan」): Housing and Urban Fund loan limit increased by 20% for public rental/sale housing, national rental housing, happy housing, and private rental housing
- Infrastructure donation payment (「Operation standards for infrastructure donation payment for housing construction projects」 2-2-2): Up to 15% reduction rate applied to infrastructure donation payment burden level (8% of the relevant project site area)
- New and renewable energy installation subsidy support (Ministry of Trade, Industry and Energy New and Renewable Energy Supply Project Announcement): Additional points are given when applying for new and renewable energy installation subsidy support projects (building support project, convergence support project)
- Tax benefits (Article 47-2 of the Restriction of Special Local Tax Act and Article 24 of the Enforcement Decree of the same Act): Up to 20% reduction in building or housing acquisition tax

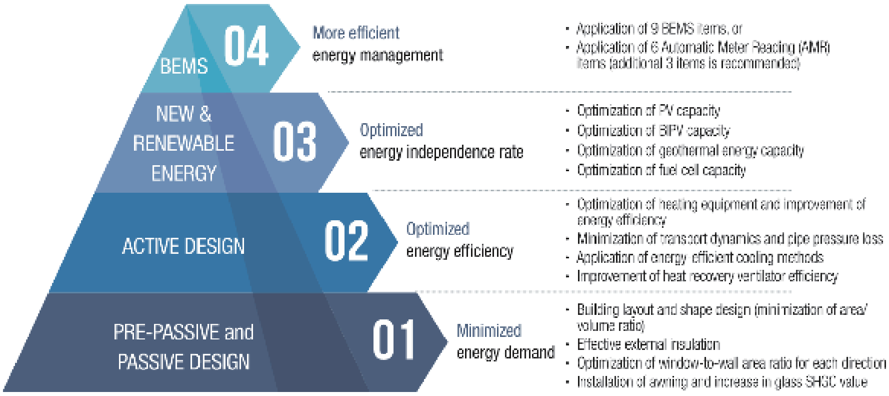
Certification level	ZEB1	ZEB2	ZEB3	ZEB4	ZEB5
Reduction rate	20%			18%	15%

- Building energy efficiency grade certification fee reduction: Building energy efficiency grade certification fee reduction according to the zero energy building certification grade for buildings that are not subject to mandatory zero energy building certification labeling.

Certification level	ZEB1	ZEB2	ZEB3	ZEB4	ZEB5
Reduction rate	100%	100%	100%	50%	30%

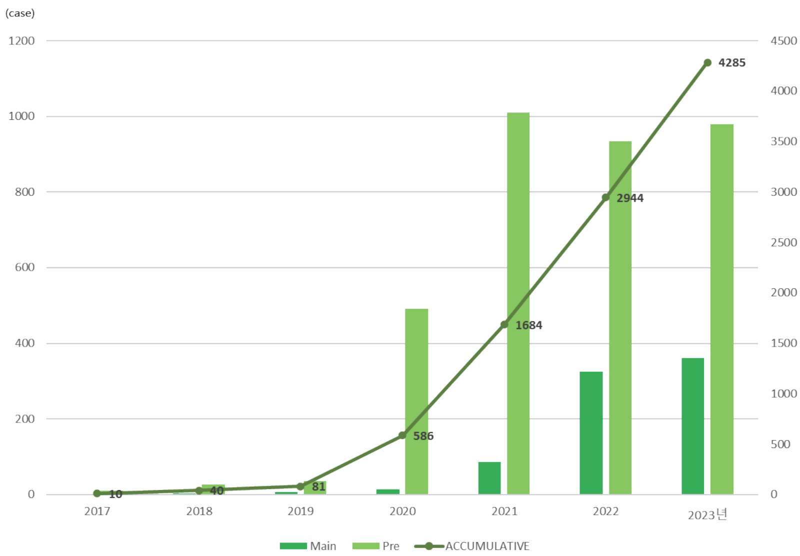
- Research is underway on the life cycle management framework as well as certification of construction projects for energy efficiency of buildings.

Integrated design for optimal energy efficiency at each stage



- Building Energy Database
- Financing and tax relief for buyers
- certification
- Grants and loans
- Relaxation of building standards
- ZEB Consulting

[Figure. Zero Energy Certification Status]



□ Green remodeling support project

- Green remodeling refers to remodeling that creates a comfortable and healthy residential environment while reducing greenhouse gas emissions and reducing heating and cooling costs by improving energy efficiency by improving the performance of insulation and facilities in old buildings.
- Green remodeling support projects include the public building green remodeling support project and the green remodeling private interest support project.

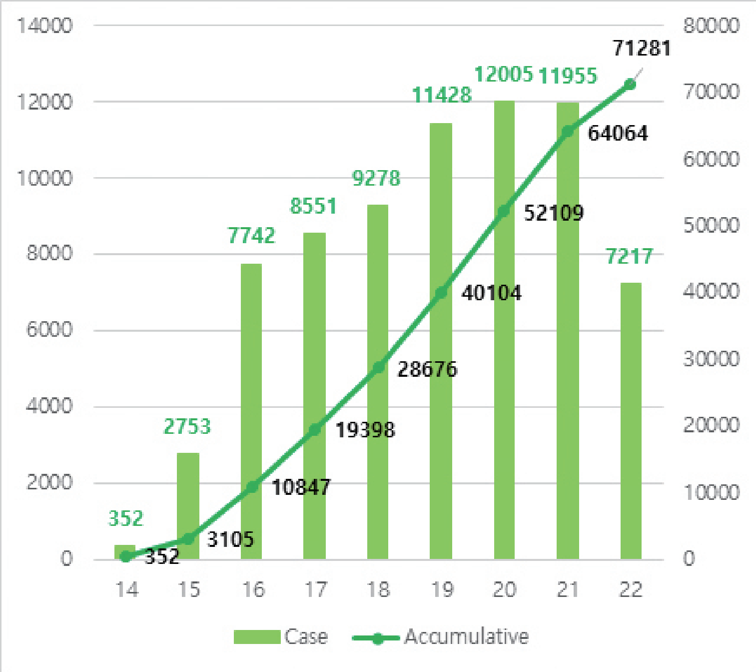
<Table. Overview of the 2023 public building green remodeling support project>

purpose	Create best practices and promote their spread to the private sector by reducing greenhouse gases and improving living environments by improving the energy performance of old public buildings.
Basis for promotion	Article 27 of the 「Green Building Construction Support Act」 and 「Notice on the operation of green remodeling support projects, etc.」
project operator	National Land Safety Management Agency (Green Remodeling Center)
Support details	Support for project costs to improve energy performance and living environment of old public buildings
Business scale	Total KRW 191 billion (based on government subsidy project budget)
Project period	Principle of execution within the year (annual carryover, minimizing project cancellation after issuance)

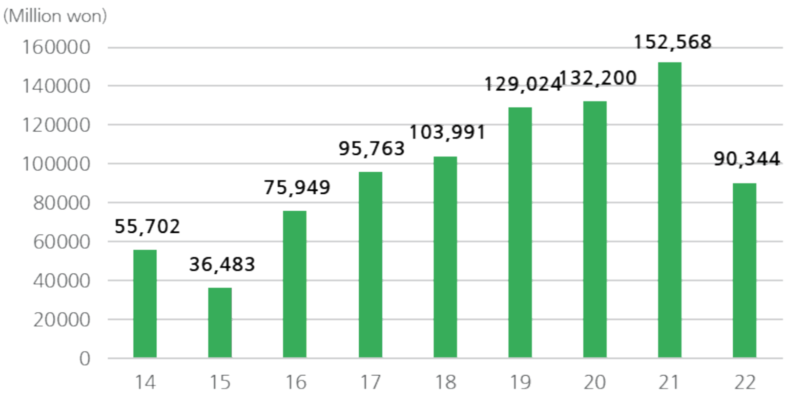
<Table. Overview of the 2023 green remodeling interest support project for private buildings>

purpose	In order to promote energy performance improvement of private buildings, we promote green remodeling projects by subsidizing a portion of construction cost loan interest.
Basis for promotion	Article 27 of the 「Green Building Construction Support Act」
project operator	National Land Safety Management Agency Green Remodeling Creation Center (hereinafter "Center")
Project period	From the date of announcement for the year until the interest support budget is exhausted
Support details	Interest support of up to 4% (5% for the second-lowest class, including basic livelihood security recipients) is provided in accordance with the support criteria when signing a loan agreement with a handling financial institution for the cost of energy performance improvement of existing buildings.

[Figure. Green remodeling private interest support project performance status]



[Figure. Status of private interest support project amount]



<Table. Targets for private interest support>

classification	Note
Required construction	High-performance windows and doors, waste heat recovery ventilators, internal and external insulation reinforcement, high-efficiency heating and cooling equipment, high-efficiency boilers, high-efficiency lighting (LED), new and renewable energy (solar power, etc.), building energy management system (BEMS), or remote meter reading electronic meters.
Selective construction	Cool roof (heat-insulating paint), solar radiation control device, smart air shower, instantaneous water heater, and other construction projects to improve energy performance and indoor air quality.
Construction available for additional support	Existing construction demolition and waste disposal, asbestos investigation and removal, structural safety reinforcement, other green remodeling-related building auxiliary work, construction costs or contributions due to heat source replacement, and green remodeling-related electrical work such as electric capacity expansion.

- Support for construction cost interest according to energy saving standards

<Table. Support criteria based on energy performance improvement rate>

Energy performance improvement rate (saving rate)*	Interest support rate
More than 20%	4%

* The energy performance improvement rate is determined by the performance improvement rate of energy demand or energy consumption (or primary energy consumption) compared to before improvement work.

Note: When the energy performance improvement rate is reduced by more than 20% compared to before improvement work

<Table. Support criteria according to the energy performance improvement rate simple evaluation table>

Energy performance improvement rate (sum of savings rate from simple evaluation table*)	Interest support rate
More than 20%	4%

* Only for single-family homes approved for use before January 1, 2013, the interest support standard according to the energy performance improvement rate simple evaluation table in [Appendix 8] can be applied.

Note: Applicable only to single-family homes approved for use before January 1, 2013

<Table. Interest support standards based on window energy consumption efficiency rating>

Window energy consumption efficiency rating*	Interest support rate
Grade 3 or higher (Grade 1~3)	4%

* Interest support standards according to window energy consumption efficiency level can be applied only to apartments (apartments, multi-family houses, townhouses)

** Window energy consumption efficiency ratings are subject to Ministry of Trade, Industry and Energy Notice No. 2022-64 (April 27, 2022) <Efficiency Management Equipment Operation Regulations>.

*** Applies to replacement of non-replaced windows among exterior windows with an efficiency rating of 3 or higher within the past 3 years. However, submit supporting documents related to window efficiency grade 3 or higher. Remarks: (Required requirement) Applies to all when replacing 2/3 of the outer peripheral window** [Excluding windows less than $1m^2$]

□ Building Energy Efficiency Database

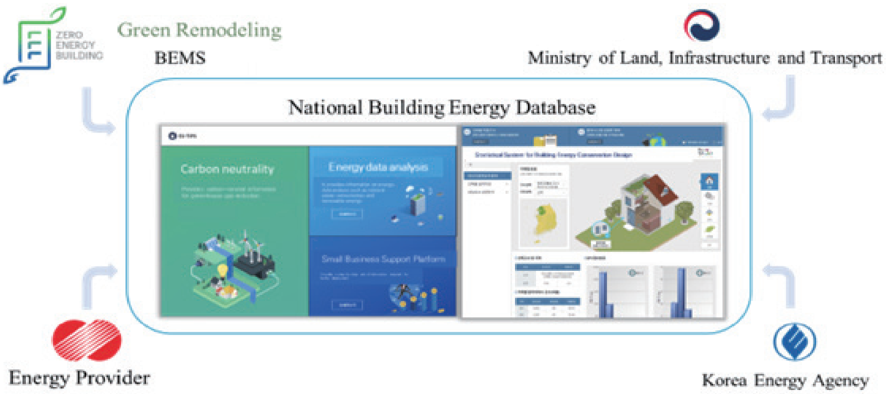
• BEMS (Building Energy Management System): The building energy management system for zero energy building certification has the following functions.

- Evaluate heating, cooling, hot water, lighting, ventilation requirements and renewable energy production, etc.

- Install sensors and measuring equipment in energy consumption facilities (lighting, heating and cooling facilities, ventilation facilities, outlets, etc.) within the building and connect them to a communication network to monitor the amount of energy consumed by energy sources (electricity, gas, fuel, etc.) in real time.

- A system that efficiently and automatically controls energy usage information collected through optimization analysis software

• Building energy data collected through smart meters in each individual building forms a ‘national building energy database’



□ Legal system in the field of building energy efficiency

Jordan	Korea
Energy Efficient Buildings Code of Jordan National Building Code	Energy-saving design of buildings
Thermal Insulation Code of Jordan National Building Code	Insulation standards for buildings
-	Total Energy Consumption System for Buildings

• The structure of the legal system is similar, but Korea has the characteristic of having standards that regulate the energy usage of individual buildings.

• Energy Efficient Building Code (Jordan)

System name	Energy Efficient Buildings Code
Year of implementation	2010
Purpose	Define the essential requirements for the energy efficiency of buildings during their design, construction, operation and maintenance phases.
Subject	New buildings and parts of new buildings, excluding low-rise residential buildings (2 stories or less)
category	1. General information 2. Architectural requirements for the design of energy-efficient buildings 3. Natural ventilation 4. Heating and air conditioning 5. Hot water supply 6. Artificial lighting equipment 7. Electric power equipment

- Provides minimum energy efficiency requirements for buildings excluding low-rise residential buildings (two stories or less) and applies to the following
  - New public, private and multi-purpose buildings and systems
  - New parts and systems of new public, private and multi-purpose buildings
  - New systems and devices in all existing buildings
  - New systems and devices used in manufacturing and industrial processes
  - Does not cover existing buildings

- Consists of the following chapters
  - general details
  - Architectural requirements for the design of energy efficient buildings
  - Natural ventilation
  - Heating and air conditioning
  - Hot water supply

- Artificial lighting equipment
  - Electric power equipment

- Energy-saving design of buildings
  - The purpose is to establish standards for energy-saving design such as heat loss prevention for efficient energy management of buildings, standards for writing energy-saving plans and design review documents, and matters related to easing building standards to promote the construction of green buildings.

- Energy-saving design standards applicable
  - Building permit (excluding major repairs)
  - Permission or report for change in use
  - Change in building register entries for buildings exceeding 500m^2 in total floor area (excluding single-family homes)

- There are energy-saving design standards for the following sectors, and there are obligations and recommendations.
  - Construction sector
  - Mechanical equipment sector
  - Electrical equipment sector
  - New and renewable energy equipment sector

- Standards for calculating the capacity of heating and cooling equipment

<Table. Design outdoor temperature and humidity standards for calculating the capacity of cooling and heating equipment>

Classification / City	Colling		Heating	
	Dry bulb temperature (℃)	Wet bulb temperature (℃)	Dry bulb temperature (℃)	Relative humidity(%)
Seoul	31.2	25.5	-11.3	63
Incheon	30.1	25.0	-10.4	58
Suwon	31.2	25.5	-12.4	70
Chun Cheon	31.6	25.2	-14.7	77
Gangneung	31.6	25.1	-7.9	42
Daejeon	32.3	25.5	-10.3	71
Rice wine	32.5	25.8	-12.1	76
Jeonju	32.4	25.8	- 8.7	72
Seosan	31.1	25.8	- 9.6	78
Gwangju	31.8	26.0	- 6.6	70
Daegu	33.3	25.8	- 7.6	61
Busan	30.7	26.2	- 5.3	46
Jinju	31.6	26.3	- 8.4	76
Ulsan	32.2	26.8	- 7.0	70

Classification / City	Colling		Heating	
	Dry bulb temperature (℃)	Wet bulb temperature (℃)	Dry bulb temperature (℃)	Relative humidity(%)
Pohang	32.5	26.0	- 6.4	41
Mokpo	31.1	26.3	- 4.7	75
Jeju	30.9	26.3	0.1	70

<Table. Indoor and outdoor temperature and humidity standards for calculating the capacity of cooling and heating equipment>

Classification / Usage	Heating	Cooling	
	Dry bulb temperature(℃)	Dry bulb temperature (℃)	relative humidity (%)
Apartment house	20 ~ 22	26 ~ 28	50 ~ 60
School (classroom)	20 ~ 22	26 ~ 28	50 ~ 60
Hospital (room)	21 ~ 23	26 ~ 28	50 ~ 60
Viewing and assembly facilities (audience seats)	20 ~ 22	26 ~ 28	50 ~ 60
Accommodation (room)	20 ~ 24	26 ~ 28	50 ~ 60
Sales facilities	18 ~ 21	26 ~ 28	50 ~ 60
office	20 ~ 23	26 ~ 28	50 ~ 60
bathhouse	26 ~ 29	26 ~ 29	50 ~ 75
swimming pool	27 ~ 30	27 ~ 30	50 ~ 70

□ Thermal Insulation Code

- Thermal Insulation Code of Jordan
  - It defines the basic design principles for building insulation and was first published in 1985 and became mandatory from 2009.
  - Insulation regulations have been mandated, but compliance with them is poor due to a lack of enforcement mechanisms.

<Table. Wall u-value criteria (Jordan)>

Walls	U-value ($W/m^2.K$)
Opaque walls or any part of it	0.57
Total Wall including percentage of openings	1.6
Divider walls between 2 different energy source provider for 2 building spaces.	2
Divider walls between 2 parts of the building one of them is heated/ air conditioned and the other not.	2

<Table. u-value standards for exposed floors and roofs (Jordan)>

Exposed Floors and roofs		U-value ($W/m^2.K$)
Exposed for outdoor air	Heat transfer towards the top	(1.2) 0.55
	Heat transfer towards the bottom	0.8
Floors/ Roofs dividing to floors with different energy source provider		1.2
Floors located above un heated/ air conditioned basements or spaces		1.2

<Table. Window u-value standards (Jordan)>

Window Type	U-value $W/m^2.K$	Allowed ratio of window to wall
Aluminum/ steel frame, single glazing	5.7	20.10%
Aluminum/ steel frame,double glazing	3.4	32.90%
Wooden/ plastic frame, single glazing	4.8	24.30%
Wooden/ plastic frame,double glazing	3.1	40.7%

- Korean Insulation standards
  - (Energy-saving design standards for buildings, Article 2 (Prevention of heat loss in buildings, etc.) Paragraph 1) When constructing a building, undergoing major repairs, changing the use, or changing the contents of the building ledger, measures must be taken to rationalize energy use, such as preventing heat loss in accordance with the following standards.
  - (Energy-saving design standards for buildings, Article 2 (Prevention of heat loss in buildings, etc.), Paragraph 2) The exterior wall of the living room, the roof or roof of the living room on the highest floor, the floor of the living room on the lowest floor, the floor between floors where underfloor heating is used, and the windows and

doors of the living room, etc. must comply with the thermal transmittance standards in Annex 1 or the insulation thickness standards in Annex 3. . In addition, general insulation measures, etc. follow the mandatory requirements for the construction sector in Article 6.

<Table. Insulation standard table for building parts by region>

(unit : W/m²·K)

Building Element				Middlel 1	Middlel 2	Southern	Jeju
External wall	Exposed to the outdoor air	Multi-family housing		0.150	0.170	0.220	0.290
		other than Multi-family housing		0.170	0.240	0.320	0.410
	Semi-exposed to the outside air	Multi-family housing		0.210	0.240	0.310	0.410
		other than Multi-family housing		0.240	0.340	0.450	0.560
Roofs in the top floor	Exposed to the outdoor air			0.150		0.180	0.250
	Semi-exposed to the outside air			0.210		0.260	0.350
Groud floor	Exposed to the outdoor air	Floor heating		0.150	0.170	0.220	0.290
		Other than floor heating		0.170	0.200	0.250	0.330
	semi-exposed to the outside air	Floor heating		0.210	0.240	0.310	0.410
		Other than floor heating		0.240	0.290	0.350	0.470
Mid-floor with floor heating				0.810			
Glazing & door	Exposed to the outdoor air	Multi-family housing		0.900	1.000	1.200	1.600
		Other than Multi-family housing	Glazing	1.300	1.500	1.800	2.200
			Door	1.500			
	Semi-exposed to the outside air	Multi-family housing		1.300	1.500	1.700	2.000
		Other than Multi-family housing	Glazing	1.600	1.900	2.200	2.800
			Door	1.900			
Door and fire door of Multi-family housing	Exposed to the outdoor air			1.400			
	Semi-exposed to the ouside air			1.800			

<Table. Insulation performance of windows and doors>

(unit : $W/m^2 \cdot K$)

Types of sindows and doors			Thermal transmittance rate by type of window frame and door frame								
			metal						plastic or wood		
			Thermal bridge barrier material not applied			Thermal bridge barrier material applied					
Air layer thickness of glass[mm]			6	12	more than 16	6	12	more than 16	6	12	more than 16
window	duplex window	General duplex window	4	3.7	3.6	3.7	3.4	3.3	3.1	2.8	2.7
		Low-E Glass(Hard Coating)	3.6	3.1	2.9	3.3	2.8	2.6	2.7	2.3	2.1
		Low-E glass(soft coating)	3.5	2.9	2.7	3.2	2.6	2.4	2.6	2.1	1.9
		argon injection	3.8	3.6	3.5	3.5	3.3	3.2	2.9	2.7	2.6
		argon in jection+Low-E Glass(Hard Coating)	3.3	2.9	2.8	3	2.6	2.5	2.5	2.1	2
		argon in jection+Low-E glass(soft coating)	3.2	2.7	2.6	2.9	2.4	2.3	2.3	1.9	1.8
	triple glazing	normal triple glazing	3.2	2.9	2.8	2.9	2.6	2.5	2.4	2.1	2
		Low-E Glass(Hard Coating)	2.9	2.4	2.3	2.6	2.1	2	2.1	1.7	1.6
		Low-E glass(soft coating)	2.8	2.3	2.2	2.5	2	1.9	2	1.6	1.5
		argon injection	3.1	2.8	2.7	2.8	2.5	2.4	2.2	2	1.9
		argon in jection+Low-E Glass(Hard Coating)	2.6	2.3	2.2	2.3	2	1.9	1.9	1.6	1.5
		argon in jection+Low-E glass(soft coating)	2.5	2.2	2.1	2.2	1.9	1.8	1.8	1.5	1.4
	quadruple window	normal quadruple sindows	2.8	2.5	2.4	2.5	2.2	2.1	2.1	1.8	1.7
		Low-E Glass(Hard Coating)	2.5	2.1	2	2.2	1.8	1.7	1.8	1.5	1.4
		Low-E glass(soft coating)	2.4	2	1.9	2.1	1.7	1.6	1.7	1.4	1.3
		argon injection	2.7	2.5	2.4	2.4	2.2	2.1	1.9	1.7	1.6
		argon in jection+Low-E Glass(Hard Coating)	2.3	2	1.9	2	1.7	1.6	1.6	1.4	1.3
		argon in jection+Low-E glass(soft coating)	2.2	1.9	1.8	1.9	1.6	1.5	1.5	1.3	1.2

Types of sindows and doors				Thermal transmittance rate by type of window frame and door frame								
				metal						plastic or wood		
				Thermal bridge barrier material not applied			Thermal bridge barrier material applied					
Air layer thickness of glass[mm]				6	12	more than 16	6	12	more than 16	6	12	more than 16
door	single window			6.6			6.1			5.3		
	normal door	Insulation thickness less than 20mm		2.7			2.6			2.4		
		Insulation thickness more than 20mm		1.8			1.7			1.6		
	glass door	single door	Glass ratio less than 50%	4.2			4			3.7		
			Glass ratio more than 50%	5.5			5.2			4.7		
		multi-story window door	Glass ratio less than 50%	3.2	3.1	3	3	2.9	2.8	2.7	2.6	2.5
			Glass ratio more than 50%	3.8	3.5	3.4	3.3	3.1	3	3	2.8	2.7

- Comparative analysis contents
  - Jordan's thermal transmittance rate has a relatively loose standard compared to domestic standards.
  - In Korea, buildings are classified by region, but in Jordan, there is no particular classification.
  - It was confirmed that even in the case of windows and doors, there is no detailed classification in Korea compared to the standards for each type.

□ Total Energy Consumption System for Buildings

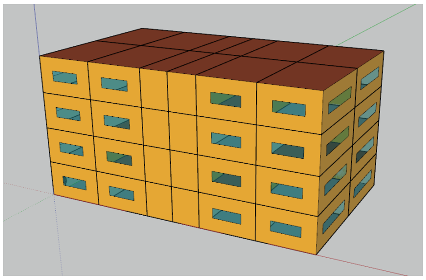
- The building energy consumption cap system is a system that displays and manages energy consumption per unit area by dividing the total amount of energy consumed by a building in a year by the building area.

Year of implementation	2011
purpose	To manage the total energy consumption of a building for one year by dividing the total energy consumption of the building by the total area of the building to express the energy consumption per unit area below a certain standard.
subject	1. Buildings with a total floor area of 3,000 square meters or more among business facilities according to Annex 1 of the Enforcement Decree of the Building Act 2. Buildings with a total floor area of 3,000 square meters or more among educational and research facilities according to Annex 1 of the Enforcement Decree of the Building Act.
article	(Article 21 (Evaluation objects of energy consumption of buildings and determination of energy consumption evaluation report) Paragraph 1) In the case of new construction or expansion into a separate building, the primary energy consumption of buildings that fall under any of the following items shall be evaluated, A building energy consumption evaluation report must be submitted according to Form No. 1 attached. (Article 21 (Evaluation object of energy consumption of buildings and determination of energy consumption evaluation report) Paragraph 2) The energy consumption evaluation report of a building is considered appropriate if the total primary energy consumption per unit area is less than 200 kWh/m^2 per year. However, public institutions buildings are considered suitable if their consumption is less than 140 kWh/m^2 per year. (Article 22 (Method for evaluating energy consumption of buildings)) Energy consumption of buildings is assessed through a program designed to comprehensively evaluate heating, cooling, hot water supply, lighting, ventilation, etc. in accordance with international standards such as ISO 52016. It is evaluated based on the calculated annual primary energy consumption per unit area, etc., and is in accordance with the evaluation criteria in Annex Table 10.

7) Simulation (General)

□ Simulation modeling

• Building model

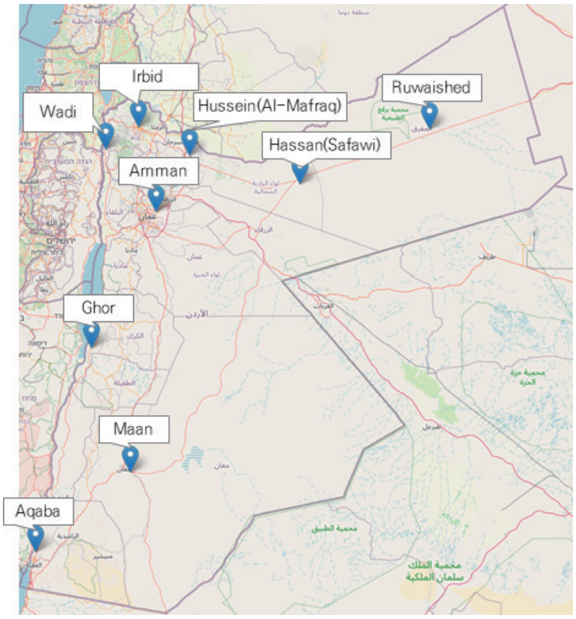


- Midrise apartment
- Azimuth : Southern
- Total floor area : 1080 [m^2]
- Floor : 4
- Households/Floor : 2
- Floor area per household : 135 [m^2]

□ Regional classification through K-Means clustering

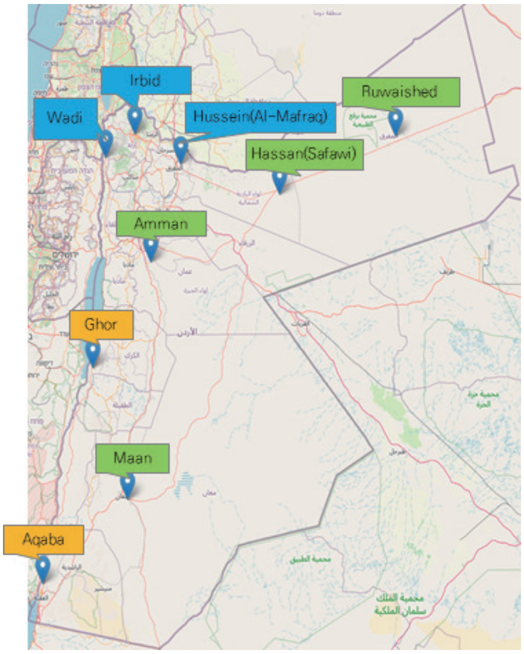
- Standard weather data (9 regions in Jordan)
  - Amman
    (Queen Alia International Airport)
  - Aqaba
    (King Hussein International Airport)
  - Wadi
    (Wadi al Rayan)
  - Ibrid
  - Ghor
    (Ghor Al-Safi)
  - Hussein (Al-Mafraq)
    (King Hussein Air Base)
  - Ruwaished
    (H-4 Air Base)
  - Hasan (Safawi)
    (Prince Hussein Air Base)
  - Ma’an
    (Port lotniczy Ma’an)

[Figure. Standard weather data local location indication]

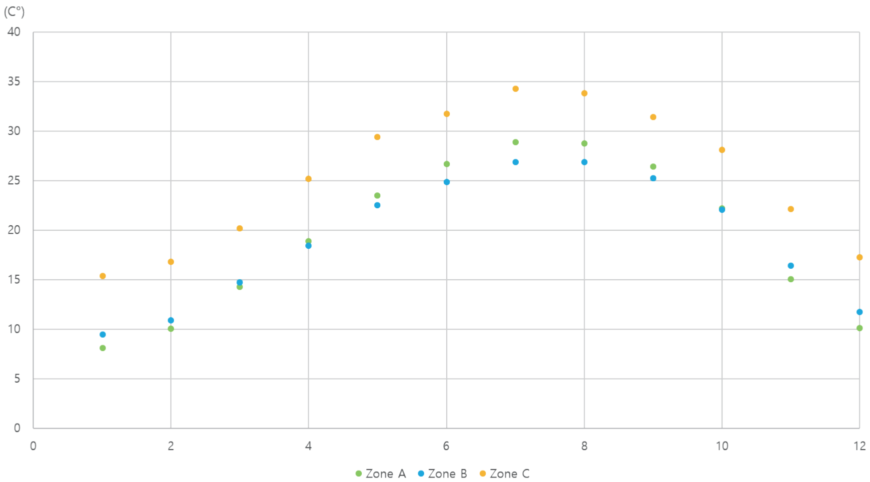


- The monthly average temperature and humidity, maximum and minimum temperature, maximum and minimum humidity, cumulative total of annual solar radiation, and annual average wind speed data of each region collected through standard meteorological data were clustered using the K-Means clustering algorithm by 3 region.
- Clustering results and analysis

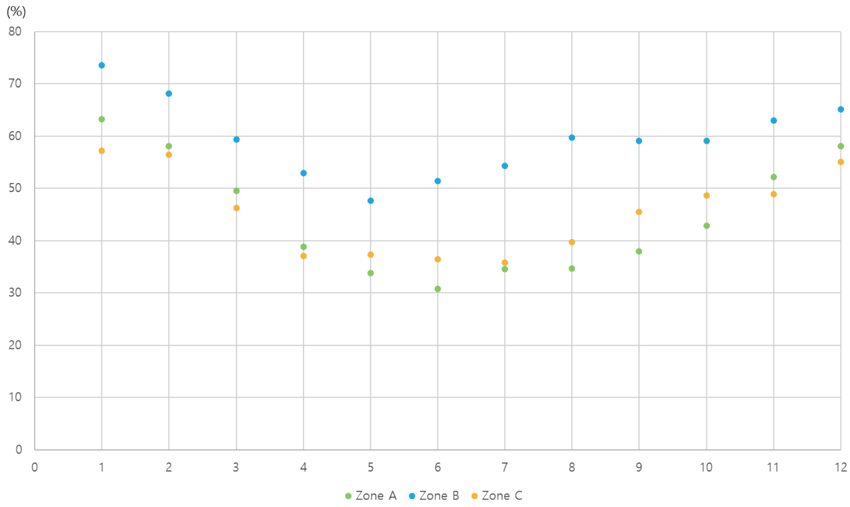
[Figure. Clustering results]



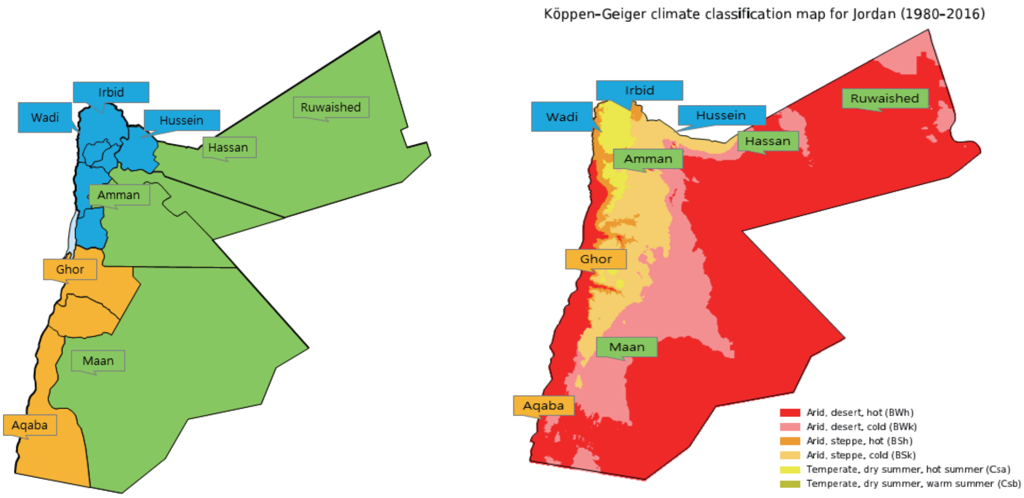
[Figure. Average monthly temperature by zone]



[Figure. Average monthly relative humidity by zone]



[Figure. Comparison of clustering results with existing climate zone classifications]



<Table. Comparison of clustering results with existing climate zone classifications>

Zone	Region	Weather description
A	Amman, Ruwaished, Hasan(Safawi), Ma'an	Moderate temperature-Dry
B	Wadi, Hussein(Al-Mafraq), Irbid, (Amman City)*	Moderate temperature-Humid
C	Aqaba, Ghor	Hot-Dry

Zone number	Altitude	Weather data	Weather description
Zone 1 (highlands)	High altitude zone (≥+800)	Amman	Moderate cold (heating season)
Zone 2 (desert)	Medium altitude zone (≥+600≥+780)	Mafraq	Hot-dry (heating & cooling season)
Zone 3 (aghwar)	Low altitude zone (≤-300)	Ghor Al-Safi	Hot humid (cooling season)

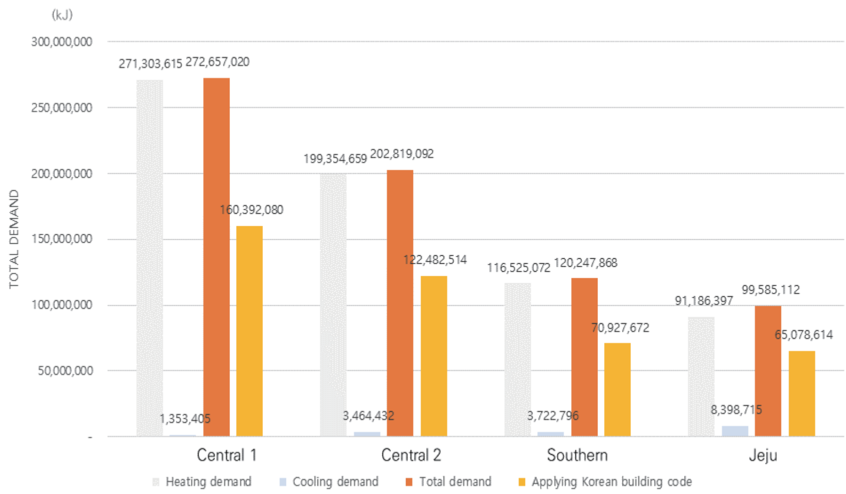
8) Simulation (Passive Measures)

□ Simulation modeling

- Insulation standards: Jordan(1) + Korea(4)
- Standard weather data (EPW) : Jordan(9 region) + Seoul, South Korea(1 region)
- Cooling and heating conditions : setpoint temperature 16 C(heating), 30 C(cooling)
- Infiltration rate : 1.0 ACH/hr
- Internal gain : ASHRAE Standard(people + equipment + lighting)
- Energy demand= sensible energy per simulation interval time

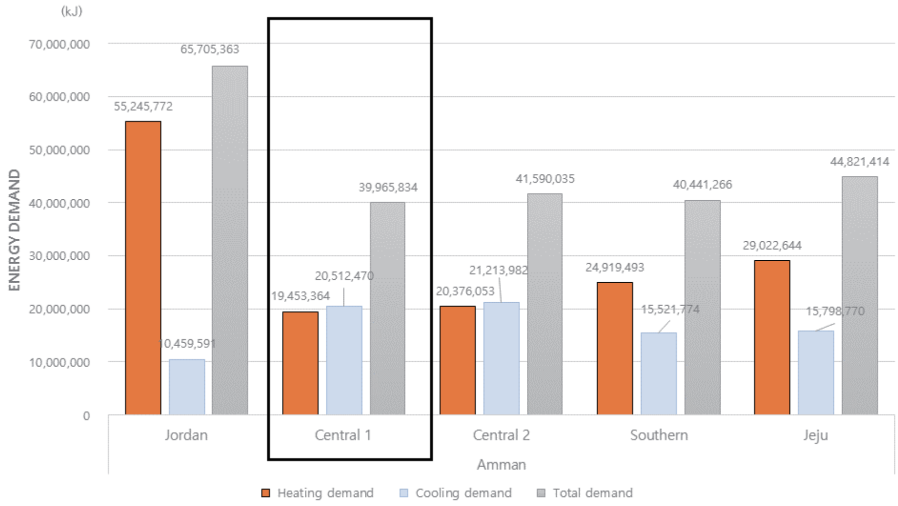
□ Simulation results of insulation standard suitability

- Jordan's insulation code applied to 4 regions in Korea (Central 1, Central 2, Southern, Jeju)

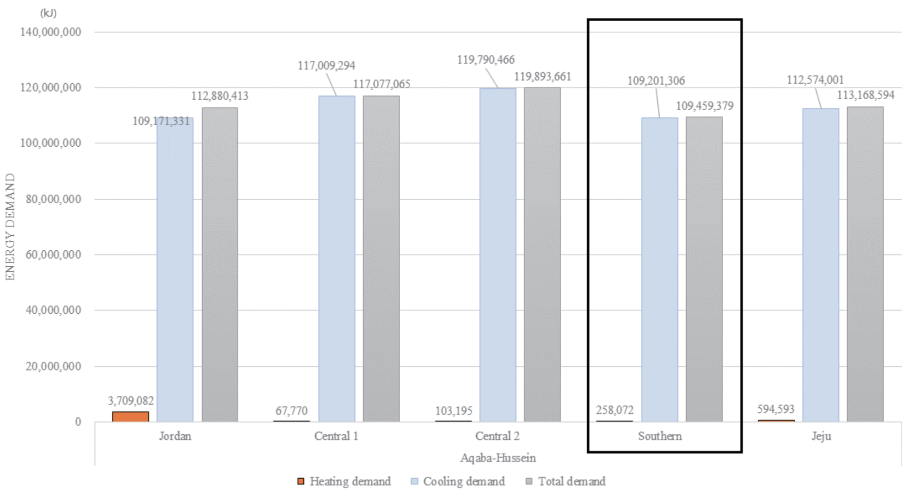


- When Jordan's insulation standards are applied to four regions in Korea, more energy is consumed than when Korea's insulation standards are applied.

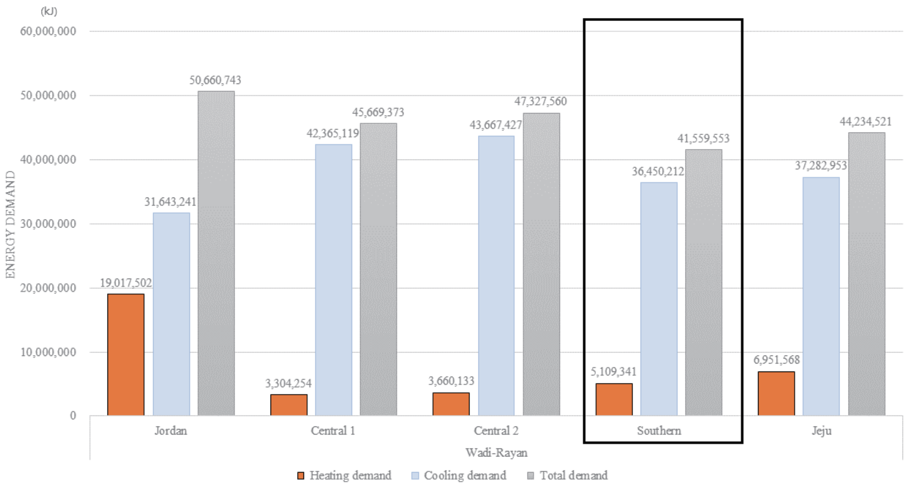
• Jordan insulation code & Korea's insulation standard applied



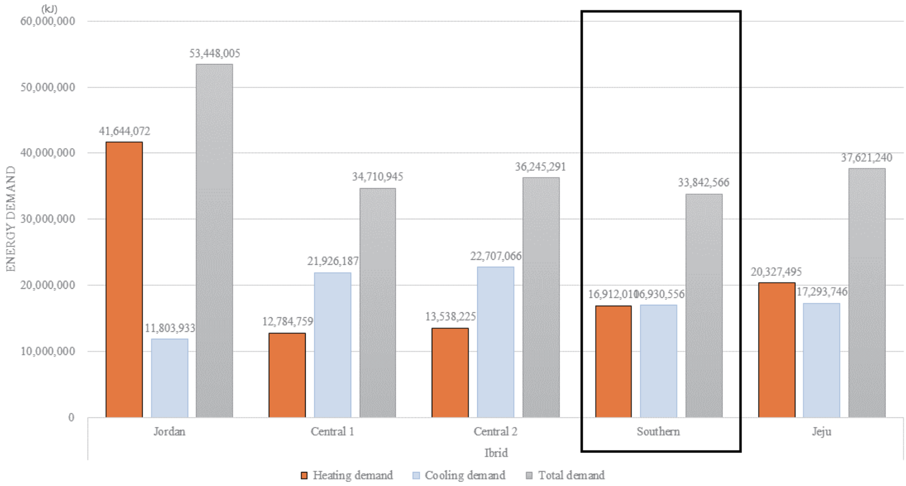
- When Korea's insulation standards for the four regions are applied to the Amman region in Jordan, the energy consumption is the lowest when the insulation standards for the Central 1 region are applied.



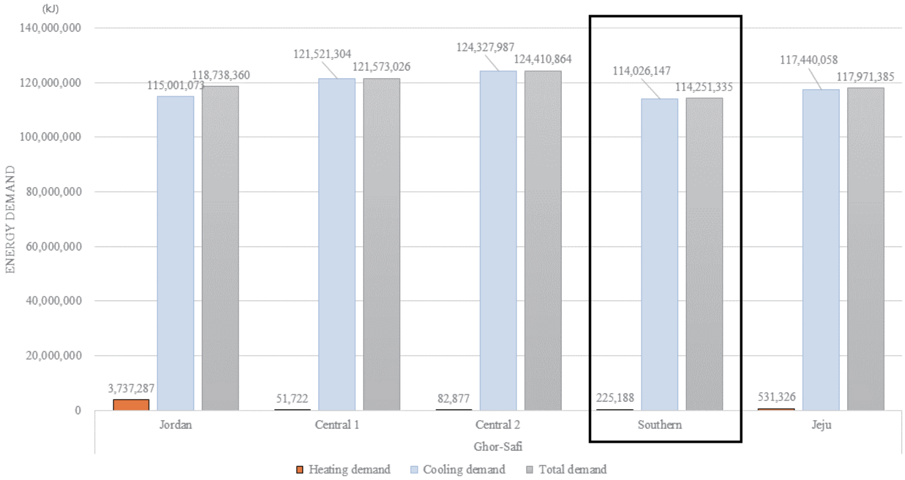
- When Korea's insulation standards for the four regions are applied to the Aqaba region in Jordan, the energy consumption is the lowest when the insulation standards for the southern region are applied.



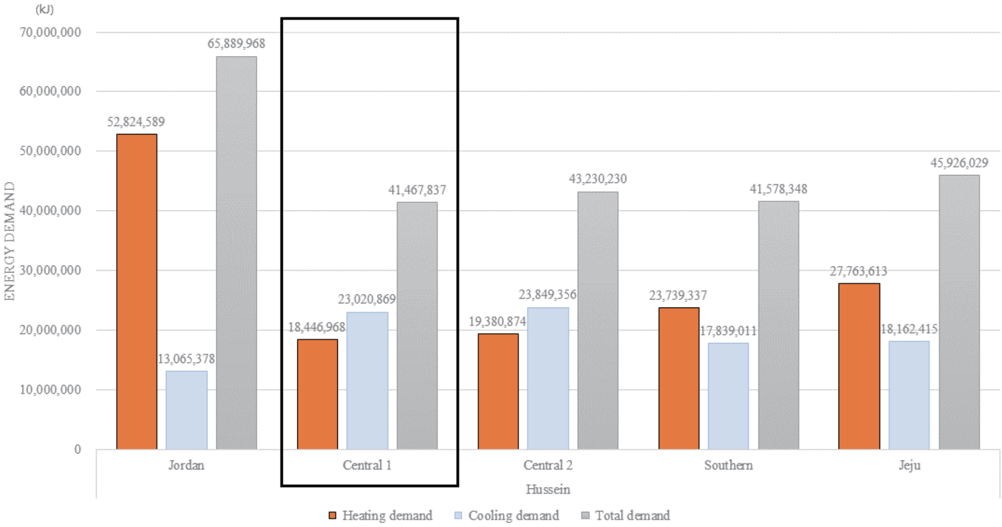
- When Korea's insulation standards for the four regions are applied to the Wadi region in Jordan, the energy consumption is the lowest when the insulation standards for the southern region are applied.



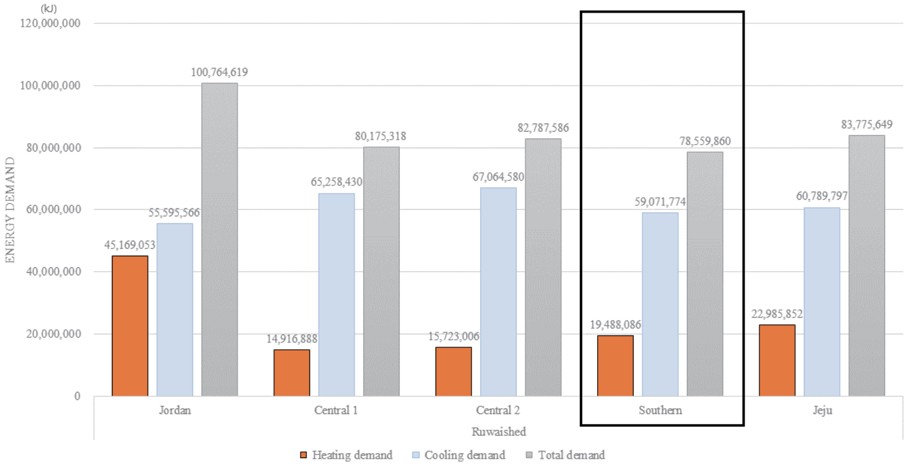
- When Korea's four regional insulation standards are applied to Jordan's Irbid region, energy consumption is the lowest when the southern region's insulation standards are applied.



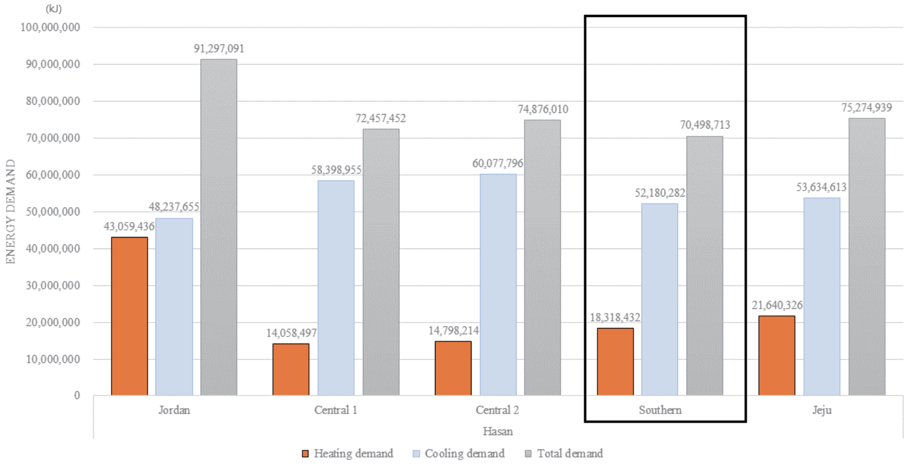
- When Korea's four regional insulation standards are applied to the Ghor-Safi region in Jordan, energy consumption is the lowest when the southern region's insulation standards are applied.



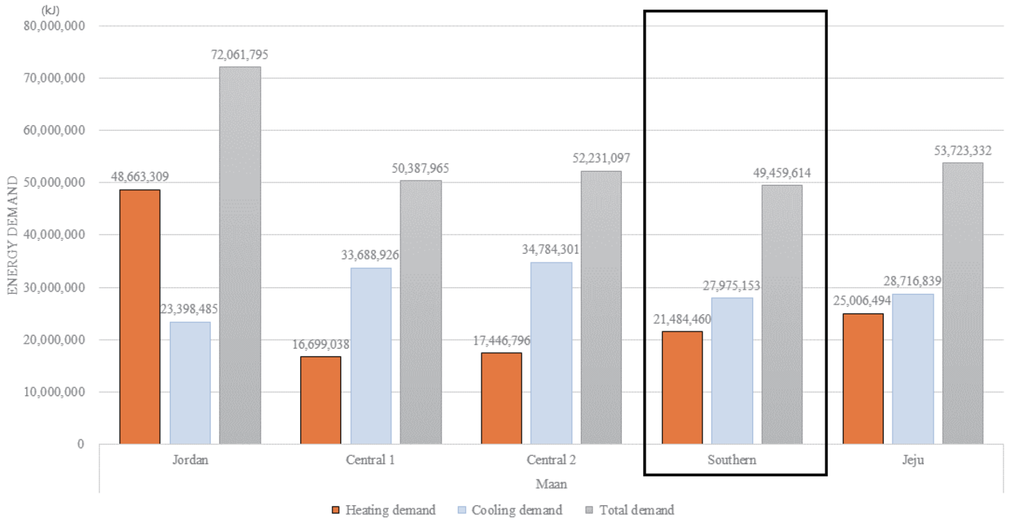
- When Korea's four regional insulation standards are applied to Jordan's Hussein region, energy consumption is the lowest when the Central 1 region's insulation standards are applied.



- When Korea's four regional insulation standards are applied to Jordan's Ruwaished region, energy consumption is the lowest when the southern region's insulation standards are applied.



- When Korea's four regional insulation standards are applied to the Hasan region in Jordan, energy consumption is the lowest when the southern region's insulation standards are applied.



- When Korea's four regional insulation standards are applied to Jordan's Ma'an region, energy consumption is the lowest when the southern region's insulation standards are applied.

□ New regional heat transmittance table

: Strengthening standards : Maintaining current status : Relaxation of standards

Region / Part of the building	Amman	Ruwaished	Ma'an	Hasan (Safawi)	Irbid	Wadi	Hussein (Mafraq)	Aqaba	Ghor
	Jordan Central1	Jordan Southern	Jordan Southern	Jordan Southern	Jordan Southern	Jordan Southern	Jordan Central1	Jordan Southern	Jordan Southern
External Roof	0.45~0.25	0.45~0.25	0.45~0.25	0.45~0.25	0.45~0.25	0.45~0.25	0.45~0.25	0.45~0.25	0.45~0.25
	0.57 0.15	0.57 0.18	0.57 0.18	0.57 0.18	0.57 0.18	0.57 0.18	0.57 0.15	0.57 0.18	0.57 0.18
External Wall	0.45~0.25	0.45~0.25	0.45~0.25	0.45~0.25	0.45~0.25	0.45~0.25	0.45~0.25	0.45~0.25	0.45~0.25
	0.57 0.15	0.57 0.22	0.57 0.22	0.57 0.22	0.57 0.22	0.57 0.22	0.57 0.15	0.57 0.22	0.57 0.22
Innerwall (Adjacent Wall)	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57
	0.57 0.21	0.57 0.31	0.57 0.31	0.57 0.31	0.57 0.31	0.57 0.31	0.57 0.21	0.57 0.31	0.57 0.31
Ground Floor	0.8	0.8	0.8	0.8	0.8	0.8	0.8	More than 0.8	More than 0.8
	0.8 0.24	0.8 0.35	0.8 0.35	0.8 0.35	0.8 0.35	0.8 0.35	0.8 0.24	0.8 0.35	0.8 0.35
Adjacent Ceiling	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	1.2 0.21	1.2 0.26	1.2 0.26	1.2 0.26	1.2 0.26	1.2 0.26	1.2 0.21	1.2 0.26	1.2 0.26

(unit : $W/m^2 \cdot K$)

- Propose a standard table for heat transmittance considering the results obtained by conducting a simulation using the thermal transmittance rate of each building part as a variable and the current situation in Jordan. (Refer to the attachment for detailed simulation results)

□ New regional heat transmittance table (clustering)

: Strengthening standards : Maintaining current status : Relaxation of standards

Region / Part of the building	Amman	Ruwaished	Ma'an	Hasan (Safawi)	Irbid	Wadi	Hussein (Mafraq)	Aqaba	Ghor
	Jordan Central1	Jordan Southern	Jordan Southern	Jordan Southern	Jordan Southern	Jordan Southern	Jordan Central1	Jordan Southern	Jordan Southern
External Roof	00.25	0.25	0.25	0.25	0.35	0.35	0.35	0.45	0.45
	0.57 0.15	0.57 0.18	0.57 0.18	0.57 0.18	0.57 0.18	0.57 0.18	0.57 0.15	0.57 0.18	0.57 0.18
External Wall	0.25	0.25	0.25	0.25	0.35	0.35	0.35	0.45	0.45
	0.57 0.15	0.57 0.22	0.57 0.22	0.57 0.22	0.57 0.22	0.57 0.22	0.57 0.15	0.57 0.22	0.57 0.22
Innerwall (Adjacent Wall)	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57
	0.57 0.21	0.57 0.31	0.57 0.31	0.57 0.31	0.57 0.31	0.57 0.31	0.57 0.21	0.57 0.31	0.57 0.31
Ground Floor	0.8	0.8	0.8	0.8	0.8	0.8	0.8	More than 0.8	More than 0.8
	0.8 0.24	0.8 0.35	0.8 0.35	0.8 0.35	0.8 0.35	0.8 0.35	0.8 0.24	0.8 0.35	0.8 0.35
Adjacent Ceiling	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	1.2 0.21	1.2 0.26	1.2 0.26	1.2 0.26	1.2 0.26	1.2 0.26	1.2 0.21	1.2 0.26	1.2 0.26

(unit : W/m²·K)

- Propose a standard table for heat transmittance of building parts by region, considering regional differences reflecting the clustering results

□ Amman

- External Roof
  - Changes the u-value of the External Roof from 0.55 ($W/m^2 \cdot K$) to 0.15 ($W/m^2 \cdot K$)
  - As u-value decreases, annual heating energy consumption tends to decrease.
  - As u-value decreases, annual cooling energy consumption tends to decrease.
  - Therefore, as u-value decreases, total annual energy consumption decreases.
  - Energy savings of approximately 10.3% are possible when strengthened to Korea's Central 1 standard.
  - Therefore, in the case of Amman, it is appropriate to improve in the direction of strengthening the u-value of the External Roof.

- External Wall
  - Changes the u-value of the External Wall from 0.55 ($W/m^2 \cdot K$) to 0.15 ($W/m^2 \cdot K$)
  - As u-value decreases, annual heating energy consumption tends to decrease.
  - Even if the u-value decreases, the change in cooling energy consumption is minimal.
  - Therefore, as u-value decreases, total annual energy consumption decreases.
  - Energy savings of approximately 9.4% are possible when strengthened to Korea's Central 1 standard.
  - Therefore, in the case of Amman, it is appropriate to improve in the direction of strengthening the u-value of the External Wall.

- Adjacent Wall
  - Changes the u-value of Adjacent Wall from 0.997 ($W/m^2 \cdot K$) to 0.21 ($W/m^2 \cdot K$)
  - There is no significant difference in annual heating energy consumption even if the u-value decreases or increases.
  - There is no significant difference in annual cooling energy consumption even if u-value decreases or increases.
  - Therefore, the total annual energy consumption is similar even if the u-value decreases or increases.
  - Therefore, in the case of Amman, it is recommended that the u-value of the Adjacent Wall maintain the current Jordanian insulation standard.

- Ground Floor
  - Changes the u-value of the ground floor from 1.38 ($W/m^2 \cdot K$) to 0.24 ($W/m^2 \cdot K$)
  - As u-value decreases, annual heating energy consumption tends to decrease.
  - As u-value decreases, annual cooling energy consumption tends to increase.
  - The annual total energy consumption graph shows a U-shaped curve, and the total annual energy consumption is lowest when the u-value of the ground floor is 0.8 ($W/m^2 \cdot K$).
  - Therefore, in the case of Amman, it is recommended that the ground floor u-value maintain the current Jordanian insulation standard.

- Adjacent Ceiling
  - Changes the u-value of Adjacent Ceiling from 1.968 ($W/m^2 \cdot K$) to 0.21 ($W/m^2 \cdot K$)
  - As u-value decreases, annual heating energy consumption tends to increase.

- As u-value increases, annual heating energy consumption decreases, but the deviation is not large.
- As u-value decreases, annual cooling energy consumption tends to increase.
- As u-value increases, annual cooling energy consumption decreases, but the deviation is not large.
- As u-value increases, total annual energy consumption decreases, but the deviation is not large.
- Therefore, in the case of Amman, it is recommended that the u-value of Adjacent Ceiling maintain the current Jordanian insulation standard.

□ Ruwaished

- External Roof
  - Changes the u-value of the External Roof from 0.55 ($W/m^2 \cdot K$) to 0.15 ($W/m^2 \cdot K$)
  - As u-value decreases, annual heating energy consumption tends to decrease.
  - As u-value decreases, annual cooling energy consumption tends to decrease.
  - Therefore, as u-value decreases, total annual energy consumption decreases.
  - Energy savings of approximately 9.7% are possible when strengthened to Korea's Central 1 standard.
  - Therefore, in the case of Ruwaished, it is appropriate to improve in the direction of strengthening the u-value of the External Roof.

- External Wall
  - Changes the u-value of the External Wall from 0.55 ($W/m^2 \cdot K$) to 0.15 ($W/m^2 \cdot K$)
  - As u-value decreases, annual heating energy consumption tends to decrease.
  - As u-value decreases, annual cooling energy consumption tends to decrease.
  - Therefore, as u-value decreases, total annual energy consumption decreases.
  - Energy savings of approximately 9.3% are possible when strengthened to Korea's Central 1 standard.
  - Therefore, in the case of Ruwaished, it is appropriate to improve in the direction of strengthening the u-value of the External Wall.

- Adjacent Wall
  - Changes the u-value of Adjacent Wall from 0.997 ($W/m^2 \cdot K$) to 0.21 ($W/m^2 \cdot K$)
  - There is no significant difference in annual heating energy consumption even if the

u-value decreases or increases.

- There is no significant difference in annual cooling energy consumption even if u-value decreases or increases.
- Therefore, the total annual energy consumption is similar even if the u-value decreases or increases.
- Therefore, in the case of Ruwaished, it is recommended that the u-value of the Adjacent Wall be maintained according to the current Jordanian insulation standards.

- Ground Floor
  - Changes the u-value of the ground floor from 1.38 ($W/m^2 \cdot K$) to 0.24 ($W/m^2 \cdot K$)
  - As the u-value increases, annual heating energy consumption tends to increase (as the thermal transmittance increases, the amount of increase in heating energy consumption increases).
  - As u-value increases, annual cooling energy consumption tends to decrease (as thermal transmittance increases, the amount of decrease in cooling energy consumption decreases)
  - As the u-value increases, heating energy consumption increases and cooling energy consumption decreases, and the decrease in cooling energy consumption is larger.
  - Therefore, as the u-value increases, the annual energy consumption decreases (however, due to the change in cooling and heating energy consumption, the annual energy consumption increases again when the thermal transmittance rate is around 1.38 ($W/m^2 \cdot K$))
  - The graph of total annual energy consumption shows a U-shaped curve, and the total annual energy consumption is lowest when the u-value of the ground floor is 1.112 ($W/m^2 \cdot K$).
  - However, since the amount of decrease is minimal, it is recommended that the u-value of the ground floor in the case of Ruwaished maintain the current Jordanian insulation standard.

- Adjacent Ceiling
  - Changes the u-value of Adjacent Ceiling from 1.968 ($W/m^2 \cdot K$) to 0.21 ($W/m^2 \cdot K$)
  - As u-value decreases, annual heating energy consumption tends to increase.
  - As u-value increases, annual heating energy consumption decreases, but the deviation is not large.

- As u-value decreases, annual cooling energy consumption tends to increase.
- As u-value increases, annual cooling energy consumption decreases, but the deviation is not large.
- As u-value increases, total annual energy consumption decreases, but the deviation is not large.
- Therefore, in the case of Ruwaished, it is recommended that the u-value of Adjacent Ceiling maintain the current Jordanian insulation standard.

□ Ma'an

- External Roof
  - Changes the u-value of the External Roof from 0.55 ($W/m^2·K$) to 0.15 ($W/m^2·K$)
  - As u-value decreases, annual heating energy consumption tends to decrease.
  - As u-value decreases, annual cooling energy consumption tends to decrease.
  - Therefore, as u-value decreases, total annual energy consumption decreases.
  - Energy savings of approximately 10.1% are possible when strengthened to Korea's Central 1 standard.
  - Therefore, in the case of Ma'an, it is appropriate to improve in the direction of strengthening the u-value of the External Roof.

- External Wall
  - Changes the u-value of the External Wall from 0.55 ($W/m^2·K$) to 0.15 ($W/m^2·K$)
  - As u-value decreases, annual heating energy consumption tends to decrease.
  - As u-value decreases, annual cooling energy consumption tends to decrease.
  - Therefore, as u-value decreases, total annual energy consumption decreases.
  - Energy savings of approximately 9.3% are possible when strengthened to Korea's Central 1 standard.
  - Therefore, in the case of Ma'an, it is appropriate to improve in the direction of strengthening the u-value of the External Wall.

- Adjacent Wall
  - Changes the u-value of Adjacent Wall from 0.997 ($W/m^2·K$) to 0.21 ($W/m^2·K$)
  - There is no significant difference in annual heating energy consumption even if the u-value decreases or increases.
  - There is no significant difference in annual cooling energy consumption even if

u-value decreases or increases.

- Therefore, the total annual energy consumption is similar even if the u-value decreases or increases.
- Therefore, in the case of Ma'an, it is recommended that the u-value of the Adjacent Wall be maintained according to the current Jordanian insulation standards.

• Ground Floor

- Changes the u-value of the ground floor from 1.38 (W/m^2·K) to 0.24 (W/m^2·K)
- As u-value decreases, annual heating energy consumption tends to decrease.
- As u-value decreases, annual cooling energy consumption tends to increase.
- The annual total energy consumption graph shows a U-shaped curve, and the total annual energy consumption is lowest when the u-value of the ground floor is 0.8 (W/m^2·K).
- Therefore, in the case of Ma'an, it is recommended that the ground floor u-value maintain the current Jordanian insulation standard.

• Adjacent Ceiling

- Changes the u-value of Adjacent Ceiling from 1.968 (W/m^2·K) to 0.21 (W/m^2·K)
- As u-value decreases, annual heating energy consumption tends to increase.
- As u-value increases, annual heating energy consumption decreases, but the deviation is not large.
- As u-value decreases, annual cooling energy consumption tends to increase.
- As u-value increases, annual cooling energy consumption decreases, but the deviation is not large.
- As u-value increases, total annual energy consumption decreases, but the deviation is not large.
- Therefore, in the case of Ma'an, it is recommended that the u-value of Adjacent Ceiling maintain the current Jordanian insulation standard.

□ Hasan

• External Roof

- Changes the u-value of the External Roof from 0.55 (W/m^2·K) to 0.15 (W/m^2·K)
- As u-value decreases, annual heating energy consumption tends to decrease.
- As u-value decreases, annual cooling energy consumption tends to decrease.

- Therefore, as u-value decreases, total annual energy consumption decreases.
- Energy savings of approximately 9.5% are possible when strengthened to Korea's Central 1 standard.
- Therefore, in the case of Hasan, it is appropriate to improve in the direction of strengthening the u-value of the External Roof.

• External Wall
- Changes the u-value of the External Wall from 0.55 ($W/m^2 \cdot K$) to 0.15 ($W/m^2 \cdot K$)
- As u-value decreases, annual heating energy consumption tends to decrease.
- As u-value decreases, annual cooling energy consumption tends to decrease.
- Therefore, as u-value decreases, total annual energy consumption decreases.
- Energy savings of approximately 9.1% are possible when strengthened to Korea's Central 1 standard.
- Therefore, in the case of Hasan, it is appropriate to improve in the direction of strengthening the u-value of the External Wall.

• Adjacent Wall
- Changes the u-value of Adjacent Wall from 0.997 ($W/m^2 \cdot K$) to 0.21 ($W/m^2 \cdot K$)
- There is no significant difference in annual heating energy consumption even if the u-value decreases or increases.
- There is no significant difference in annual cooling energy consumption even if u-value decreases or increases.
- Therefore, the total annual energy consumption is similar even if the u-value decreases or increases.
- Therefore, in the case of Hasan, it is recommended that the u-value of the Adjacent Wall be maintained according to the current Jordanian insulation standards.

• Ground Floor
- Changes the u-value of the ground floor from 1.38 ($W/m^2 \cdot K$) to 0.24 ($W/m^2 \cdot K$)
- As the u-value increases, annual heating energy consumption tends to increase (as the thermal transmittance increases, the amount of increase in heating energy consumption increases).
- As u-value increases, annual cooling energy consumption tends to decrease (as thermal transmittance increases, the amount of decrease in cooling energy consumption decreases)

- As the u-value increases, heating energy consumption increases and cooling energy consumption decreases, and the decrease in cooling energy consumption is larger.
- Therefore, as the u-value increases, the annual energy consumption decreases (however, due to the change in cooling and heating energy consumption, the annual energy consumption increases again when the thermal transmittance rate is around 1.38 ($W/m^2 \cdot K$))
- The graph of total annual energy consumption shows a U-shaped curve, and the total annual energy consumption is lowest when the u-value of the ground floor is 1.112 ($W/m^2 \cdot K$).
- However, since the decrease is minimal, it is recommended that Hasan maintain the u-value of the ground floor according to the current Jordanian insulation standard.

• Adjacent Ceiling
- Changes the u-value of Adjacent Ceiling from 1.968 ($W/m^2 \cdot K$) to 0.21 ($W/m^2 \cdot K$)
- As u-value decreases, annual heating energy consumption tends to increase.
- As u-value increases, annual heating energy consumption decreases, but the deviation is not large.
- As u-value decreases, annual cooling energy consumption tends to increase.
- As u-value increases, annual cooling energy consumption decreases, but the deviation is not large.
- As u-value increases, total annual energy consumption decreases, but the deviation is not large.
- Therefore, in the case of Hasan, it is recommended that the u-value of the Adjacent Ceiling maintain the current Jordanian insulation standard.

□ Irbid

• External Roof
- Changes the u-value of the External Roof from 0.55 ($W/m^2 \cdot K$) to 0.15 ($W/m^2 \cdot K$)
- As u-value decreases, annual heating energy consumption tends to decrease.
- As u-value decreases, annual cooling energy consumption tends to decrease.
- Therefore, as u-value decreases, total annual energy consumption decreases.
- Energy savings of approximately 9.6% are possible when strengthened to Korea's Central 1 standard.
- Therefore, in the case of Irbid, it is appropriate to improve in the direction of strengthening the u-value of the External Roof.

- External Wall
  - Changes the u-value of the External Wall from 0.55 ($W/m^2 \cdot K$) to 0.15 ($W/m^2 \cdot K$)
  - As u-value decreases, annual heating energy consumption tends to decrease.
  - Even if the u-value decreases, the change in annual cooling energy consumption is minimal.
  - Therefore, as u-value decreases, total annual energy consumption decreases.
  - Energy savings of approximately 8.2% are possible when strengthened to Korea's Central 1 standard.
  - Therefore, in the case of Irbid, it is appropriate to improve in the direction of strengthening the u-value of the External Wall.

- Adjacent Wall
  - Changes u-value of Adjacent Wall from 0.997 ($W/m^2 \cdot K$) to 0.21 ($W/m^2 \cdot K$)
  - There is no significant difference in annual heating energy consumption even if u-value decreases or increases.
  - There is no significant difference in annual cooling energy consumption even if u-value decreases or increases.
  - Therefore, the total annual energy consumption is similar even if u-value decreases or increases.
  - Therefore, in the case of Irbid, it is recommended that the u-value of the Adjacent Wall maintain the current Jordanian insulation standards.

- Ground Floor
  - Changes the u-value of the ground floor from 1.38 ($W/m^2 \cdot K$) to 0.24 ($W/m^2 \cdot K$)
  - As u-value decreases, annual heating energy consumption tends to decrease.
  - As u-value decreases, annual cooling energy consumption tends to increase.
  - The annual total energy consumption graph shows a U-shaped curve, and the total annual energy consumption is lowest when the u-value of the ground floor is 0.8 ($W/m^2 \cdot K$).
  - Therefore, in the case of Irbid, it is recommended that the ground floor u-value maintain the current Jordanian insulation standard.

- Adjacent Ceiling
  - Changes the u-value of Adjacent Ceiling from 1.968 ($W/m^2 \cdot K$) to 0.21 ($W/m^2 \cdot K$)

- As u-value decreases, annual heating energy consumption tends to increase.
- As u-value increases, annual heating energy consumption decreases, but the deviation is not large.
- As u-value decreases, annual cooling energy consumption tends to increase.
- As u-value increases, annual cooling energy consumption decreases, but the deviation is not large.
- As u-value increases, total annual energy consumption decreases, but the deviation is not large.
- Therefore, in the case of Irbid, it is recommended that the u-value of Adjacent Ceiling maintain the current Jordanian insulation standard.

□ Wadi

- External Roof
  - Changes the u-value of the External Roof from 0.55 ($W/m^2 \cdot K$) to 0.15 ($W/m^2 \cdot K$)
  - As u-value decreases, annual heating energy consumption tends to decrease.
  - As u-value decreases, annual cooling energy consumption tends to decrease.
  - Therefore, as u-value decreases, total annual energy consumption decreases.
  - Energy savings of approximately 8.4% are possible when strengthened to Korea's Central 1 standard.
  - Therefore, in the case of Wadi, it is appropriate to improve in the direction of strengthening the u-value of the External Roof.

- External Wall
  - Changes the u-value of the External Wall from 0.55 ($W/m^2 \cdot K$) to 0.15 ($W/m^2 \cdot K$)
  - As u-value decreases, annual heating energy consumption tends to decrease.
  - Even if the u-value decreases, the change in annual cooling energy consumption is minimal.
  - Therefore, as u-value decreases, total annual energy consumption decreases.
  - Energy savings of approximately 6.8% are possible when strengthened to Korea's Central 1 standard.
  - Therefore, in the case of Wadi, it is appropriate to improve in the direction of strengthening the u-value of the External Wall.

- Adjacent Wall
  - Changes the u-value of Adjacent Wall from 0.997 ($W/m^2 \cdot K$) to 0.21 ($W/m^2 \cdot K$)
  - There is no significant difference in annual heating energy consumption even if the u-value decreases or increases.
  - There is no significant difference in annual cooling energy consumption even if u-value decreases or increases.
  - Therefore, the total annual energy consumption is similar even if the u-value decreases or increases.
  - Therefore, in the case of Wadi, it is recommended that the u-value of the Adjacent Wall maintain the current Jordanian insulation standard.

- Ground Floor
  - Changes the u-value of the ground floor from 1.38 ($W/m^2 \cdot K$) to 0.24 ($W/m^2 \cdot K$)
  - As u-value decreases, annual heating energy consumption tends to decrease.
  - As u-value decreases, annual cooling energy consumption tends to increase.
  - The graph of total annual energy consumption shows a U-shaped curve, and although the total annual energy consumption is the lowest when the u-value is about 1.25 ($W/m^2 \cdot K$), the figure is insignificant.
  - Therefore, in the case of Wadi, it is recommended that the ground floor u-value maintain the current Jordanian insulation standard.

- Adjacent Ceiling
  - Changes the u-value of Adjacent Ceiling from 1.968 ($W/m^2 \cdot K$) to 0.21 ($W/m^2 \cdot K$)
  - As u-value decreases, annual heating energy consumption tends to increase.
  - As u-value increases, annual heating energy consumption decreases, but the deviation is not large.
  - As u-value decreases, annual cooling energy consumption tends to increase.
  - As u-value increases, annual cooling energy consumption decreases, but the deviation is not large.
  - As u-value increases, total annual energy consumption decreases, but the deviation is not large.
  - Therefore, in the case of Wadi, it is recommended that the u-value of Adjacent Ceiling maintain the current Jordanian insulation standard.

□ Hussein

- External Roof
  - Changes the u-value of the External Roof from 0.55 ($W/m^2 \cdot K$) to 0.15 ($W/m^2 \cdot K$)
  - As u-value decreases, annual heating energy consumption tends to decrease.
  - As u-value decreases, annual cooling energy consumption tends to decrease.
  - Therefore, as u-value decreases, total annual energy consumption decreases.
  - Energy savings of approximately 10.1% are possible when strengthened to Korea's Central 1 standard.
  - Therefore, in the case of Hussein, it is appropriate to improve in the direction of strengthening the u-value of the External Roof.

- External Wall
  - Changes the u-value of the External Wall from 0.55 ($W/m^2 \cdot K$) to 0.15 ($W/m^2 \cdot K$)
  - As u-value decreases, annual heating energy consumption tends to decrease.
  - Even if the u-value decreases, the change in annual cooling energy consumption is minimal.
  - Therefore, as u-value decreases, total annual energy consumption decreases.
  - Energy savings of approximately 9% are possible when strengthened to Korea's Central 1 standard.
  - Therefore, in the case of Hussein, it is appropriate to improve in the direction of strengthening the u-value of the External Wall.

- Adjacent Wall
  - Changes the u-value of Adjacent Wall from 0.997 ($W/m^2 \cdot K$) to 0.21 ($W/m^2 \cdot K$)
  - There is no significant difference in annual heating energy consumption even if the u-value decreases or increases.
  - There is no significant difference in annual cooling energy consumption even if u-value decreases or increases.
  - Therefore, the total annual energy consumption is similar even if the u-value decreases or increases.
  - Therefore, in the case of Hussein, it is recommended that the u-value of the Adjacent Wall be maintained according to the current Jordanian insulation standards.

- Ground Floor
  - Changes the u-value of the ground floor from 1.38 (W/m²·K) to 0.24 (W/m²·K)
  - As u-value decreases, annual heating energy consumption tends to decrease.
  - As u-value decreases, annual cooling energy consumption tends to increase.
  - The annual total energy consumption graph shows a U-shaped curve, and the total annual energy consumption is lowest when the u-value of the ground floor is 0.8 (W/m²·K).
  - Therefore, in the case of Hussein, it is recommended that the u-value of the ground floor be maintained according to the current Jordanian insulation standard.

- Adjacent Ceiling
  - Changes the u-value of Adjacent Ceiling from 1.968 (W/m²·K) to 0.21 (W/m²·K)
  - As u-value decreases, annual heating energy consumption tends to increase.
  - As u-value increases, annual heating energy consumption decreases, but the deviation is not large.
  - As u-value decreases, annual cooling energy consumption tends to increase.
  - As u-value increases, annual cooling energy consumption decreases, but the deviation is not large.
  - As u-value increases, total annual energy consumption decreases, but the deviation is not large.
  - Therefore, in the case of Hussein, it is recommended that the u-value of the Adjacent Ceiling maintain the current Jordanian insulation standard.

□ Aqaba

- External Roof
  - Changes the u-value of the External Roof from 0.55 (W/m²·K) to 0.15 (W/m²·K)
  - As u-value decreases, annual heating energy consumption tends to decrease.
  - As u-value decreases, annual cooling energy consumption tends to decrease.
  - Therefore, as u-value decreases, total annual energy consumption decreases.
  - Approximately 8% energy savings are possible when reinforced to Korea's Central 1 standard.
  - Therefore, in the case of Aqaba, it is appropriate to improve in the direction of strengthening the u-value of the External Roof.

- External Wall
  - Changes the u-value of the External Wall from 0.55 ($W/m^2 \cdot K$) to 0.15 ($W/m^2 \cdot K$)
  - As u-value decreases, annual heating energy consumption tends to decrease.
  - As u-value decreases, annual cooling energy consumption tends to decrease.
  - Therefore, as u-value decreases, total annual energy consumption decreases.
  - Energy savings of approximately 7% are possible when reinforced to Korea's Central 1 standard.
  - Therefore, in the case of Aqaba, it is appropriate to improve in the direction of strengthening the u-value of the External Wall.

- Adjacent Wall
  - Changes the u-value of Adjacent Wall from 0.997 ($W/m^2 \cdot K$) to 0.21 ($W/m^2 \cdot K$)
  - There is no significant difference in annual heating energy consumption even if the u-value decreases or increases.
  - There is no significant difference in annual cooling energy consumption even if u-value decreases or increases.
  - Therefore, the total annual energy consumption is similar even if the u-value decreases or increases.
  - Therefore, in the case of Aqaba, it is recommended that the u-value of the Adjacent Wall maintain the current Jordanian insulation standard.

- Ground Floor
  - Changes the u-value of the ground floor from 1.38 ($W/m^2 \cdot K$) to 0.24 ($W/m^2 \cdot K$)
  - As u-value decreases, annual heating energy consumption tends to decrease.
  - As u-value increases, annual cooling energy consumption tends to decrease.
  - Because the magnitude of cooling energy savings is greater than the heating energy savings, as the u-value increases, the total annual energy consumption decreases.
  - When u-value is relaxed from Jordan's standard of 0.8 ($W/m^2 \cdot K$) to 1.38 ($W/m^2 \cdot K$), energy savings of approximately 20.4% are possible.
  - Therefore, in the case of Aqaba, it is appropriate to improve the u-value of the ground floor in a direction that is more relaxed than the current Jordanian insulation standards.

- Adjacent Ceiling
  - Changes the u-value of Adjacent Ceiling from 1.968 ($W/m^2 \cdot K$) to 0.21 ($W/m^2 \cdot K$)
  - As u-value increases, annual heating energy consumption tends to decrease.
  - Even with changes in u-value, the change in annual cooling energy consumption is minimal.
  - In the Aqaba region, cooling energy consumption is much higher than heating energy consumption, so it is hardly affected by heating energy consumption.
  - Therefore, as the u-value increases, the total annual energy consumption decreases, but the deviation is not large.
  - Therefore, in the case of Aqaba, it is recommended that the u-value of Adjacent Ceiling maintain the current Jordanian insulation standard.

□ Ghor

- External Roof
  - Changes the u-value of the External Roof from 0.55 ($W/m^2 \cdot K$) to 0.15 ($W/m^2 \cdot K$)
  - As u-value decreases, annual heating energy consumption tends to decrease.
  - As u-value decreases, annual cooling energy consumption tends to decrease.
  - Therefore, as u-value decreases, total annual energy consumption decreases.
  - Approximately 8% energy savings are possible when reinforced to Korea's Central 1 standard.
  - Therefore, in the case of Ghor, it is appropriate to improve in the direction of strengthening the u-value of the External Roof.

- External Wall
  - Changes the u-value of the External Wall from 0.55 ($W/m^2 \cdot K$) to 0.15 ($W/m^2 \cdot K$)
  - As u-value decreases, annual heating energy consumption tends to decrease.
  - As u-value decreases, annual cooling energy consumption tends to decrease.
  - Therefore, as u-value decreases, total annual energy consumption decreases.
  - Energy savings of approximately 7.4% are possible when strengthened to Korea's Central 1 standard.
  - Therefore, in the case of Ghor, it is appropriate to improve in the direction of strengthening the u-value of the External Wall.

- Adjacent Wall
  - Changes the u-value of Adjacent Wall from 0.997 ($W/m^2 \cdot K$) to 0.21 ($W/m^2 \cdot K$)
  - There is no significant difference in annual heating energy consumption even if the u-value decreases or increases.
  - There is no significant difference in annual cooling energy consumption even if u-value decreases or increases.
  - Therefore, the total annual energy consumption is similar even if the u-value decreases or increases.
  - Therefore, in the case of Ghor, it is recommended that the u-value of the Adjacent Wall maintain the current Jordanian insulation standard.

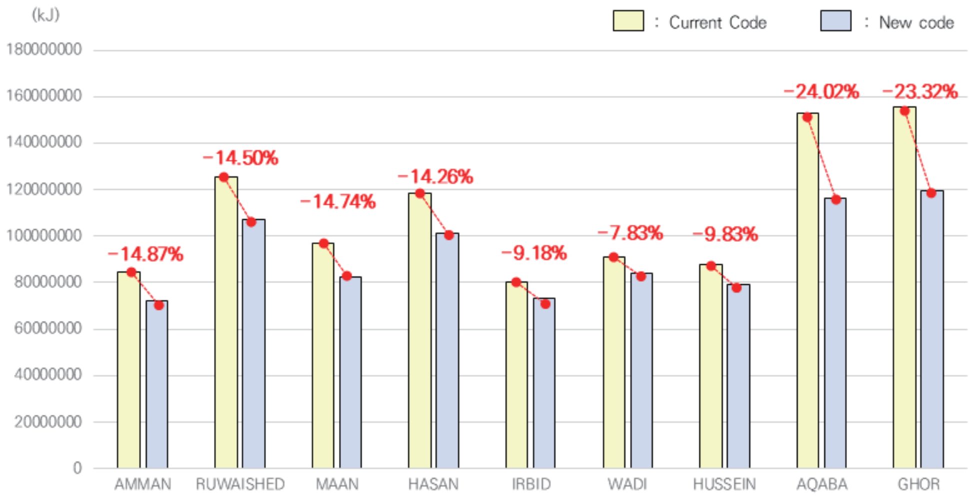
- Ground Floor
  - Changes the u-value of the ground floor from 1.38 ($W/m^2 \cdot K$) to 0.24 ($W/m^2 \cdot K$)
  - As u-value decreases, annual heating energy consumption tends to decrease.
  - As u-value increases, annual cooling energy consumption tends to decrease.
  - Because the magnitude of cooling energy savings is greater than the heating energy savings, as the u-value increases, the total annual energy consumption decreases.
  - When u-value is relaxed from Jordan's standard of 0.8 ($W/m^2 \cdot K$) to 1.38 ($W/m^2 \cdot K$), energy savings of approximately 19.6% are possible.
  - Therefore, in the case of Ghor, it is appropriate to improve the u-value of the ground floor in a direction that is more relaxed than the current Jordanian insulation standards.

- Adjacent Ceiling
  - Changes the u-value of Adjacent Ceiling from 1.968 ($W/m^2 \cdot K$) to 0.21 ($W/m^2 \cdot K$)
  - As u-value increases, annual heating energy consumption tends to decrease.
  - with changes in u-value, the change in annual cooling energy consumption is minimal.
  - In the Ghor region, cooling energy consumption is much higher than heating energy consumption, so it is hardly affected by heating energy consumption.
  - Therefore, as the u-value increases, the total annual energy consumption decreases, but the deviation is not large.
  - Therefore, in the case of Ghor, it is recommended that the u-value of the Adjacent Ceiling maintain the current Jordanian insulation standard.

□ Expected energy savings

Region	Code	EXT_ ROOF	EXT_ WALL	ADJ_ WALL	GROUND_ FLOOR	ADJ_ CEILING	Annual Heating Energy Demand (kJ)	Annual Cooling Energy Demand (kJ)	Annual Total Energy Demand (kJ)	Energy saving rate (%)
Amman	Jordan	0.55	0.57	0.57	0.8	1.2	35,139,861	49,456,526	83,596,386	-14.87
	New	0.25	0.25	0.57	0.8	1.2	25,610,605	46,403,622	72,014,227	
Ruwaished	Jordan	0.55	0.57	0.57	0.8	1.2	29,388,331	95,978,626	125,388,956	-14.50
	New	0.25	0.25	0.57	0.8	1.2	21,449,422	85,740,928	107,190,350	
Ma'an	Jordan	0.55	0.57	0.57	0.8	1.2	31,226,348	65,414,468	96,640,817	-14.74
	New	0.25	0.25	0.57	0.8	1.2	22,669,260	59,722,445	82,391,705	
Hasan	Jordan	0.55	0.57	0.57	0.8	1.2	28,209,728	90,131,348	118,341,076	-14.26
	New	0.25	0.25	0.57	0.8	1.2	20,515,638	80,946,254	101,461,892	
Irbid	Jordan	0.55	0.57	0.57	0.8	1.2	26,970,173	53,512,394	80,482,567	-9.18
	New	0.35	0.35	0.57	0.8	1.2	21,951,830	51,140,538	73,092,378	
Wadi	Jordan	0.55	0.57	0.57	0.8	1.2	13,009,709	77,830,286	90,839,994	-7.83
	New	0.35	0.35	0.57	0.8	1.2	10,520,021	73,218,197	83,738,218	
Hussein	Jordan	0.55	0.57	0.57	0.8	1.2	33,852,571	53,772,093	87,624,883	-9.83
	New	0.35	0.35	0.57	0.8	1.2	27,581,633	51,422,303	79,003,936	
Aqaba	Jordan	0.55	0.57	0.57	0.8	1.2	2,159,979	150,695,064	152,855,042	-24.02
	New	0.45	0.45	0.57	1.38	1.2	16,265,560	99,880,722	116,146,283	
Ghor	Jordan	0.55	0.57	0.57	0.8	1.2	2,123,156	153,420,379	155,543,535	-23.32
	New	0.45	0.45	0.57	1.38	1.2	17,141,273	102,128,038	119,269,311	
Seoul	Jordan	0.55	0.57	0.57	0.8	1.2	115,788,369	31,071,174	146,859,543	-

[Figure. Expected energy savings]



□ Proposal of u-value and g-value of windows by region in Jordan

	Amman	Ruwaished	Hasan (Safawi)	Ma'an	Irbid	Hussein (Al-mafraq)	Wadi	Aqaba	Ghor
u-value	strengthen	strengthen	strengthen	strengthen	strengthen	strengthen	Maintain Current Code	Maintain Current Code	Maintain Current Code
g-value	Maintain Current Code	Maintain Current Code	Select low g-value	Maintain Current Code	Maintain Current Code	Maintain Current Code	Select low g-value	Select low g-value	Select low g-value

- Proposal considering the results obtained by conducting a simulation using the u-value and g-value of regional windows as variables and the current situation in Jordan (refer to the attachment for detailed simulation results)

- Amman

<Simulation result>

u-value ($W/m^2 \cdot K$)	g-value (%)	SQHEAT	SQCOOL	TOTAL	RATE
1.0	20	40,862,801	37,481,412	78,344,212	-21.14%
	30	38,828,485	39,453,132	78,281,617	-21.20%
	40	34,996,839	43,797,980	78,794,819	-20.68%
	50	30,800,730	49,451,715	80,252,445	-19.21%
2.0	20	44,156,900	37,052,337	81,209,236	-18.25%
	30	40,593,035	40,464,110	81,057,145	-18.40%
	40	36,389,179	45,237,566	81,626,745	-17.83%
	50	33,192,252	49,537,922	82,730,173	-16.72%
3.0	20	47,044,262	36,990,259	84,034,521	-15.41%
	30	43,464,514	40,321,838	83,786,352	-15.66%
	40	38,117,389	46,442,040	84,559,429	-14.88%
	50	35,460,953	50,015,082	85,476,035	-13.96%
5.7	80	36,129,137	63,211,185	99,340,322	0.00%

- When the u-value is constant, the lower the g-value value, the lower the annual heating energy consumption tends to increase, and the annual cooling energy consumption tends to decrease.
- Since the decrease in annual cooling energy consumption is greater than the increase in annual heating energy consumption, when the u-value is constant, the lower the g-value, the lower the total annual energy consumption.
- When the g-value is constant, the lower the u-value, the lower the annual cooling energy consumption tends to increase, and the annual heating energy consumption tends to decrease.
- Since the decrease in annual heating energy consumption is greater than the increase in annual cooling energy consumption, when the g-value is constant, the lower the u-value, the lower the total annual energy consumption.
- In the case of Amman, improvement is appropriate in the direction of strengthening the u-value of the window and lowering the g-value.

- Ruwaished

<Simulation result>

u-value ($W/m^2 \cdot K$)	g-value	SQHEAT	SQCOOL	TOTAL	RATE
1.0	20	33,859,544	76,847,116	110,706,660	-25.51%
	30	32,222,820	79,668,613	111,891,432	-24.71%
	40	29,149,972	85,747,690	114,897,661	-22.69%
	50	25,773,757	93,290,695	119,064,452	-19.88%
2.0	20	36,604,176	77,755,891	114,360,068	-23.05%
	30	33,730,555	82,607,280	116,337,835	-21.72%
	40	30,344,228	89,236,880	119,581,108	-19.54%
	50	27,768,046	94,938,060	122,706,106	-17.43%
3.0	20	39,019,532	79,193,323	118,212,855	-20.46%
	30	36,125,099	83,914,502	120,039,601	-19.23%
	40	31,810,794	92,436,570	124,247,364	-16.40%
	50	29,668,121	97,106,926	126,775,046	-14.69%
5.7	80	30,427,981	118,185,807	148,613,788	0.00%

- When the u-value is constant, the lower the g-value, the lower the annual heating energy consumption tends to increase, and the annual cooling energy consumption tends to decrease.
- Since the decrease in annual cooling energy consumption is greater than the increase in annual heating energy consumption, when the u-value is constant, the lower the g-value, the lower the total annual energy consumption.
- When the g-value is constant, the lower the u-value, the lower the annual cooling energy consumption and the annual heating energy consumption tend to decrease. Therefore, the lower the u-value, the lower the total annual energy consumption.
- However, in the case of Ruwaished, even if the u-value is high, the total energy consumption may be reduced more than a window with a lower u-value depending on the combination with the g-value. Therefore, it is appropriate to select an appropriate u-value and g-value.

- Hasan

<Simulation result>

u-value (W/m²·K)	g-value	SQHEAT	SQCOOL	TOTAL	RATE
1.0	20	32,865,431	71,368,509	104,233,940	-25.82%
	30	31,207,522	74,205,307	105,412,829	-24.98%
	40	28,087,933	80,297,233	108,385,167	-22.87%
	50	24,673,409	87,857,480	112,530,889	-19.92%
2.0	20	35,583,718	72,048,878	107,632,596	-23.40%
	30	32,672,861	76,928,795	109,601,655	-22.00%
	40	29,235,072	83,566,550	112,801,623	-19.72%
	50	26,623,178	89,269,168	115,892,347	-17.52%
3.0	20	37,962,721	73,257,416	111,220,137	-20.85%
	30	35,031,569	78,016,978	113,048,547	-19.55%
	40	30,648,413	86,541,363	117,189,776	-16.60%
	50	28,469,561	91,195,610	119,665,171	-14.84%
5.7	80	28,931,258	111,584,983	140,516,241	0.00%

- When the u-value is constant, the lower the g-value, the lower the annual heating energy consumption tends to increase, and the annual cooling energy consumption tends to decrease.
- Since the decrease in annual cooling energy consumption is greater than the increase in annual heating energy consumption, when the u-value is constant, the lower the g-value, the lower the total annual energy consumption.
- When the g-value is constant, the lower the u-value, the lower the annual cooling energy consumption and the annual heating energy consumption tend to decrease. Therefore, the lower the u-value, the lower the total annual energy consumption.
- However, in the case of Hasan, even if the u-value is high, the total energy consumption may be reduced more than a window with a lower u-value depending on the combination with the g-value. Therefore, it is appropriate to select an appropriate u-value and g-value.

- Ma’an

<Simulation result>

u-value (W/m²·K)	g-value	SQHEAT	SQCOOL	TOTAL	RATE
1.0	20	37,330,672	50,306,498	87,637,170	-22.98%
	30	35,299,215	52,652,370	87,951,585	-22.70%
	40	31,462,432	57,850,501	89,312,933	-21.51%
	50	27,243,862	64,536,450	91,780,312	-19.34%
2.0	20	40,428,394	50,280,390	90,708,784	-20.28%
	30	36,869,519	54,343,076	91,212,595	-19.84%
	40	32,649,065	60,074,230	92,723,295	-18.51%
	50	29,434,517	65,136,595	94,571,112	-16.89%
3.0	20	43,113,231	50,688,291	93,801,523	-17.56%
	30	39,534,957	54,659,792	94,194,749	-17.22%
	40	34,152,986	62,024,470	96,177,457	-15.48%
	50	31,478,435	66,191,445	97,669,880	-14.16%
5.7	80	31,311,121	82,475,687	113,786,808	0.00%

- When the u-value is constant, the g-value adjusts the tendency to increase the amount of annual heating energy, which gradually decreases, and tends to increase the tendency for the annual density to increase.
- Since the decrease in annual cooling energy consumption is greater than the increase in annual heating energy consumption, when the u-value is constant, the lower the g-value, the lower the total annual energy consumption.
- When the g-value is constant, even if the u-value changes, the annual cooling energy consumption does not change significantly, and the annual heating energy consumption tends to decrease, so the lower the u-value, the lower the total annual energy consumption. This decreases
- However, in the case of Ma’an, even if the u-value is high, the total energy consumption may be reduced more than a window with a lower u-value depending on the combination with the g-value. Therefore, it is appropriate to select an appropriate u-value and g-value.

• Irbid

<Simulation result>

u-value ($W/m^2 \cdot K$)	g-value	SQHEAT	SQCOOL	TOTAL	RATE
1.0	20	31,285,331	41,054,971	72,340,302	-24.29%
	30	29,702,004	43,076,887	72,778,890	-23.83%
	40	26,753,836	47,589,226	74,343,061	-22.19%
	50	23,572,328	53,461,883	77,034,212	-19.37%
2.0	20	33,893,929	40,659,170	74,553,100	-21.97%
	30	31,118,369	44,165,503	75,283,872	-21.21%
	40	27,880,284	49,128,782	77,009,066	-19.40%
	50	25,450,647	53,574,923	79,025,570	-17.29%
3.0	20	36,166,797	40,640,243	76,807,039	-19.61%
	30	33,367,292	44,065,802	77,433,094	-18.96%
	40	29,245,551	50,427,283	79,672,834	-16.61%
	50	27,217,073	54,100,366	81,317,439	-14.89%
5.7	80	27,872,548	67,672,381	95,544,929	0.00%

- When the u-value is constant, the lower the g-value, the lower the annual heating energy consumption tends to increase, and the annual cooling energy consumption tends to decrease.
- Since the decrease in annual cooling energy consumption is greater than the increase in annual heating energy consumption, when the u-value is constant, the lower the g-value, the lower the total annual energy consumption.
- When the g-value is constant, the lower the u-value, the lower the annual cooling energy consumption tends to increase, and the annual heating energy consumption tends to decrease.
- Since the decrease in annual heating energy consumption is greater than the change in annual cooling energy consumption, when the g-value is constant, the lower the u-value, the lower the total annual energy consumption.
- However, in the case of Irbid, even if the u-value is high, the total energy consumption may be reduced more than a window with a lower u-value depending on the combination with the g-value. Therefore, it is appropriate to select an appropriate u-value and g-value.

• Hussein

<Simulation result>

u-value ($W/m^2 \cdot K$)	g-value	SQHEAT	SQCOOL	TOTAL	RATE
1.0	20	38,828,426	41,005,196	79,833,623	-22.60%
	30	36,987,324	43,120,530	80,107,854	-22.33%
	40	33,521,407	47,759,322	81,280,729	-21.20%
	50	29,710,585	53,714,468	83,425,054	-19.12%
2.0	20	41,944,788	40,596,781	82,541,570	-19.97%
	30	38,716,091	44,249,574	82,965,665	-19.56%
	40	34,905,962	49,334,260	84,240,223	-18.33%
	50	31,998,042	53,833,419	85,831,461	-16.78%
3.0	20	44,685,717	40,586,342	85,272,059	-17.33%
	30	41,438,608	44,148,067	85,586,675	-17.02%
	40	36,592,124	50,665,152	87,257,276	-15.40%
	50	34,171,714	54,368,268	88,539,981	-14.16%
5.7	80	35,071,989	68,070,835	103,142,824	0.00%

- When the u-value is constant, the lower the g-value, the lower the annual heating energy consumption tends to increase, and the annual cooling energy consumption tends to decrease.
- Since the decrease in annual cooling energy consumption is greater than the increase in annual heating energy consumption, when the u-value is constant, the lower the g-value, the lower the total annual energy consumption.
- When the g-value is constant, the lower the u-value, the lower the annual cooling energy consumption tends to increase, and the annual heating energy consumption tends to decrease.
- Since the decrease in annual heating energy consumption is greater than the increase in annual cooling energy consumption, when the g-value is constant, the lower the u-value, the lower the total annual energy consumption.
- However, in the case of Hussein, even if the u-value is high, the total energy consumption may be reduced more than a window with a lower u-value depending on the combination with the g-value. Therefore, it is appropriate to select an appropriate u-value and g-value.

- Wadi

<Simulation result>

u-value ($W/m^2 \cdot K$)	g-value	SQHEAT	SQCOOL	TOTAL	RATE
1.0	20	15,954,907	61,075,558	77,030,465	-29.88%
	30	14,957,420	63,657,831	78,615,252	-28.44%
	40	13,135,596	69,275,593	82,411,189	-24.99%
	50	11,225,821	76,384,251	87,610,072	-20.25%
2.0	20	17,426,848	61,381,179	78,808,028	-28.27%
	30	15,673,899	65,819,729	81,493,629	-25.82%
	40	13,670,318	71,957,076	85,627,394	-22.06%
	50	12,208,192	77,320,098	89,528,291	-18.51%
3.0	20	18,683,584	62,165,146	80,848,731	-26.41%
	30	16,905,325	66,485,672	83,390,997	-24.10%
	40	14,345,626	74,354,972	88,700,598	-19.26%
	50	13,121,974	78,741,143	91,863,117	-16.38%
5.7	80	13,056,978	96,805,726	109,862,705	0.00%

- When the u-value is constant, the lower the g-value, the lower the annual heating energy consumption tends to increase, and the annual cooling energy consumption tends to decrease.
- Since the decrease in annual cooling energy consumption is greater than the increase in annual heating energy consumption, when the u-value is constant, the lower the g-value, the lower the total annual energy consumption.
- When the g-value is constant, the lower the u-value, the lower the annual cooling energy consumption and the annual heating energy consumption tend to decrease. Therefore, the lower the u-value, the lower the total annual energy consumption.
- However, in the case of Wadi, even if the u-value is high, the total energy consumption may be reduced more than a window with a lower u-value depending on the combination with the g-value. Therefore, it is appropriate to select an appropriate u-value and g-value.

- Aqaba

<Simulation result>

u-value ($W/m^2 \cdot K$)	g-value	SQHEAT	SQCOOL	TOTAL	RATE
1.0	20	3,496,401	123,017,044	126,513,445	-31.75%
	30	3,082,634	126,900,299	129,982,932	-29.88%
	40	2,393,534	135,204,091	137,597,625	-25.77%
	50	1,772,416	145,502,672	147,275,088	-20.55%
2.0	20	3,936,477	125,168,032	129,104,509	-30.36%
	30	3,207,194	131,790,301	134,997,495	-27.18%
	40	2,458,352	140,844,148	143,302,500	-22.70%
	50	1,983,473	148,633,161	150,616,634	-18.75%
3.0	20	4,285,438	128,024,699	132,310,137	-28.63%
	30	3,534,462	134,432,778	137,967,240	-25.57%
	40	2,567,687	146,085,639	148,653,326	-19.81%
	50	2,170,342	152,422,501	154,592,843	-16.61%
5.7	80	1,857,007	183,519,048	185,376,056	0.00%

- When the u-value is constant, the lower the g-value, the lower the annual heating energy consumption tends to increase, and the annual cooling energy consumption tends to decrease.
- Since the decrease in annual cooling energy consumption is greater than the increase in annual heating energy consumption, when the u-value is constant, the lower the g-value, the lower the total annual energy consumption.
- When the g-value is constant, the lower the u-value, the lower the annual cooling energy consumption and the annual heating energy consumption tend to decrease. Therefore, the lower the u-value, the lower the total annual energy consumption.
- However, in the case of Aqaba, even if the u-value is high, the total energy consumption may be reduced more than a window with a lower u-value depending on the combination with the g-value. Therefore, it is appropriate to select an appropriate u-value and g-value.

• Ghor

<Simulation result>

u-value ($W/m^2 \cdot K$)	g-value	SQHEAT	SQCOOL	TOTAL	RATE
1.0	20	3,419,798	125,945,054	129,364,852	-31.20%
	30	3,012,004	129,736,708	132,748,713	-29.40%
	40	2,342,312	137,834,059	140,176,371	-25.45%
	50	1,739,291	147,804,125	149,543,416	-20.47%
2.0	20	3,863,434	128,356,083	132,219,517	-29.68%
	30	3,142,180	134,817,844	137,960,024	-26.63%
	40	2,410,254	143,629,106	146,039,360	-22.33%
	50	1,948,304	151,171,804	153,120,108	-18.57%
3.0	20	4,216,874	131,449,694	135,666,568	-27.85%
	30	3,470,228	137,700,060	141,170,288	-24.92%
	40	2,522,819	149,039,291	151,562,110	-19.39%
	50	2,135,699	155,166,879	157,302,578	-16.34%
5.7	80	1,850,154	186,178,611	188,028,765	0.00%

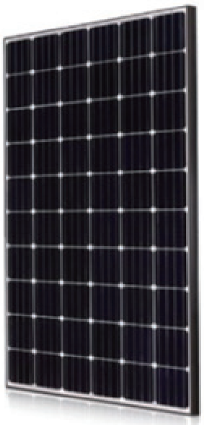
- When the u-value is constant, the lower the g-value, the lower the annual heating energy consumption tends to increase, and the annual cooling energy consumption tends to decrease.
- Since the decrease in annual cooling energy consumption is greater than the increase in annual heating energy consumption, when the u-value is constant, the lower the g-value, the lower the total annual energy consumption.
- When the g-value is constant, the lower the u-value, the lower the annual cooling energy consumption and the annual heating energy consumption tend to decrease. Therefore, the lower the u-value, the lower the total annual energy consumption.
- However, in the case of Aqaba, even if the u-value is high, the total energy consumption may be reduced more than a window with a lower u-value depending on the combination with the g-value. Therefore, it is appropriate to select an appropriate u-value and g-value.

9) Simulation (Active Measures)

□ Simulation modeling

- PV spec.
  - Capacity : 3kW, 6kW
  - Installation angle : 35°

[Figure. L company solar module reference]



Electrical Properties (STC*)

Model		LG300S1C-A5	LG295S1C-A5	LG290S1C-A5
Maximum Power (Pmax)	[W]	300	295	290
MPP Voltage (Vmpp)	[V]	31.7	31.3	31.0
MPP Current (Impp)	[A]	9.47	9.43	9.36
Open Circuit Voltage (Voc)	[V]	38.9	38.6	38.3
Short Circuit Current (Isc)	[A]	10.07	10.02	9.97
Module Efficiency	[%]	17.5	17.2	16.9
Operating Temperature	[°C]	-40 ~ +90		
Maximum System Voltage	[V]	1,000 (UL / IEC)		
Maximum Series Fuse Rating	[A]	20		
Power Tolerance	[%]	0 ~ +3		

* STC (Standard Test Condition): Irradiance 1000 W/m², cell temperature 25 °C, AM 1.5
The nameplate power output is measured and determined by LG Electronics at its sole and absolute discretion.

- Solar thermal spec.
  - Total collector area : 15 [m^2]
  - Plate absorptance : 0.9
  - Fluid mass flow rate : 200 kg/hr
  - Tank volume : 0.2725 m^3
  - Tank height : 1.331 m

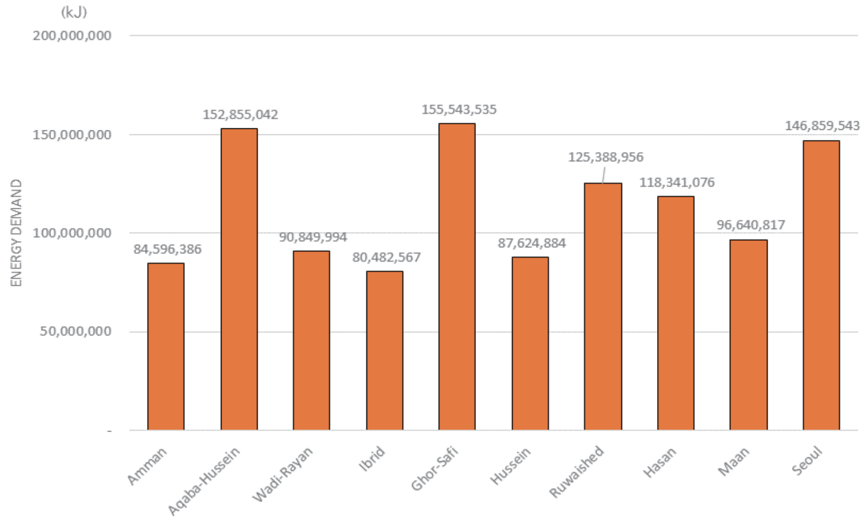
[Figure. Temperature characteristics reference]

Temperature Characteristics

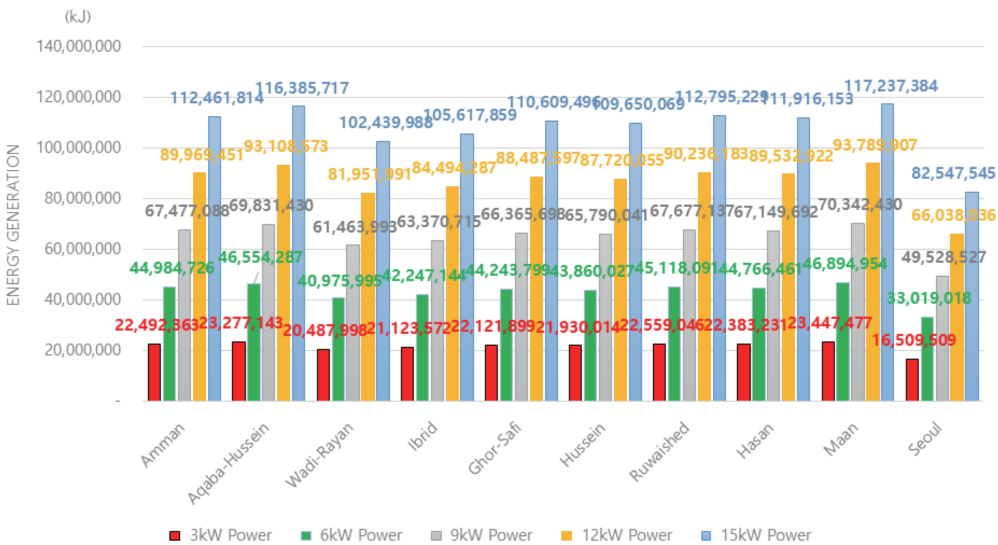
NOCT	[°C]	45 ± 3
Pmax	[%/°C]	-0.41
Voc	[%/°C]	-0.30
Isc	[%/°C]	0.03

□ Active facility simulation results

• Cooling and Heating energy demand by EHP supply

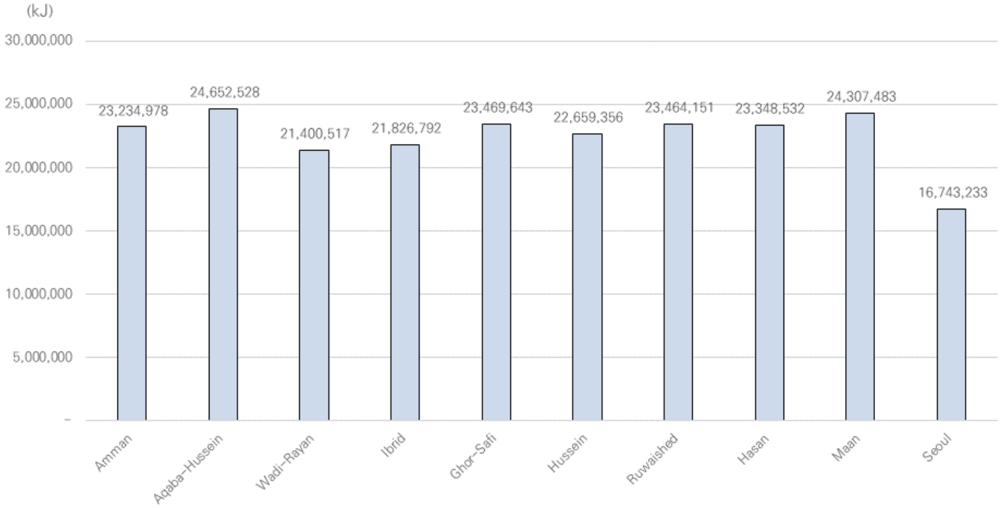


• PV generation amount



- All regions of Jordan have more solar power generation than Seoul, Korea.

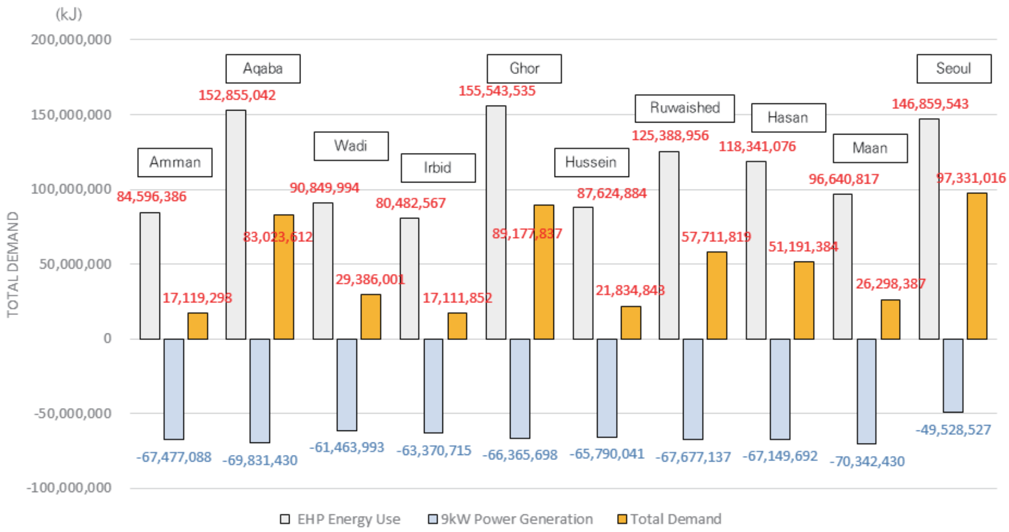
- Solar Thermal heat gain



- All regions of Jordan produce more solar energy than Seoul, Korea.

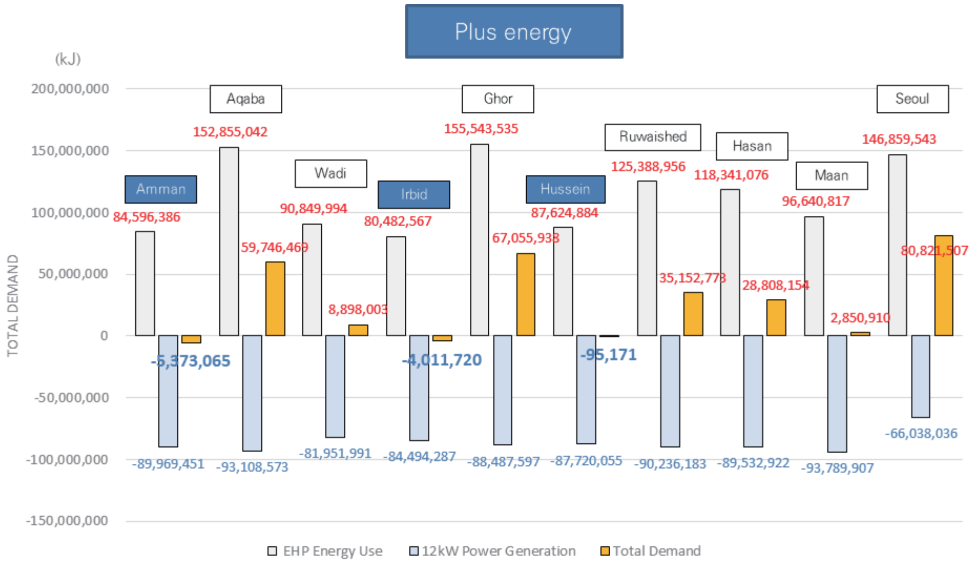
□ EHP + PV combination

- EHP + PV(9kW)



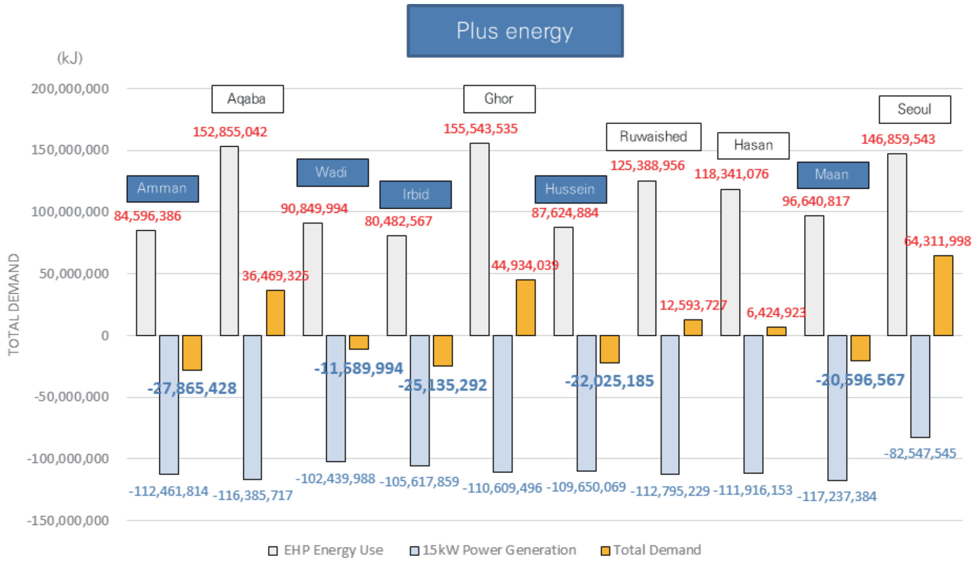
- In the case of EHP + PV (9kW), total energy consumption decreases, but energy consumption is still higher than production.

• EHP + PV(12kW)



- In the case of EHP + PV (12kW), energy production in Amman, Irbid, and Hussein regions exceeds requirements.

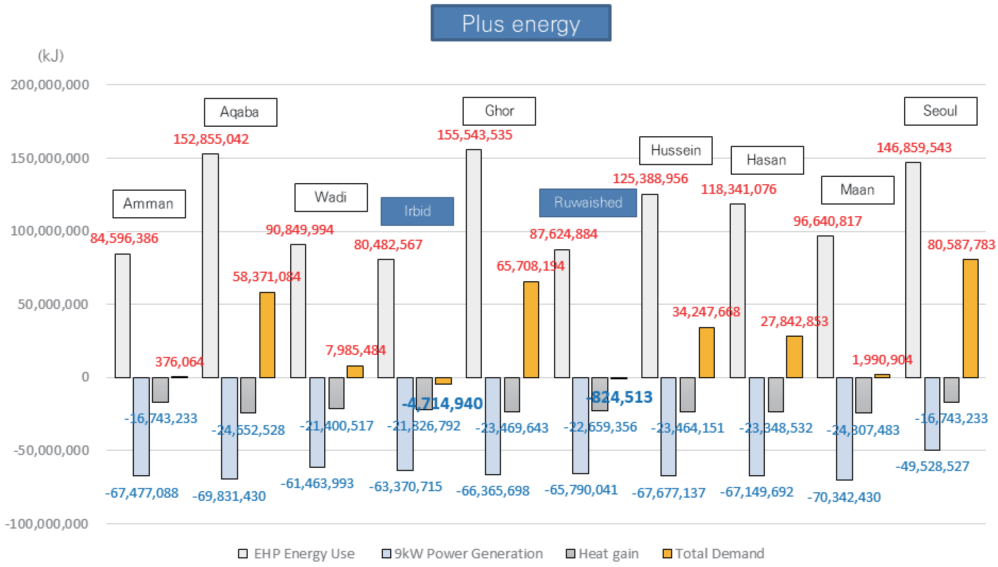
• EHP + PV(15kW)



- In the case of EHP + PV (15kW), additional energy production in Wadi and Ma’an areas exceeds requirements.

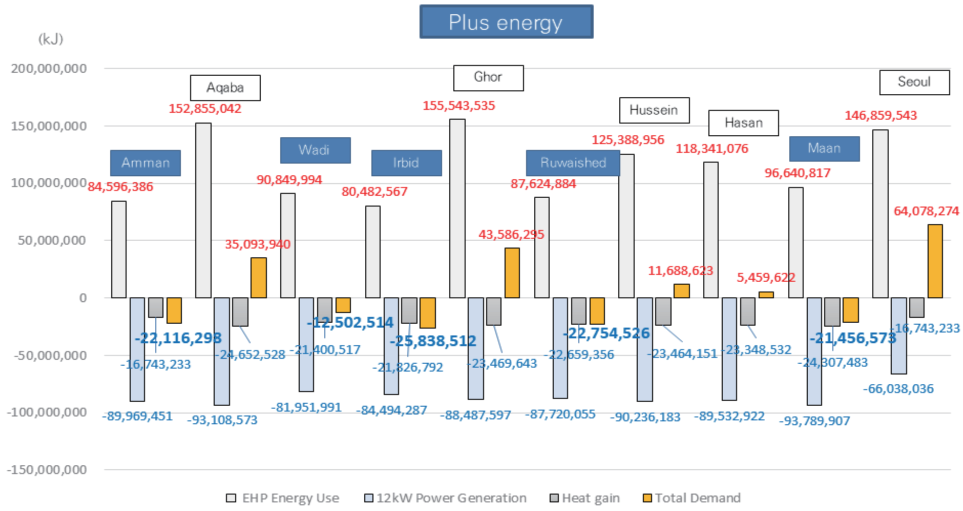
□ EHP + PV + Solar thermal combination

- EHP + PV(9kW) + Solar thermal



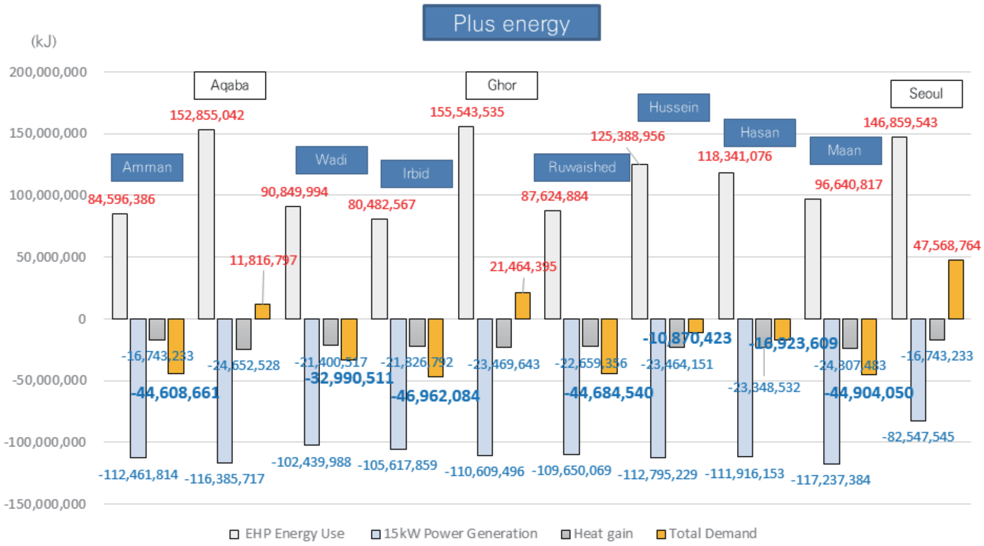
- In the case of EHP + PV (9kW) + Solar thermal, energy production in Irbid and Hussein regions exceeds consumption.

- EHP + PV(12kW) + Solar thermal



- In the case of EHP + PV (12kW) + Solar thermal, energy production in Amman, Wadi, and Ma’an regions additionally exceeds consumption.

- EHP + PV(15kW) + Solar thermal



- In the case of EHP + PV (15kW) + Solar thermal, energy production in Ruwaished and Hasan regions additionally exceeds consumption.

□ Implications of active facility simulation

- A simulation was conducted using EHP as cooling and heating equipment for the energy consumption calculated after applying Jordan's insulation standards to all 9 regions.
- In relation to solar power and solar thermal facilities, all nine regions in Jordan have more advantageous location conditions than Seoul, Korea.
  - The areas with the highest efficiency of solar power and solar thermal facilities are Irbid and Hussein, and if these two areas are selected as pilot areas for active facility policies in the future, even better effects can be seen.
  - In the case of the combination of EHP + PV (15kW) + Solar thermal, energy production in all 7 regions except Aqaba and Ghor exceeded requirements, resulting in surplus energy. In other words, Jordan may also comply with the Zero Energy Building certification system being implemented in Korea in the future.

10) Building Energy Efficiency Improvement Roadmap

□ Korean case

Guideline	Building a Foundation and Improving Laws	Strengthening Education and Incentives	Technological Innovation and Improvement	Strengthening Building Energy Management, Cooperation with the Building Industry
Korean case	o Building Energy Performance Index (EPI) o Green Building Certification (G-SEED) o Building energy efficiency rating certification system o ZEB Certification System o Green remodeling o New building acquisition tax reduction and standard easing o Building property tax reduction o Renewable energy installation subsidy support o Interest support for construction cost loans to improve building energy performance	o Korea Environment and Architecture Institute - certification standards, design standard practical training - smart architecture, urban revitalization training - healthy architecture, green building expert training o Ministry of Land, Infrastructure and Transport - Zero energy architecture professional training project o Construction Technology Education Institute - Green architecture professional training course	o Eco-friendly construction materials - Classification of construction materials among green products o Energy-saving heating and cooling equipment - Energy consumption efficiency rating system o Development of new energy technology - ESS, EMS, IoT, etc	o Korea Energy Agency & Korea EMS Association - Establishment and support of government energy related policies - sharing of business models and resolution of difficulties among members - research on policy system improvement, creation of a foundation to promote industry supply

- Before proposing Jordan's roadmap, we first looked at the case of Korea. First of all, Korea is implementing quite a few certification systems like the above example to build confidence and improve laws. Additionally, there are various incentives according to the certification system. Next, we train experts by strengthening the incentives and building energy-related education programs mentioned above. Next, technological innovation and continuous improvement are needed, and Korea has developed eco-friendly building materials, energy-saving heating and cooling equipment, and new energy technologies. Lastly, building energy management must be strengthened nationally, and continuous development must be achieved in cooperation with the building industry. Korea has established and implemented the Korea Energy Agency and the Korea EMS Association.

□ Jordan Roadmap

Guideline	Building a Foundation and Improving Laws	Strengthening Education and Incentives	Technological Innovation and Improvement	Strengthening Building Energy Management, Cooperation with the Building Industry
Main Content	1. Improve building energy efficiency standards and introduce new building energy efficiency regulations 2. Strengthen the building energy efficiency certification and evaluation process and strictly manage compliance. 3. Expand research and innovation projects to improve building energy efficiency 4. Introduce financial support programs to improve building energy efficiency and provide subsidies and tax benefits.	1. Expand education campaigns on building energy efficiency and expand education programs for building professionals and citizens. 2. Continue to develop, improve, and disclose building energy efficiency improvement guidelines and materials. 3. Introduce detailed incentives that provide economic benefits of the certification system to building owners and operators.	1. Continue research into innovative building materials and systems to improve building energy efficiency, promote the adoption of these technologies in the construction industry. 2. Further maximize building energy efficiency by Energy consumption efficiency rating system & EMS.	1. Monitor building energy consumption, identify energy consumption patterns through data analysis, and make improvements. 2. Collaborate with the building industry to promote improvements in building energy efficiency and select and share best practices.

- At present, Jordan must first improve its building energy-related legal system by referring to the above guidelines. Additionally, financial support programs can be introduced to improve building energy efficiency and related subsidies can be provided. Next, we need to expand education programs for building professionals and citizens. Next, research into high-performance building materials must continue to drive technological innovation and continuous improvement. Lastly, building energy consumption must be monitored and continuously improved at the national level. However, the above process should not be thought of as individual steps, but as things connected to each step. Therefore, it is better to proceed with the flow as above, and it will be effective if applied fluidly during the connection process.

□ Example of specific step-by-step implementation plan

• Step 1 : Building a Foundation and Improving Laws

Strengthening the building energy-related certification system	Example of subsidy support policy
• LEED certification • JGBG certification • EDGE certification	• Renewable energy facility installation subsidies • Subsidies for window and insulation replacement to improve energy performance • Subsidies for installing control devices for energy savings • Other matters deemed necessary to increase energy efficiency

• Step 2 : Strengthening Education and Incentives

Strengthening educational programs
Expansion of building energy-related education programs operated by JGBC
Certification system training • LEED: Core Concepts & Strategies • LEED: Understanding the Building Design + Construction LEED Rating System • LEED: Understanding the Building Design • Energy Efficient Building Envelope (Basic Level, Intermediate Level) • EDGE Expert Technical Training
Building energy efficiency education • Energy Efficient Building Envelope (Basic Level, Intermediate Level) • Energy Efficient HVAC Design Duration • Solar Passive Design Of Homes In Jordan
Energy inspector-related training • Energy Auditing Fundamentals
Incentive example
• Acquisition tax reduction for new buildings • Property tax reduction for buildings

• Step 3 : Technological Innovation and Improvement

Example of National level for technological innovation
• Securing budget to support national R&D projects (development of high-efficiency building materials, EMS technology research) • Introduction of BEMS (Building Energy Management System)

• Step 4 : Strengthening Building Energy Management, Cooperation with the Building Industry

Examples of strengthening management and cooperation
• Promote a national building energy demand management system • Expand the supply of high-efficiency building materials and promote the growth of related industries • Sharing best practices of energy saving in Jordanian buildings

04

CHAPTER

Summary of Results

Summary of Results

□ Local seminars and Launching seminars

- We decided to listen to opinions and collaborate on the project through a meeting with local related organizations in Jordan.(Such as Jordan Southern Power, Jordan Ministry of Energy and Mineral Resources, German Jordan University, Jordan Green Building Council, Jordan University of Science & Technology, Jordan National Building Council, Royal Scientific Society, Middle East Insurance, and Arab Technical Group)
- Through the launch briefing, analysis of the energy status of Jordan's energy and residential sectors, analysis of related systems in both countries, direction and plans for investigation and research will be announced, and questions and opinions will be shared.

□ Field survey and local seminars

- Through a workshop with German Jordan University and MEMR, research progress was shared and local surveys were discussed.
- Total of 14 on-site surveys were conducted to investigate energy use at residential building sites in Jordan, and residential environments and facilities were investigated through surveys with actual residents, and policy advice was sought.
- Hold a local seminar to share research progress and local survey results, and establish research direction and plan through Q&A and sharing opinions with attendees.

□ Policy worker training and interim briefing session

- Nine local Jordanian government officials and one person from a research cooperation organization were invited to Korea to conduct a total of seven field trips for policy practitioner training, including the Korea Energy Agency, and meetings with eight domestic companies, including LG Energy Solutions.

- Through the interim report, questions and opinions are shared on the mid-term report and plan based on the results of the study, which includes preliminary field surveys through the launch report and detailed survey, as well as simulations for analysis of legal systems and system proposals.

□ Local seminar and Final Reporting Seminar

- Before the final report, there was an opportunity to share research results and listen to corrections and feedback through a local seminar with German Jordan University and MEMR.
- The final research results were announced, including overall task progress, analysis of Jordan's energy status, analysis of legal systems, simulation of passive methods to present insulation standards, simulation of active methods, and presentation of a policy roadmap for building energy efficiency. Additionally, questions and opinions are shared regarding the research content and results.

□ Jordan status analysis

- Jordan is a non-oil-producing country and relies heavily on imports for energy sources, and energy consumption in the residential sector is increasing significantly. In addition, residential buildings account for approximately 24% of final energy consumption and 48% of electricity usage, accounting for a major portion of Jordan's national energy consumption, so it is necessary to improve energy efficiency in the residential sector among buildings.
- Jordan is similar to Korea in that it relies on imports for energy sources, the population is concentrated in the metropolitan area, and the proportion of apartments among residential types is high.

□ Legal system analysis

- We summarized the building energy-related certification systems such as Jordan's LEED, JGBG, and EDGE and Korea's G-SEED, building energy efficiency rating, zero energy building certification, and green remodeling support project, and introduced the current status and Korea's advanced systems.
- Comparison was conducted by organizing the contents of Jordan's Energy Efficient Building Code, which are the building energy efficiency laws of both countries, Thermal Insulation Code, energy saving design of buildings, and thermal transmittance rate of building parts by region.

- Among them, a simulation is planned and conducted to propose a new insulation standard policy, focusing on comparison of insulation standards.

□ Building energy simulation

- Regions were classified using K-Means clustering based on the average temperature and humidity, maximum and minimum temperature, maximum and minimum humidity, cumulative total of annual solar radiation, and annual average wind speed data of nine regions obtained through Jordan standard meteorological data.
- As a passive method, a simulation was conducted while changing the u-value for 9 regions, and a new u-value was proposed through analysis of energy requirements for the building area. ('External Wall', 'External Roof', 'Adjacent Wall', 'Adjacent Ceiling', 'Ground Floor')
- As a passive method, a simulation was conducted with the u-value and g-value of windows as variables for 9 regions, and compared to the current, standards for u-value and g-value of windows were proposed.
- Assuming that the annual energy demand is to be met with EHP as an active method, solar power facilities are installed and used as boiler facilities, and the solar power generation facility capacity is increased from 3kW to 15kW and a simulation is performed. Through this, we propose active facilities suitable for the Jordanian region and analyze the resulting power generation by region.

□ Policy roadmap proposal

- Building energy-related legal systems must first be improved based on benchmarking of Korea's cases. Next, a financial support program must be introduced to improve building energy efficiency and a related subsidy system must be established. Next, we must expand educational programs for building professionals and citizens, and continue research on high-performance building materials for technological innovation and continuous improvement. Lastly, a roadmap is presented in order of the need for efforts to monitor and continuously improve building energy consumption at the national level, along with examples of specific action plans for each step.

Attachment 1　List of attendees at Jordan KSP Launching Seminar

No.	Name	Affiliation & Position (Kor)	Name (Eng)	Affiliation & Position (Eng)	Note
1	홍영표	수석고문 前 수출입은행 수석부행장	Hong Youngpyo	Senior Advisor & Head of 2021/22 KSP Consultation with Jordan	
2	김동기	주요르단한국대사	Kim, Donggi	Ambassador, Embassy of the Republic of Korea	
3	맹수진	주요르단한국대사관 서기관	Maeng, Sujin	First Secretary, Embassy of the Republic of Korea	
4	박철호	KOTRA 개발협력실 실장	Park, Chulho	Director General, Development Cooperation Office, KOTRA	KOTRA
5	장덕환	KOTRA 개발협력실 과장 (요르단 KSP PM)	Jang DukHwan	Project Manager, Development Cooperation Office, KOTRA	
6	강동훈	KOTRA 개발협력실 대리 (요르단 KSP 업무보조)	Kang, DongHun	Assistant Manager	
7	김찬열	KOTRA 암만무역관 부관장	Kim, Chanyoul	Deputy Director, KOTRA Amman	KOTRA (Amman)
8	이호빈	KOTRA 암만무역관 차장	Lee, Hobin	Deputy Director, KOTRA Amman	
9	이정현	KOTRA 암만무역관 마케팅 팀장	Lee, Junghyun	Marketing Team Leader, KOTRA Amman	
10	유병천	(주)레플러스 대표이사	Yoo ByungChun	President&CEO, REPLUS Co.,Ltd.	Researcher
11	이순명	상명대학교 융합공과대학 교수	Lee SoonMyung	College of Convergence Engineering, Seoul Sangmyung University	
12	홍준기	상명대학교 융합공과대학 연구원	Hong JunGi	College of Convergence Engineering, Seoul Sangmyung University	

* Excluding KOTRA Amman members attending

No.	Name	Affiliation	Position
1	Eng. Amani Al-Azzam	Ministry of Energy and Mineral Resources	Secretary General
2	Eng. Hasan Alheyari		Assistant of Secretary General
3	Eng. Yacoub Marar		Director of Renewable Energy and Energy Efficiency Directorate
4	Eng. Shorouq Abdel Ghani		Director of Planning and Organization Development Directorate
5	Eng. Reem Al-Bzour		RE & EE Directorate
6	Eng. Marwa Al-Mefleh		
7	Eng. Arwa Abu Kashef		
8	Eng. Baraa Alsurdi		P & OD Directorate
9	Ms. Rowaida Al-Ajaleen		
10	Mr. Rasmi Hamzeh	JREEEF	Executive Director
11	Eng. Nedal Jaber		Engineer
12	Eng. Ahmad Bassam		Technical Advisor
13	Dr. Jamal Otaishat	Jordan National Building Council	Secretary
14	Eng. Moheeb Arabiyat		Sustainability Manager
15	Eng. Ramia Shakhatreh		Sustainable Unit
16	Eng. Abdullah Badeer	Jordan Green Building Council	Research and Innovation Committee
17	Eng. Shefaa Al Khatatbah		Vice Chair
18	Eng. Hind Alhadidi		Team Leader (Acting Executive Director)
19	Eng. Rawan Alqudah	The National Energy Research Center	Manager of Campus Development
20	Eng. Mutasim Saffi		Specialist / Studies

No.	Name	Affiliation	Position
21	Eng. Walid Shahin	Royal Scientific Society	Senior Assistant to the President for Sustainable Solutions
22	Dr Adel Al-Assaf		Director of Building Research Centre
23	Eng. Majd Shatnawi		Manager of Building Codes Division, Building Research Center
24	Eng. Sawsan Bawaresh		Manager of Energy Efficiency & Solar Thermal Energy Division
25	Prof. Omaimah Ali	German Jordanian University	Dean, School of Architecture and Built Environment, GJU
26	Dr. Farah Al-Atrash		Head of the Architecture and Interior Architecture
27	Arch. Tala Samir Awadallah		Deans Assistant for Graduate Studies
28	Prof. Anne Gharaibe	Jordan University of Science & Technology	Act as the Dean of Architecture
29	Prof. Hikmat Hammad Ali		-
30	Dr. Laith Obeidat		-
31	Dr. Shouib Mabdeh		-

※ Antecedents of key Jordanian personnel

Photo	Name	Position	Main antecedents
	Amani Al-Azzam	Secretary General	• Electrical Engineering, Jordan University of Science and Technology ('89) • Jordan Electric Power Company (JEPCO) ('90~'96) • Jordan Ministry of Energy and Mineral Resources ('96~'04) • Jordan National Electric Power Company (NEPCO) ('04~'16) • Deputy Minister of Energy and Mineral Resources, Jordan ('16~present)
	Rasmi A. Hamzeh	Executive Director	• Worked as a business development consultant for 25 years - JREEEF strategy, plan design - More than $100 million raised through international organization/NGO cooperation - Participation in designing renewable energy laws and regulations

Attachment 2 Jordan Field Survey Questionnaire

I. Housing in general

1. Please write the address of the house.

2. Please write the number of rooms, bathrooms, living rooms, kitchens etc.
   ① Rooms (   )
   ② Bathrooms (   )
   ③ Living rooms (   )
   ④ Kitchens (   )
   ⑤ etc. (   )

3. Please write down your electricity energy usage and charges.
   (Approximate figures) Monthly electricity consumption & monthly electricity bill

4. Please write down your gas/oil energy usage and charges.
   (Approximate figures) Monthly gas usage & monthly gas bill or
   Monthly oil consumption & monthly oil bill

5. Please write down your water usage and charges.
   (Approximate figures) Monthly water consumption & monthly water bill

6. Please write down, If there are other energy usage and charges. (Approximate figures) Monthly consumption & monthly bill

7. Please list the following in your home in order of greatest dissatisfaction.
   ① It's cold (heating required)
   ② It's hot (cooling required)
   ③ The water temperature is not constant
   ④ Power outages occur frequently
   ⑤ I'm running out of gas/oil
   ⑥ I'm short of water
   ⑦ Electricity is expensive
   ⑧ Gas/Oil is expensive
   ⑨ Water is expensive
   ⑩ etc. (   )

Please write your order here: (   )-(   )-(   )-(   )-(   )-(   )-(   )-(   )-(   )-(   )

8. Please list in order the parts of the home you would most like to improve.
   ① Wall
   ② Roof
   ③ Window
   ④ Toilet
   ⑤ Kitchen
   ⑥ Entrance
   ⑦ Heating equipment
   ⑧ Cooling equipment
   ⑨ Water supply equipment
   ⑩ Lighting
   ⑪ etc. (   )

Please write your order here: (   )-(   )-(   )-(   )-(   )-(   )-(   )-(   )-(   )-(   )-(   )

9. What is the main heating system in your home?
   ① Gas boiler
   ② Oil boiler
   ③ Electric boiler
   ④ etc. (   )

10. What is the main cooling system in your home?
   ① Air conditioner If you checked this question, how many air conditioners do you have in your house? (   )
   ② Electric fan
   ③ etc. (   )
   ④ None

11. What is the main hot water system in your bathroom & kitchen?
   ① Gas boiler
   ② Oil boiler
   ③ Electric boiler
   ④ etc. ( )

12. Are renewable energy system in your home? If so, What type of renewable energy is installed and at what capacity?

13. If you need renewable energy for your home, which one do you need?
   ① Solar power generation (electricity)
   ② Solar heat generation (hot water)
   ③ Heat pump (heat exchange of air heat, geothermal heat, etc.)

II. PoLicy comments

1. Did you know that in Jordan, the residential sector accounts for 24% of the country's total energy use and 48% of electricity consumption?
   ① Yes, I know
   ② I found out today that it is such a high percentage

2. What can be done to reduce energy use in residential areas in Jordan?
   ① It is necessary to enable energy savings in new houses, because there is a limit to energy savings in existing houses
   ② It is necessary to remodeling of existing houses, because there is a limit on the number of new construction houses

3. What can be done to reduce energy use in residential areas in Jordan?
   ① It is necessary to enable energy savings in new construction houses, because there is a limit to energy savings in existing houses which is no way to force it
   ② It is necessary to enable energy savings in existing houses, because there is a limit to energy savings in new construction houses which quantity is too small

4. What kind of institutional method should be taken in relation to new construction house to reduce energy consumption in Jordan's residential sector? Please list in order
   ① New construction houses should be designed to save energy
   ② New construction houses should be constructed to save energy
   ③ There must be a variety of good equipment products such as boilers/air conditioners/lighting, etc. in Jordan
   ④ There must be a variety of construction materials such as Insulation/windows/interior/exterior materials, etc. in Jordan
   ⑤ Renewable energy facilities such as photovoltaic/solar heat must be installed in each houses
   ⑥ If energy can be saved, there should be an incentive to build bigger/taller houses
   ⑦ If energy can be saved, tax incentives should be given
   ⑧ etc. ( )

Please write your order here: ( )-( )-( )-( )-( )-( )-( )-( )

5. What kind of institutional method should be taken in relation to renovation house to reduce energy consumption in Jordan's residential sector?
   Please list in order
   ① A campaign is needed to encourage the renovation of existing houses
   ② There should be government support policy to make it easier for existing houses to be renovated
   ③ There should be cost support to make it easier for existing houses to be renovated
   ④ There should be low interest rate loan system support to make it easier for existing houses to be renovated
   ⑤ There should be tax reduce system support to make it easier for existing houses to be renovated
   ⑥ There should be many companies in Jordan that do renovation of existing houses
   ⑦ etc. ( )

Please write your order here: ( )-( )-( )-( )-( )-( )-( )

Attachment 3 List of attendees at Jordan KSP Interim Seminar

□ List of major attendees in Korea

No.	Name (Kor)	Affiliation & Position (Kor)	Name (Eng)	Affiliation & Position (Eng)	Note.
1	홍영표	수석고문 前 수출입은행 수석부행장	Hong Youngpyo	Senior Advisor & Head of 2021/22 KSP Consultation with Jordan	
2	박철호	KOTRA 개발협력실 실장	Park, Chulho	Director General, Development Cooperation Office, KOTRA	KOTRA
3	장덕환	KOTRA 개발협력실 과장 (요르단 KSP PM)	Jang DukHwan	Project Manager, Development Cooperation Office, KOTRA a	
4	강동훈	KOTRA 개발협력실 대리	Kang DongHun	Assistant Manager	
5	이영희	KOTRA 암만무역관 관장	Lee YoungHee	General Director, KOTRA Amman	KOTRA (Amman)
6	이정현	KOTRA 암만무역관 마케팅 팀장	Lee Junghyun	Marketing Team Leader, KOTRA Amman	
7	이순명	상명대학교 융합공과대학 교수	Lee SoonMyung	College of Convergence Engineering, Seoul Sangmyung University	Researcher
8	유병천	(주)레플러스 대표이사	Yoo ByungChun	President&CEO, REPLUS Co.,Ltd.	
9	김길중	상명대학교 융합공과대학 연구원	Kim GilJung	College of Convergence Engineering, Seoul Sangmyung University	
10	이성현	상명대학교 융합공과대학 연구원	Lee SungHyun	College of Convergence Engineering, Seoul Sangmyung University	

□ List of major attendees in Jordan

No.	Name	Affiliation	Position	department
1	ZEYAD MUSADAG MOHAMMAD HAMMOUDEH	Ministry of Energy and Mineral Resources	Head of renewable energy and energy efficiency studies department	renewable energy and energy efficiency
2	REEM EMAD MOHAMMAD AL-BZOUR	Ministry of Energy and Mineral Resources	Engineer	renewable energy and energy efficiency
3	MARWA ALI SALEH ALMEFLEH	Ministry of Energy and Mineral Resources	Engineer	renewable energy and energy efficiency
4	AHMAD BASSAM HILMI IBRAHIM	Ministry of Energy and Mineral Resources	Sustainable Energy Advisor (Expert)	Jordan renewable energy and Energy efficiency fund
5	NEDAL EMAN AHMAD JABER	Ministry of Energy and Mineral Resources	Engineer	Jordan renewable energy and Energy efficiency fund
6	OMAR ABED HASAN BARQAWI	Ministry of Energy and Mineral Resources	Head of Innovation and Knowledge Management Department	planning and Organization development
7	KARAM MAHMOUD ABDEL HAFEZ ALMAKANIN	Ministry of Energy and Mineral Resources	Engineer	Jordan renewable energy and energy efficiency fund
8	WALEED NEDAL SAEED ABUJARADEH	Ministry of Energy and Mineral Resources	Head of Crisis Management Section	planning and Organization development
9	OMAR MAHMOUD HAMIDEH ALNAWAISHEH	Ministry of Energy and Mineral Resources	Engineer	Jordan renewable energy and energy efficiency fund
10	OMAIMAH A. M. AL-ARJA	German Jordan University	Dean of school of architecture and bulit environment, associate professor in building sciences	architecture and interior architecture

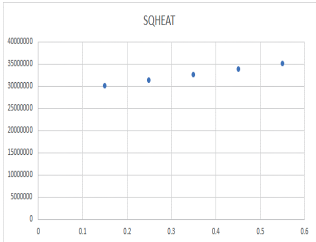
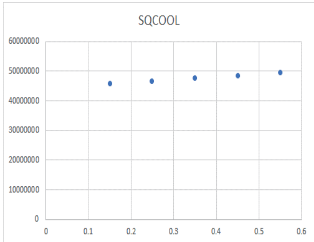
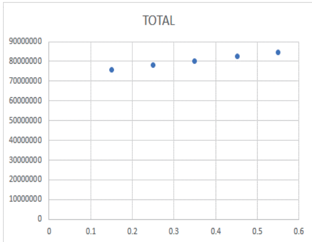
Attachment 4　Detailed results of thermal transmittance simulation

□ Amman

- External Roof

<Simulation result>

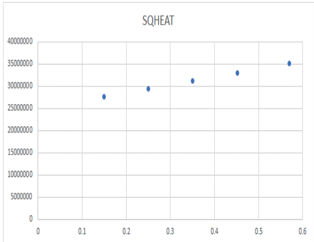
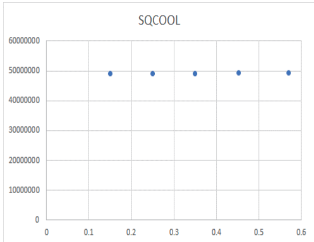
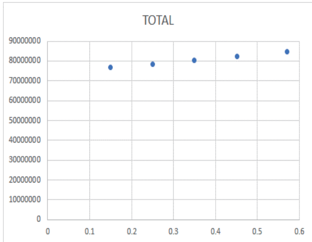
EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.15	0.57	0.57	0.8	1.2	75,874,355	-10.31%
0.25	0.57	0.57	0.8	1.2	78,025,324	-7.77%
0.35	0.57	0.57	0.8	1.2	80,206,126	-5.19%
0.45	0.57	0.57	0.8	1.2	82,434,064	-2.56%
0.55	0.57	0.57	0.8	1.2	84,596,386	0.00%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- External Wall

<Simulation result>

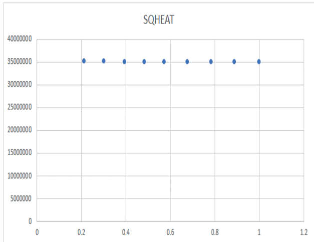
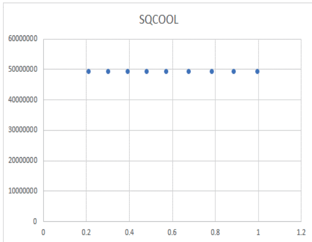
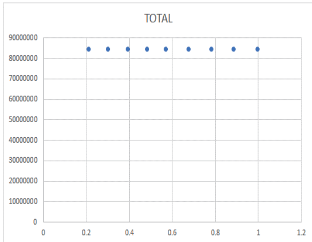
EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.15	0.57	0.8	1.2	76,644,191	-9.40%
0.55	0.25	0.57	0.8	1.2	78,491,945	-7.22%
0.55	0.35	0.57	0.8	1.2	80,383,823	-4.98%
0.55	0.452	0.57	0.8	1.2	8,2329,851	-2.68%
0.55	0.57	0.57	0.8	1.2	84,596,386	0.00%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- Adjacent Wall

<Simulation result>

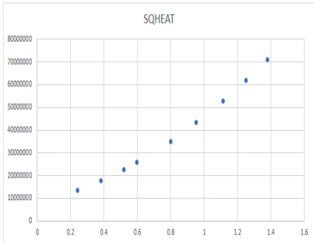
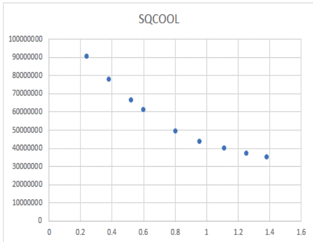
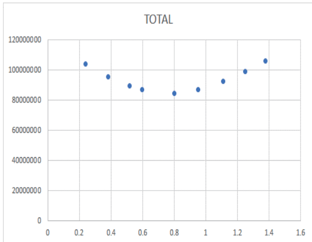
EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.21	0.8	1.2	84,692,700	0.11%
0.55	0.57	0.3	0.8	1.2	84,672,038	0.09%
0.55	0.57	0.392	0.8	1.2	84,645,773	0.06%
0.55	0.57	0.481	0.8	1.2	84,620,279	0.03%
0.55	0.57	0.57	0.8	1.2	84,596,386	0.00%
0.55	0.57	0.676	0.8	1.2	84,570,111	-0.03%
0.55	0.57	0.782	0.8	1.2	84,546,112	-0.06%
0.55	0.57	0.886	0.8	1.2	84,524,439	-0.09%
0.55	0.57	0.997	0.8	1.2	84,503,139	-0.11%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- Ground Floor

<Simulation result>

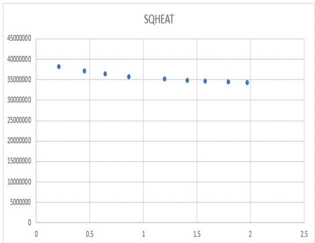
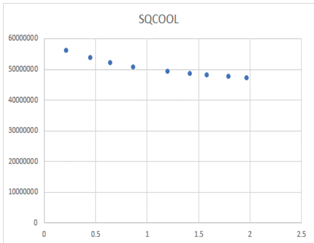
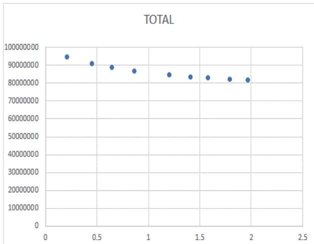
EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.57	0.24	1.2	104,095,136	23.05%
0.55	0.57	0.57	0.381	1.2	95,742,968	13.18%
0.55	0.57	0.57	0.52	1.2	89,651972.8	5.98%
0.55	0.57	0.57	0.597	1.2	87,182,553	3.06%
0.55	0.57	0.57	0.8	1.2	84,596,386.5	0.00%
0.55	0.57	0.57	0.953	1.2	87,054,767.7	2.91%
0.55	0.57	0.57	1.112	1.2	92,777,394.5	9.67%
0.55	0.57	0.57	1.251	1.2	99,233,496.4	17.30%
0.55	0.57	0.57	1.38	1.2	106,343,856	25.71%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- Adjacent Ceiling

<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.57	0.8	0.21	94,621,764	11.85%
0.55	0.57	0.57	0.8	0.448	90,915,295	7.47%
0.55	0.57	0.57	0.8	0.642	88,678,690	4.83%
0.55	0.57	0.57	0.8	0.863	86,728,831	2.52%
0.55	0.57	0.57	0.8	1.2	84,596,386	0.00%
0.55	0.57	0.57	0.8	1.412	83,597,167	-1.18%
0.55	0.57	0.57	0.8	1.579	82,938,241	-1.96%
0.55	0.57	0.57	0.8	1.791	82,228,955	-2.80%
0.55	0.57	0.57	0.8	1.968	81,722,660	-3.40%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

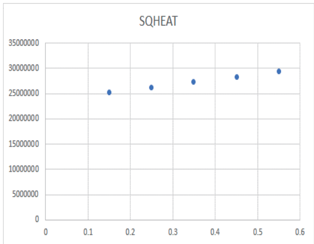
□ Ruwaished

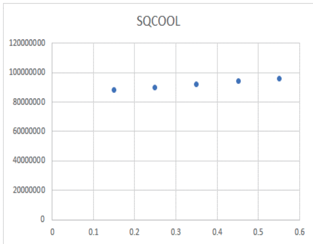
- External Roof

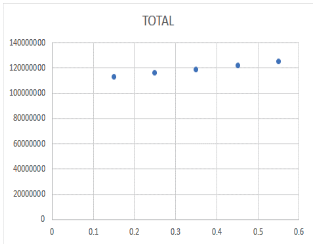
<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.15	0.57	0.57	0.8	1.2	113,165,251	-9.73%
0.249	0.57	0.57	0.8	1.2	116,194,703	-7.32%
0.349	0.57	0.57	0.8	1.2	119,247,969	-4.88%
0.451	0.57	0.57	0.8	1.2	122,359,166	-2.40%
0.55	0.57	0.57	0.8	1.2	125,366,956	0.00%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)





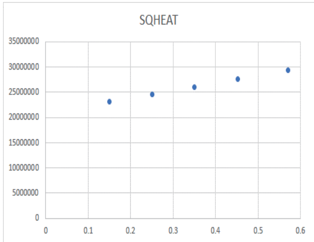


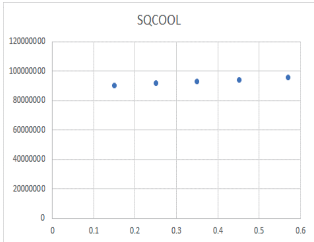
- External Wall

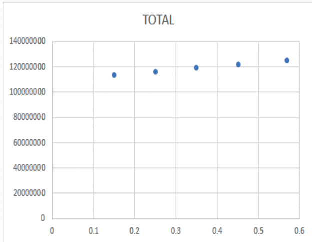
<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.15	0.57	0.8	1.2	113,660,058	-9.34%
0.55	0.25	0.57	0.8	1.2	116,432,107	-7.13%
0.55	0.35	0.57	0.8	1.2	119,226,561	-4.90%
0.55	0.452	0.57	0.8	1.2	122,076,591	-2.62%
0.55	0.57	0.57	0.8	1.2	125,366,956	0.00%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)



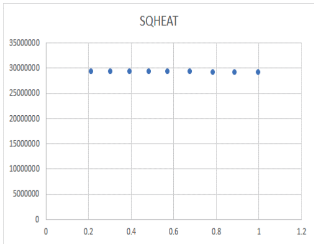
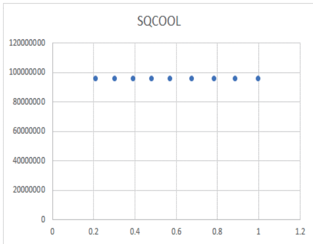
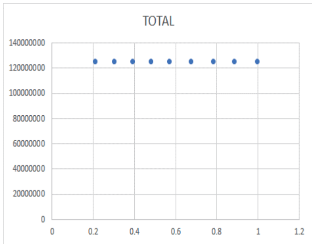




- Adjacent Wall

<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.21	0.8	1.2	125,474,720	0.09%
0.55	0.57	0.3	0.8	1.2	125,447,337	0.06%
0.55	0.57	0.392	0.8	1.2	125,417,805	0.04%
0.55	0.57	0.481	0.8	1.2	125,391,139	0.02%
0.55	0.57	0.57	0.8	1.2	125,366,956	0.00%
0.55	0.57	0.676	0.8	1.2	125,340,994	-0.02%
0.55	0.57	0.782	0.8	1.2	125,317,542	-0.04%
0.55	0.57	0.886	0.8	1.2	125,296,483	-0.06%
0.55	0.57	0.997	0.8	1.2	125,275,887	-0.07%

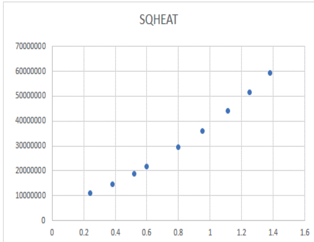
Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- Ground Floor

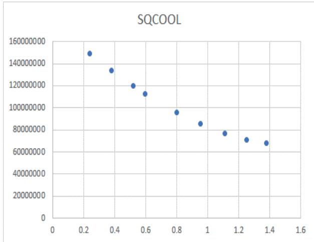
<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.57	0.24	1.2	159,965,228	27.60%
0.55	0.57	0.57	0.381	1.2	148,447,404	18.41%
0.55	0.57	0.57	0.52	1.2	139,006,331	10.88%
0.55	0.57	0.57	0.597	1.2	134,494,860	7.28%
0.55	0.57	0.57	0.8	1.2	125,366,956	0.00%
0.55	0.57	0.57	0.953	1.2	121,598,176	-3.01%
0.55	0.57	0.57	1.112	1.2	120,854,869	-3.60%
0.55	0.57	0.57	1.251	1.2	122,876,575	-1.99%
0.55	0.57	0.57	1.38	1.2	126,913,440	1.23%

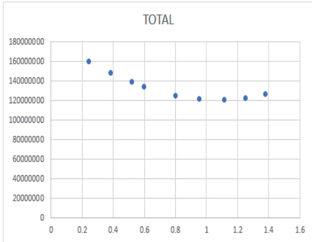
Annual Heat Demand (kJ)



Annual Cool Demand (kJ)



Annual Total Demand (kJ)

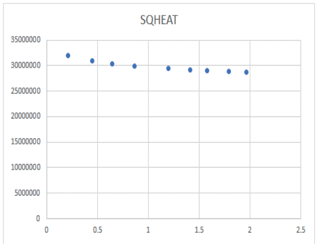


- Adjacent Ceiling

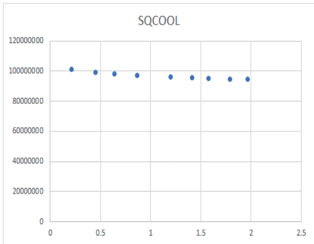
<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.57	0.8	0.21	132,839,861	5.96%
0.55	0.57	0.57	0.8	0.448	130,084,541	3.76%
0.55	0.57	0.57	0.8	0.642	128,434,015	2.45%
0.55	0.57	0.57	0.8	0.863	126,982,727	1.29%
0.55	0.57	0.57	0.8	1.2	125,366,956	0.00%
0.55	0.57	0.57	0.8	1.412	124,600,755	-0.61%
0.55	0.57	0.57	0.8	1.579	124,091,601	-1.02%
0.55	0.57	0.57	0.8	1.791	123,540,349	-1.46%
0.55	0.57	0.57	0.8	1.968	123,146,932	-1.77%

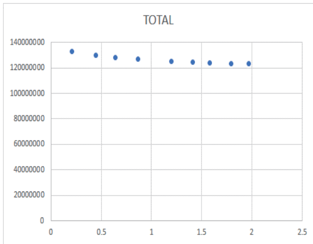
Annual Heat Demand (kJ)



Annual Cool Demand (kJ)



Annual Total Demand (kJ)

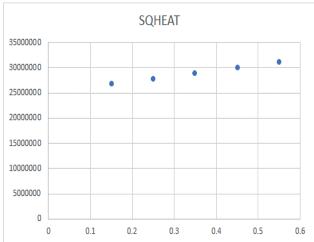
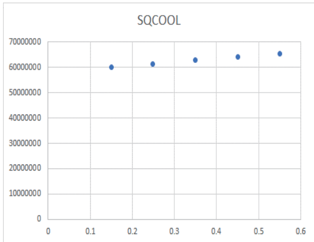
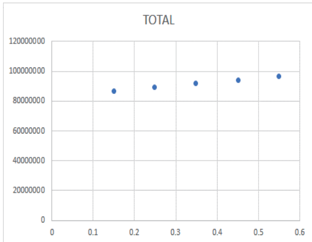


□ Man

• External Roof

<Simulation result>

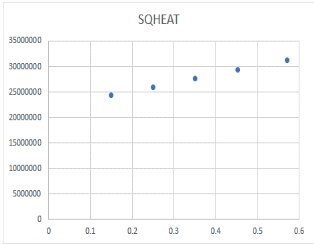
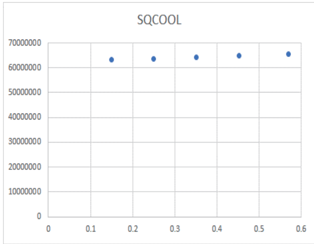
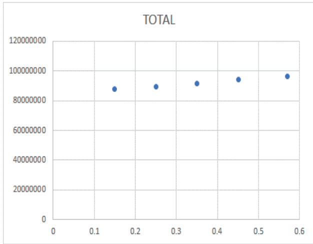
EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.15	0.57	0.57	0.8	1.2	86,859,749	-10.12%
0.249	0.57	0.57	0.8	1.2	89,278,478	-7.62%
0.349	0.57	0.57	0.8	1.2	91,722,894	-5.09%
0.451	0.57	0.57	0.8	1.2	94,219,347	-2.51%
0.55	0.57	0.57	0.8	1.2	96,640,817	0.00%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- External Wall

<Simulation result>

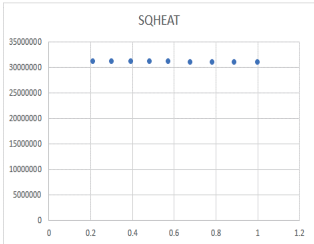
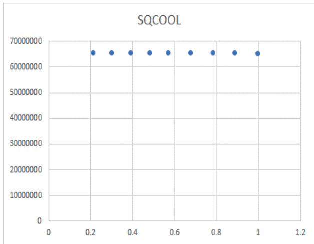
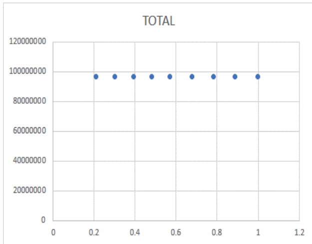
EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.15	0.57	0.8	1.2	87,589,673	-9.37%
0.55	0.25	0.57	0.8	1.2	89,710,558	-7.17%
0.55	0.35	0.57	0.8	1.2	91,866,439	-4.94%
0.55	0.452	0.57	0.8	1.2	94,075,685	-2.65%
0.55	0.57	0.57	0.8	1.2	96,640,817	0.00%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- Adjacent Wall

<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.21	0.8	1.2	96,758,781	0.12%
0.55	0.57	0.3	0.8	1.2	96,730,314	0.09%
0.55	0.57	0.392	0.8	1.2	96,698,411	0.06%
0.55	0.57	0.481	0.8	1.2	96,668,511	0.03%
0.55	0.57	0.57	0.8	1.2	96,640,817	0.00%
0.55	0.57	0.676	0.8	1.2	96,610,494	-0.03%
0.55	0.57	0.782	0.8	1.2	96,582,738	-0.06%
0.55	0.57	0.886	0.8	1.2	96,557,707	-0.09%
0.55	0.57	0.997	0.8	1.2	96,533,071	-0.11%

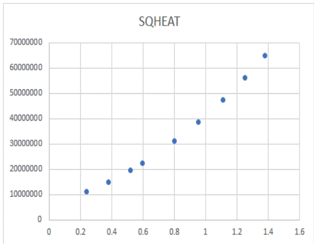
Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- Ground Floor

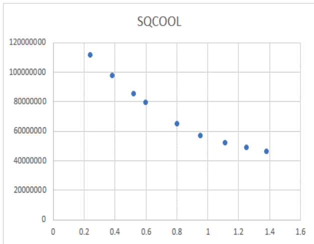
<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.57	0.24	1.2	122828,817	27.10%
0.55	0.57	0.57	0.381	1.2	112933,996	16.86%
0.55	0.57	0.57	0.52	1.2	105435,224	9.10%
0.55	0.57	0.57	0.597	1.2	102175,583	5.73%
0.55	0.57	0.57	0.8	1.2	96,640816	0.00%
0.55	0.57	0.57	0.953	1.2	96,111205	-0.55%
0.55	0.57	0.57	1.112	1.2	99,757,526	3.23%
0.55	0.57	0.57	1.251	1.2	105,262,682	8.92%
0.55	0.57	0.57	1.38	1.2	111,528,055	15.40%

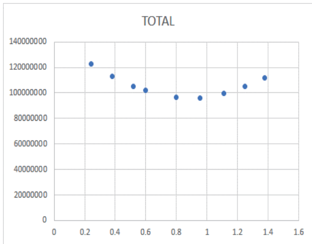
Annual Heat Demand (kJ)



Annual Cool Demand (kJ)



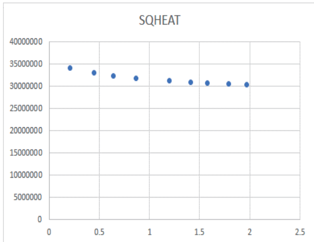
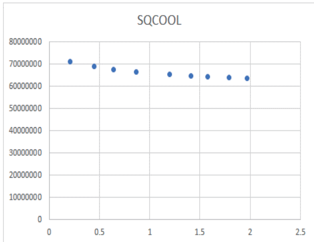
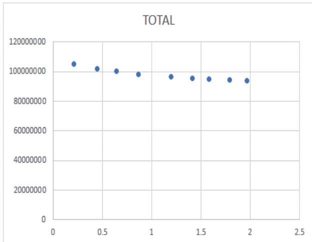
Annual Total Demand (kJ)



- Adjacent Ceiling

<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.57	0.8	0.21	105,259,050	8.92%
0.55	0.57	0.57	0.8	0.448	102,024,056	5.57%
0.55	0.57	0.57	0.8	0.642	100,118,583	3.60%
0.55	0.57	0.57	0.8	0.863	98,465,057	1.89%
0.55	0.57	0.57	0.8	1.2	96,640,817	0.00%
0.55	0.57	0.57	0.8	1.412	95,772,464	-0.90%
0.55	0.57	0.57	0.8	1.579	95,194,318	-1.50%
0.55	0.57	0.57	0.8	1.791	94,567,186	-2.15%
0.55	0.57	0.57	0.8	1.968	94,118,154	-2.61%

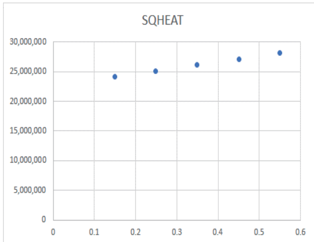
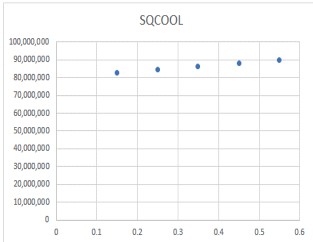
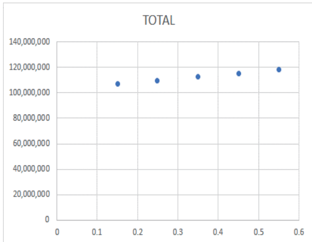
Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

□ Hasan

- External Roof

<Simulation result>

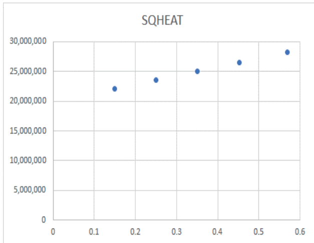
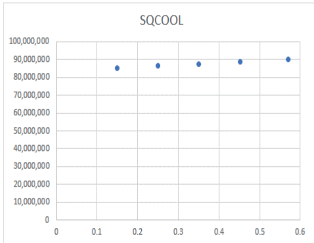
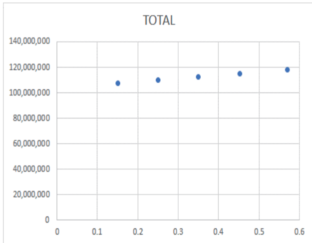
EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.15	0.57	0.57	0.8	1.2	106,906,956	-9.66%
0.249	0.57	0.57	0.8	1.2	109,731,073	-7.28%
0.349	0.57	0.57	0.8	1.2	112,584,585	-4.86%
0.451	0.57	0.57	0.8	1.2	115,505,513	-2.40%
0.55	0.57	0.57	0.8	1.2	118,341,076	0.00%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- External Wall

<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.15	0.57	0.8	1.2	107,500,525	-9.16%
0.55	0.25	0.57	0.8	1.2	110,057,196	-7.00%
0.55	0.35	0.57	0.8	1.2	112,642,175	-4.82%
0.55	0.452	0.57	0.8	1.2	115,283,120	-2.58%
0.55	0.57	0.57	0.8	1.2	118,341,076	0.00%

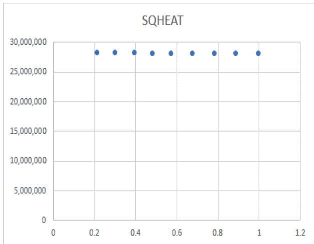
Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- Adjacent Wall

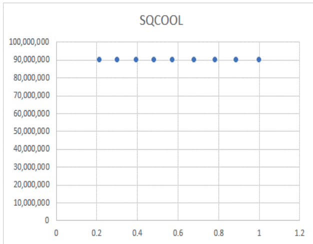
<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.21	0.8	1.2	118,447,199	0.09%
0.55	0.57	0.3	0.8	1.2	118,420,849	0.07%
0.55	0.57	0.392	0.8	1.2	118,391,925	0.04%
0.55	0.57	0.481	0.8	1.2	118,365,292	0.02%
0.55	0.57	0.57	0.8	1.2	118,341,076	0.00%
0.55	0.57	0.676	0.8	1.2	118,314,893	-0.02%
0.55	0.57	0.782	0.8	1.2	118,291,226	-0.04%
0.55	0.57	0.886	0.8	1.2	118,269,997	-0.06%
0.55	0.57	0.997	0.8	1.2	118,249,270	-0.08%

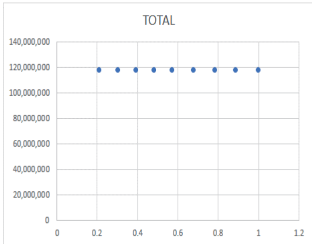
Annual Heat Demand (kJ)



Annual Cool Demand (kJ)



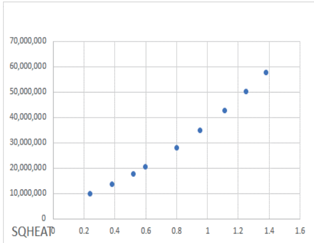
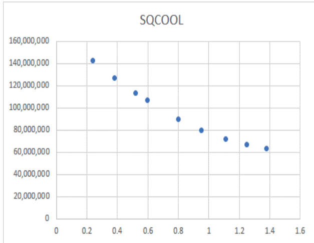
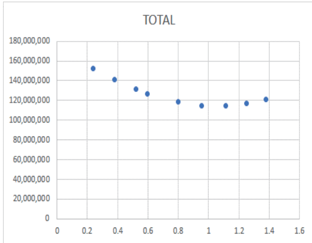
Annual Total Demand (kJ)



- Ground Floor

<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.57	0.24	1.2	152,469,631	28.84%
0.55	0.57	0.57	0.381	1.2	140,835,304	19.01%
0.55	0.57	0.57	0.52	1.2	131,490,350	11.11%
0.55	0.57	0.57	0.597	1.2	127,064,093	7.37%
0.55	0.57	0.57	0.8	1.2	118,341,076	0.00%
0.55	0.57	0.57	0.953	1.2	114,789,836	-3.00%
0.55	0.57	0.57	1.112	1.2	114,324,998	-3.39%
0.55	0.57	0.57	1.251	1.2	116,860,878	-1.25%
0.55	0.57	0.57	1.38	1.2	121,249,604	2.46%

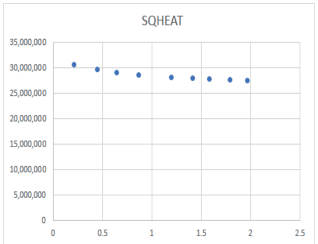
Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- Adjacent Ceiling

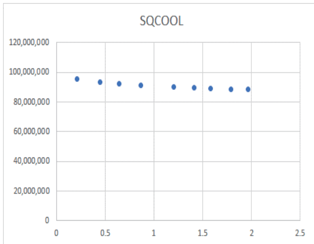
<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.57	0.8	0.21	126,103,432	6.56%
0.55	0.57	0.57	0.8	0.448	123,269,518	4.16%
0.55	0.57	0.57	0.8	0.642	121,555,950	2.72%
0.55	0.57	0.57	0.8	0.863	120,043,367	1.44%
0.55	0.57	0.57	0.8	1.2	118,341,076	0.00%
0.55	0.57	0.57	0.8	1.412	117,525,797	-0.69%
0.55	0.57	0.57	0.8	1.579	116,984,613	-1.15%
0.55	0.57	0.57	0.8	1.791	116,398,421	-1.64%
0.55	0.57	0.57	0.8	1.968	115,977,507	-2.00%

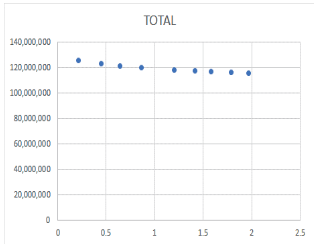
Annual Heat Demand (kJ)



Annual Cool Demand (kJ)



Annual Total Demand (kJ)

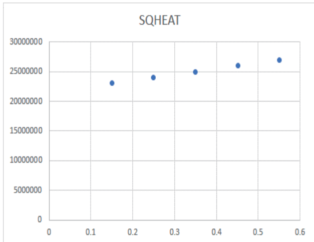
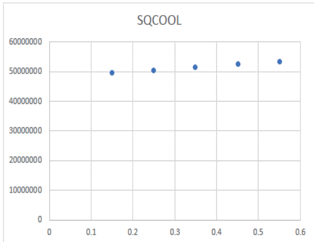
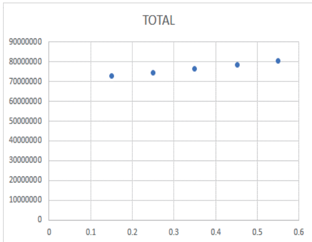


□ Irbid

- External Roof

<Simulation result>

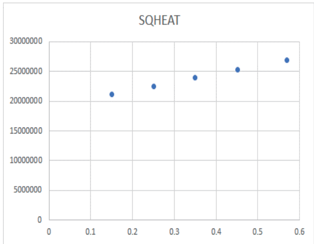
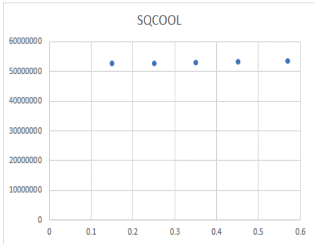
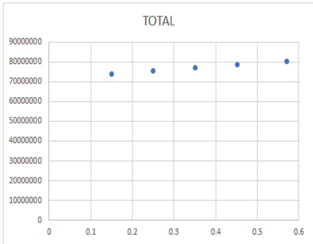
EXT_ROOF	EXT_WALL	wADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.15	0.57	0.57	0.8	1.2	72,728,789	-9.63%
0.249	0.57	0.57	0.8	1.2	74,642,421	-7.26%
0.349	0.57	0.57	0.8	1.2	76,575,076	-4.86%
0.451	0.57	0.57	0.8	1.2	78,553,680	-2.40%
0.55	0.57	0.57	0.8	1.2	80,482,567	0.00%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- External Wall

<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.15	0.57	0.8	1.2	73,852,887	-8.24%
0.55	0.25	0.57	0.8	1.2	75,394,325	-6.32%
0.55	0.35	0.57	0.8	1.2	76,968,921	-4.37%
0.55	0.452	0.57	0.8	1.2	78,589,398	-2.35%
0.55	0.57	0.57	0.8	1.2	80,482,567	0.00%

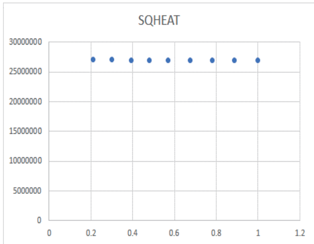
Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

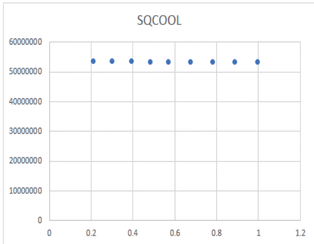
- Adjacent Wall

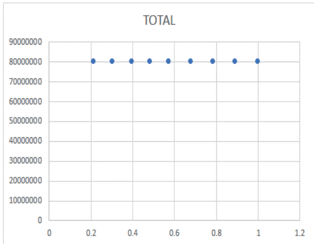
<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.21	0.8	1.2	80,588,721	0.13%
0.55	0.57	0.3	0.8	1.2	80,564,123	0.10%
0.55	0.57	0.392	0.8	1.2	80,535,510	0.07%
0.55	0.57	0.481	0.8	1.2	80,508,138	0.03%
0.55	0.57	0.57	0.8	1.2	80,482,567	0.00%
0.55	0.57	0.676	0.8	1.2	80,454,410	-0.03%
0.55	0.57	0.782	0.8	1.2	80,428,687	-0.07%
0.55	0.57	0.886	0.8	1.2	80,405,301	-0.10%
0.55	0.57	0.997	0.8	1.2	80,382,381	-0.12%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)



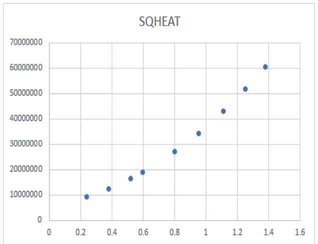
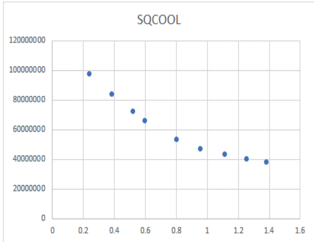
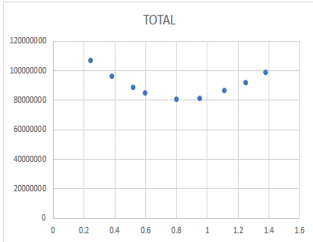




- Ground Floor

<Simulation result>

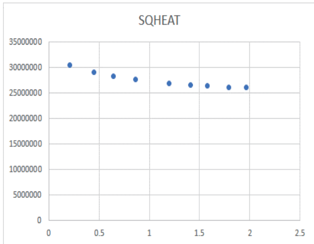
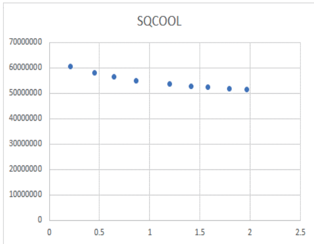
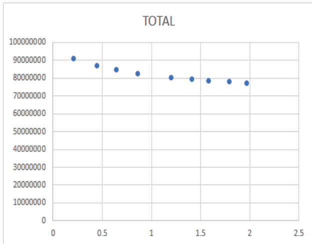
EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.57	0.24	1.2	106,883,080	32.80%
0.55	0.57	0.57	0.381	1.2	96,478,386	19.87%
0.55	0.57	0.57	0.52	1.2	88,596,466	10.08%
0.55	0.57	0.57	0.597	1.2	85,232,262	5.90%
0.55	0.57	0.57	0.8	1.2	80,482,567	0.00%
0.55	0.57	0.57	0.953	1.2	81,547,206	1.32%
0.55	0.57	0.57	1.112	1.2	86,381,481	7.33%
0.55	0.57	0.57	1.251	1.2	92,184,572	14.54%
0.55	0.57	0.57	1.38	1.2	98,685,657	22.62%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- Adjacent Ceiling

<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.57	0.8	0.21	91,056,396	13.14%
0.55	0.57	0.57	0.8	0.448	87,102,515	8.23%
0.55	0.57	0.57	0.8	0.642	84,755,835	5.31%
0.55	0.57	0.57	0.8	0.863	82,720,084	2.78%
0.55	0.57	0.57	0.8	1.2	80,482,567	0.00%
0.55	0.57	0.57	0.8	1.412	79,425,178	-1.31%
0.55	0.57	0.57	0.8	1.579	78,726,974	-2.18%
0.55	0.57	0.57	0.8	1.791	77,972,933	-3.12%
0.55	0.57	0.57	0.8	1.968	77,437,861	-3.78%

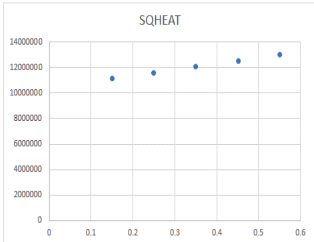
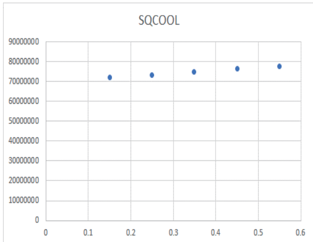
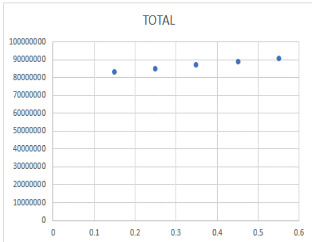
Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

□ Wadi

- External Roof

<Simulation result>

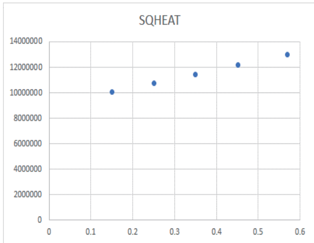
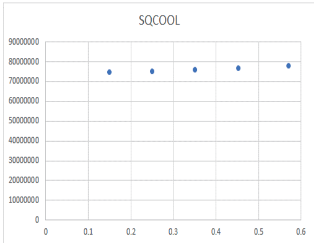
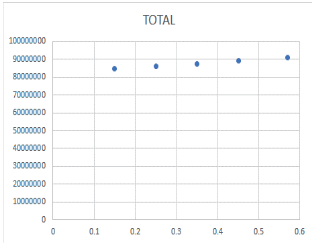
EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.15	0.57	0.57	0.8	1.2	83,203,107	-8.42%
0.249	0.57	0.57	0.8	1.2	85,084,565	-6.35%
0.349	0.57	0.57	0.8	1.2	86,988,707	-4.25%
0.451	0.57	0.57	0.8	1.2	88,942,947	-2.10%
0.55	0.57	0.57	0.8	1.2	90,849,994	0.00%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- External Wall

<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.15	0.57	0.8	1.2	84,663,149	-6.81%
0.55	0.25	0.57	0.8	1.2	86,082,864	-5.25%
0.55	0.35	0.57	0.8	1.2	87,553,941	-3.63%
0.55	0.452	0.57	0.8	1.2	89,073,279	-1.96%
0.55	0.57	0.57	0.8	1.2	90,849,994	0.00%

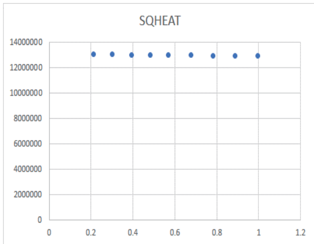
Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

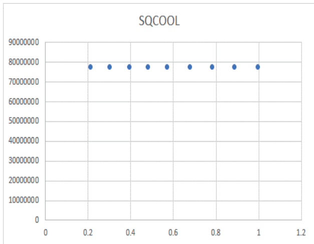
- Adjacent Wall

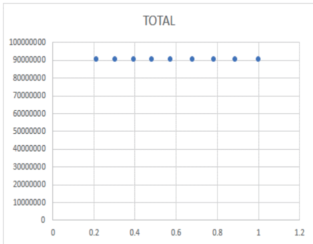
<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.21	0.8	1.2	90,956,600	0.12%
0.55	0.57	0.3	0.8	1.2	90,933,118	0.09%
0.55	0.57	0.392	0.8	1.2	90,904,333	0.06%
0.55	0.57	0.481	0.8	1.2	90,876,324	0.03%
0.55	0.57	0.57	0.8	1.2	90,849,994	0.00%
0.55	0.57	0.676	0.8	1.2	90,820,844	-0.03%
0.55	0.57	0.782	0.8	1.2	90,794,100	-0.06%
0.55	0.57	0.886	0.8	1.2	90,769,919	-0.09%
0.55	0.57	0.997	0.8	1.2	90,746,222	-0.11%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)



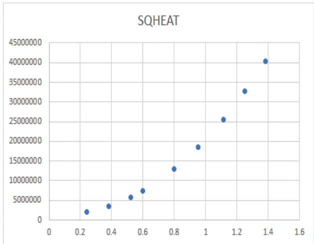
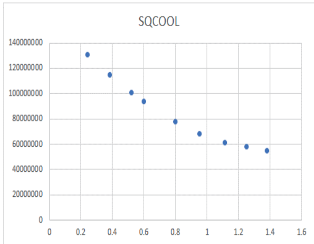
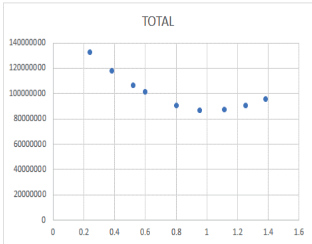




- Ground Floor

<Simulation result>

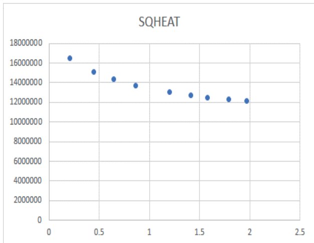
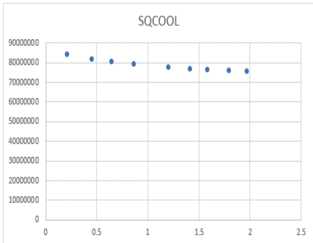
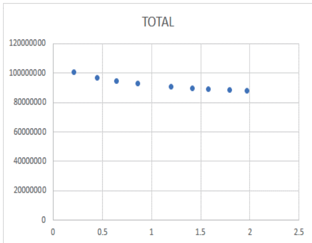
EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.57	0.24	1.2	132,638,442	46.00%
0.55	0.57	0.57	0.381	1.2	118,321,853	30.24%
0.55	0.57	0.57	0.52	1.2	106,757,343	17.51%
0.55	0.57	0.57	0.597	1.2	101,354,827	11.56%
0.55	0.57	0.57	0.8	1.2	90,849,994	0.00%
0.55	0.57	0.57	0.953	1.2	86,926,237	-4.32%
0.55	0.57	0.57	1.112	1.2	87,157,085	-4.06%
0.55	0.57	0.57	1.251	1.2	90,725,211	-0.14%
0.55	0.57	0.57	1.38	1.2	95,464,974	5.08%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- Adjacent Ceiling

<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.57	0.8	0.21	100,762,476	10.91%
0.55	0.57	0.57	0.8	0.448	97,040,449	6.81%
0.55	0.57	0.57	0.8	0.642	94,837,534	4.39%
0.55	0.57	0.57	0.8	0.863	92,936,334	2.30%
0.55	0.57	0.57	0.8	1.2	90,849,994	0.00%
0.55	0.57	0.57	0.8	1.412	89,860,730	-1.09%
0.55	0.57	0.57	0.8	1.579	89,204,148	-1.81%
0.55	0.57	0.57	0.8	1.791	88,496,166	-2.59%
0.55	0.57	0.57	0.8	1.968	87,992,751	-3.15%

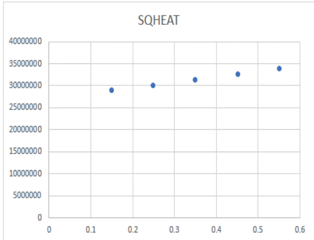
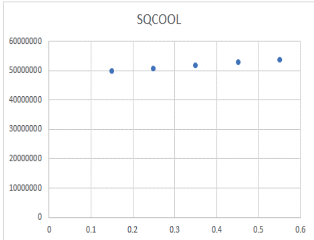
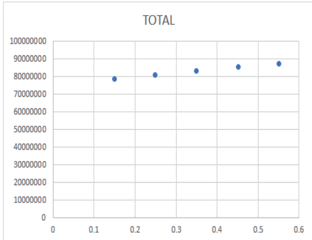
Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

□ Hussein

- External Roof

<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.15	0.57	0.57	0.8	1.2	78,768,438	-10.11%
0.249	0.57	0.57	0.8	1.2	80,950,481	-7.62%
0.349	0.57	0.57	0.8	1.2	83,161,015	-5.09%
0.451	0.57	0.57	0.8	1.2	85,423,762	-2.51%
0.55	0.57	0.57	0.8	1.2	87,624,664	0.00%

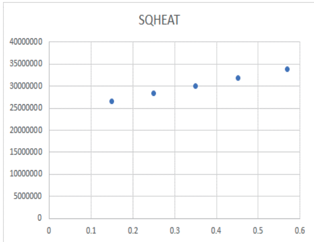
Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

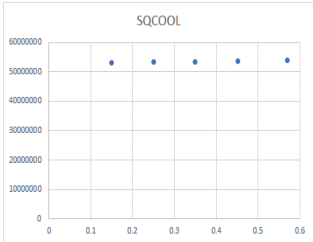
- External Wall

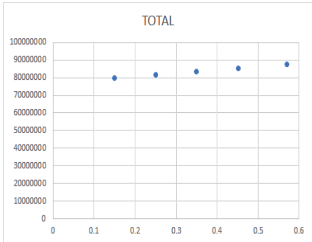
<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.15	0.57	0.8	1.2	79,711,819	-9.03%
0.55	0.25	0.57	0.8	1.2	81,560,791	-6.92%
0.55	0.35	0.57	0.8	1.2	83,442,790	-4.77%
0.55	0.452	0.57	0.8	1.2	85,375,384	-2.57%
0.55	0.57	0.57	0.8	1.2	87,624,664	0.00%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)





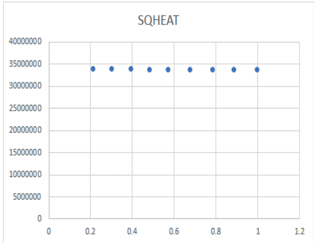


- Adjacent Wall

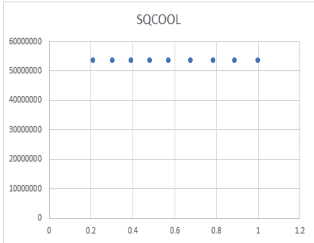
<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.21	0.8	1.2	87,727,451	0.12%
0.55	0.57	0.3	0.8	1.2	87,703,111	0.09%
0.55	0.57	0.392	0.8	1.2	87,675,176	0.06%
0.55	0.57	0.481	0.8	1.2	87,648,920	0.03%
0.55	0.57	0.57	0.8	1.2	87,624,664	0.00%
0.55	0.57	0.676	0.8	1.2	87,598,299	-0.03%
0.55	0.57	0.782	0.8	1.2	87,574,342	-0.06%
0.55	0.57	0.886	0.8	1.2	87,552,770	-0.08%
0.55	0.57	0.997	0.8	1.2	87,531,732	-0.11%

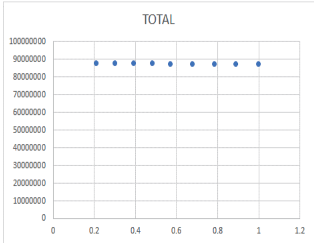
Annual Heat Demand (kJ)



Annual Cool Demand (kJ)



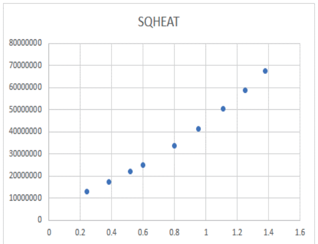
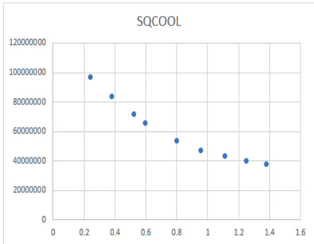
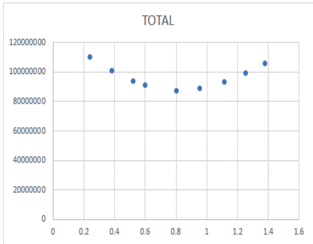
Annual Total Demand (kJ)



- Ground Floor

<Simulation result>

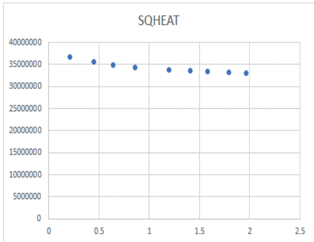
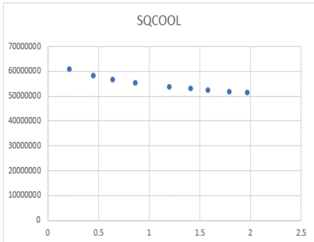
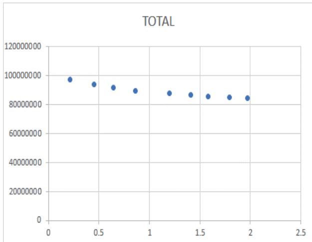
EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.57	0.24	1.2	110.337.938	25.92%
0.55	0.57	0.57	0.381	1.2	101.082.363	15.36%
0.55	0.57	0.57	0.52	1.2	94.100.200	7.39%
0.55	0.57	0.57	0.597	1.2	91.164.406	4.04%
0.55	0.57	0.57	0.8	1.2	87.624.664	0.00%
0.55	0.57	0.57	0.953	1.2	89.014.786	1.59%
0.55	0.57	0.57	1.112	1.2	93.590.324	6.81%
0.55	0.57	0.57	1.251	1.2	99.241.161	13.26%
0.55	0.57	0.57	1.38	1.2	105.789.854	20.73%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- Adjacent Ceiling

<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.57	0.8	0.21	97,582,356	11.36%
0.55	0.57	0.57	0.8	0.448	93,944,001	7.21%
0.55	0.57	0.57	0.8	0.642	91,728,103	4.68%
0.55	0.57	0.57	0.8	0.863	89,780,277	2.46%
0.55	0.57	0.57	0.8	1.2	87,624,664	0.00%
0.55	0.57	0.57	0.8	1.412	86,601,330	-1.17%
0.55	0.57	0.57	0.8	1.579	85,922,041	-1.94%
0.55	0.57	0.57	0.8	1.791	85,185,950	-2.78%
0.55	0.57	0.57	0.8	1.968	84,660,688	-3.38%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

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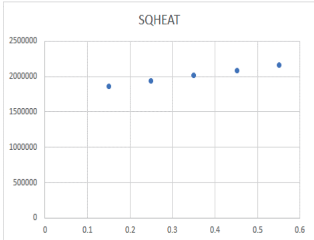
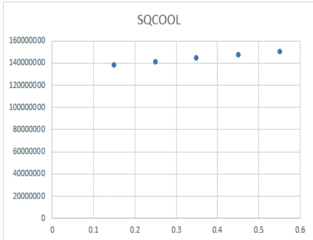
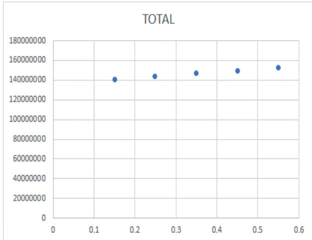
• External Roof

<Simulation result>

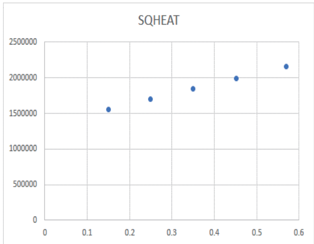
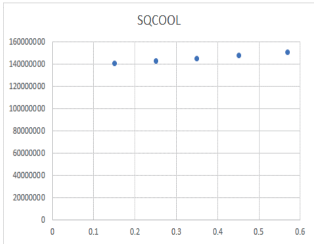
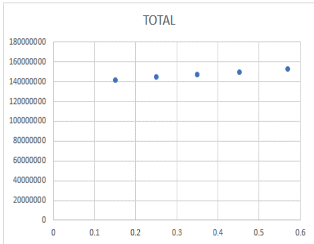
EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.15	0.57	0.57	0.8	1.2	140,597,088	-8.02%
0.249	0.57	0.57	0.8	1.2	143,643,619	-6.03%
0.349	0.57	0.57	0.8	1.2	146,712,507	-4.02%
0.451	0.57	0.57	0.8	1.2	149,835,918	-1.98%
0.55	0.57	0.57	0.8	1.2	152,855,042	0.00%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- External Wall

<Simulation result>

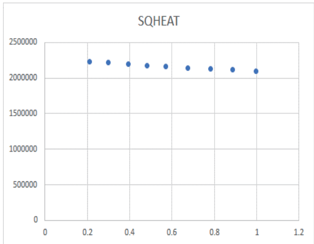
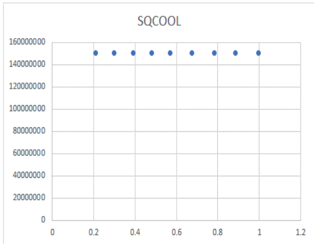
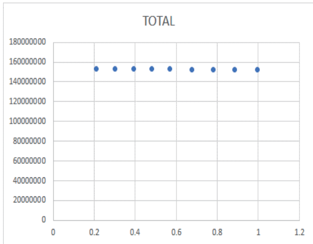
EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.15	0.57	0.8	1.2	142,063,429	-7.06%
0.55	0.25	0.57	0.8	1.2	144,624,395	-5.38%
0.55	0.35	0.57	0.8	1.2	147,208,260	-3.69%
0.55	0.452	0.57	0.8	1.2	149,832,850	-1.98%
0.55	0.57	0.57	0.8	1.2	152,855,042	0.00%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- Adjacent Wall

<Simulation result>

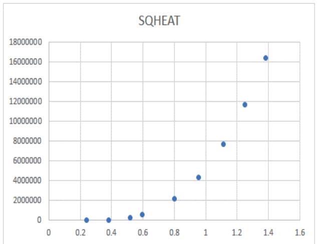
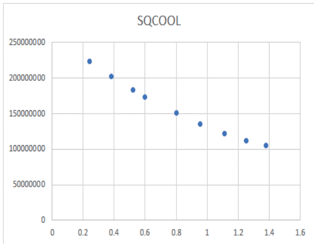
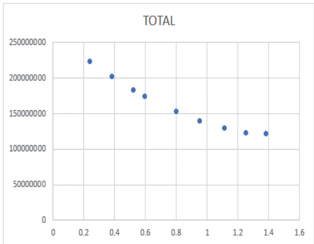
EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.21	0.8	1.2	153,030,063	0.11%
0.55	0.57	0.3	0.8	1.2	152,982,687	0.08%
0.55	0.57	0.392	0.8	1.2	152,935,656	0.05%
0.55	0.57	0.481	0.8	1.2	152,893,440	0.03%
0.55	0.57	0.57	0.8	1.2	152,855,042	0.00%
0.55	0.57	0.676	0.8	1.2	152,813,706	-0.03%
0.55	0.57	0.782	0.8	1.2	152,776,423	-0.05%
0.55	0.57	0.886	0.8	1.2	152,743,074	-0.07%
0.55	0.57	0.997	0.8	1.2	152,710,702	-0.09%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- Ground Floor

<Simulation result>

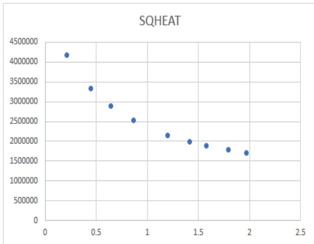
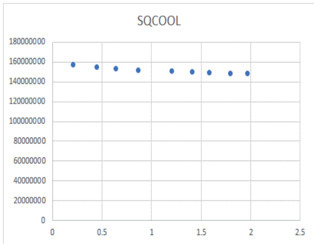
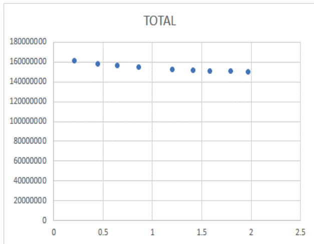
EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.57	0.24	1.2	223,112,793	45.96%
0.55	0.57	0.57	0.381	1.2	202,247,264	32.31%
0.55	0.57	0.57	0.52	1.2	183,778,726	20.23%
0.55	0.57	0.57	0.597	1.2	174,364,618	14.07%
0.55	0.57	0.57	0.8	1.2	152,855,042	0.00%
0.55	0.57	0.57	0.953	1.2	139,891,414	-8.48%
0.55	0.57	0.57	1.112	1.2	129,556,663	-15.24%
0.55	0.57	0.57	1.251	1.2	123,745,772	-19.04%
0.55	0.57	0.57	1.38	1.2	121,563,945	-20.47%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- Adjacent Ceiling

<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.57	0.8	0.21	161,475,619	5.64%
0.55	0.57	0.57	0.8	0.448	158,287,473	3.55%
0.55	0.57	0.57	0.8	0.642	156,374,714	2.30%
0.55	0.57	0.57	0.8	0.863	154,703,659	1.21%
0.55	0.57	0.57	0.8	1.2	152,855,042	0.00%
0.55	0.57	0.57	0.8	1.412	151,978,256	-0.57%
0.55	0.57	0.57	0.8	1.579	151,397,142	-0.95%
0.55	0.57	0.57	0.8	1.791	150,767,368	-1.37%
0.55	0.57	0.57	0.8	1.968	150,317,772	-1.66%

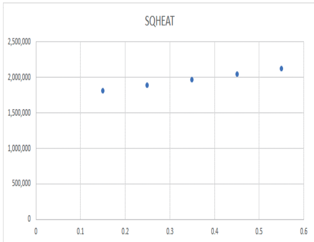
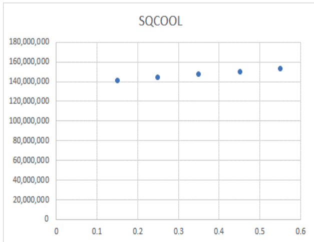
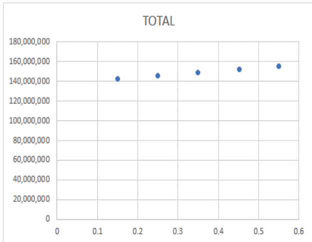
Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

□ Ghor

- External Roof

<Simulation result>

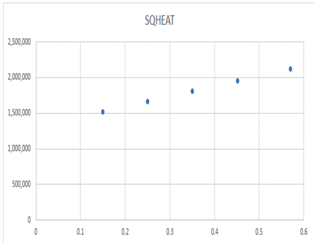
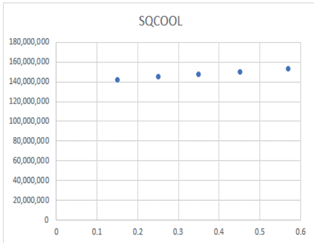
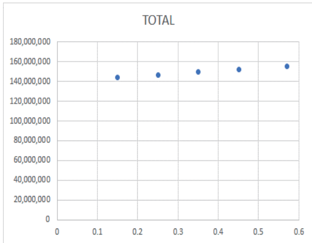
EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.15	0.57	0.57	0.8	1.2	143,030,029	-8.05%
0.249	0.57	0.57	0.8	1.2	146,147,664	-6.04%
0.349	0.57	0.57	0.8	1.2	149,280,516	-4.03%
0.451	0.57	0.57	0.8	1.2	152,466,003	-1.98%
0.55	0.57	0.57	0.8	1.2	155,543,535	0.00%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

□ External Wall

<Simulation result>

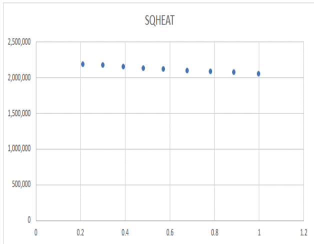
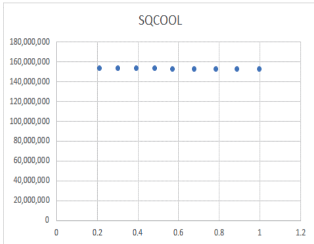
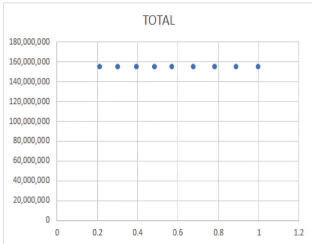
EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.15	0.57	0.8	1.2	144,031,113	-7.40%
0.55	0.25	0.57	0.8	1.2	146,768,602	-5.64%
0.55	0.35	0.57	0.8	1.2	149,521,738	-3.87%
0.55	0.452	0.57	0.8	1.2	152,319,280	-2.07%
0.55	0.57	0.57	0.8	1.2	155,543,535	0.00%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- Adjacent Wall

<Simulation result>

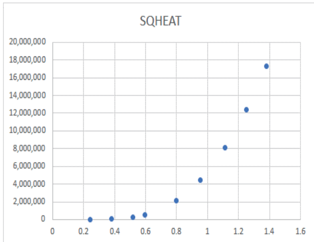
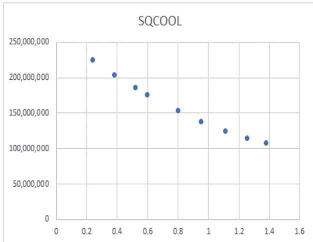
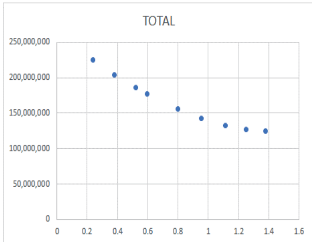
EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.21	0.8	1.2	155,712,470	0.11%
0.55	0.57	0.3	0.8	1.2	155,666,734	0.08%
0.55	0.57	0.392	0.8	1.2	155,621,219	0.05%
0.55	0.57	0.481	0.8	1.2	155,580,432	0.02%
0.55	0.57	0.57	0.8	1.2	155,543,535	0.00%
0.55	0.57	0.676	0.8	1.2	155,503,895	-0.03%
0.55	0.57	0.782	0.8	1.2	155,468,210	-0.05%
0.55	0.57	0.886	0.8	1.2	155,436,303	-0.07%
0.55	0.57	0.997	0.8	1.2	155,405,559	-0.09%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- Ground Floor

<Simulation result>

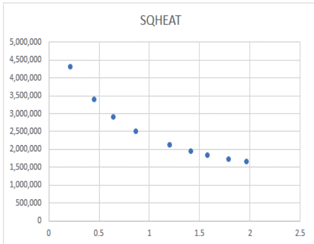
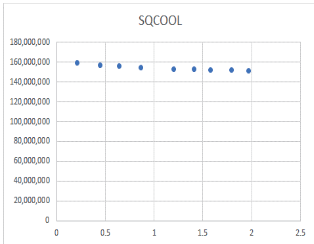
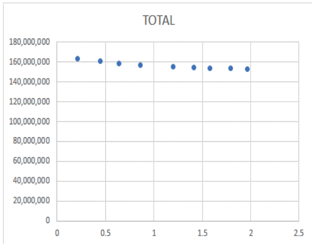
EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.57	0.24	1.2	225,025,123	44.67%
0.55	0.57	0.57	0.381	1.2	204,545,180	31.50%
0.55	0.57	0.57	0.52	1.2	186,377,663	19.82%
0.55	0.57	0.57	0.597	1.2	177,047,060	13.82%
0.55	0.57	0.57	0.8	1.2	155,543,535	0.00%
0.55	0.57	0.57	0.953	1.2	142,520,525	-8.37%
0.55	0.57	0.57	1.112	1.2	132,417,568	-14.87%
0.55	0.57	0.57	1.251	1.2	127,073,339	-18.30%
0.55	0.57	0.57	1.38	1.2	125,017,383	-19.63%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- Adjacent Ceiling

<Simulation result>

EXT_ROOF	EXT_WALL	ADJ_WALL	GROUND_ FLOOR	ADJ_CEILING	TOTAL (kJ)	RATE
0.55	0.57	0.57	0.8	0.21	163,864,591	5.35%
0.55	0.57	0.57	0.8	0.448	160,740,716	3.34%
0.55	0.57	0.57	0.8	0.642	158,894,285	2.15%
0.55	0.57	0.57	0.8	0.863	157,293,671	1.13%
0.55	0.57	0.57	0.8	1.2	155,543,535	0.00%
0.55	0.57	0.57	0.8	1.412	154,724,333	-0.53%
0.55	0.57	0.57	0.8	1.579	154,182,811	-0.87%
0.55	0.57	0.57	0.8	1.791	153,597,499	-1.25%
0.55	0.57	0.57	0.8	1.968	153,179,517	-1.52%

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

Attachment 5 Detailed results of simulation of windows by region

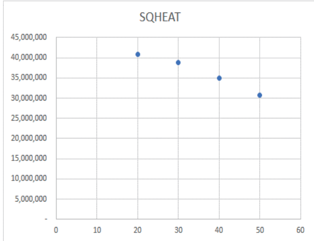
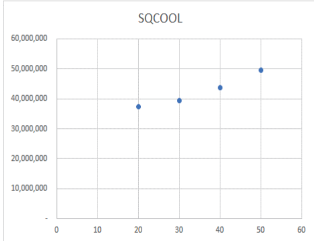
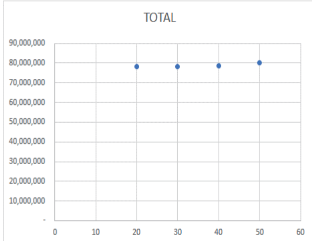
□ Amman

<Simulation result>

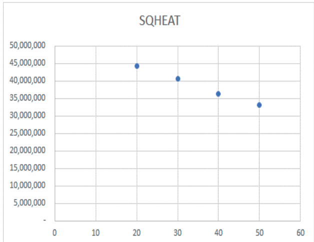
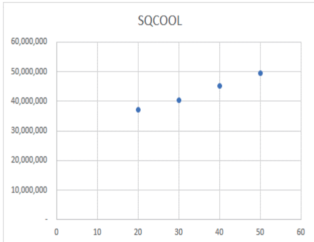
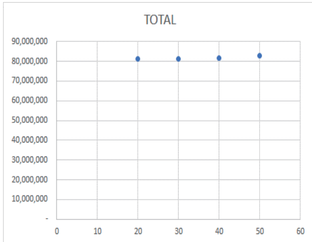
u-value ($W/m^2 \cdot K$)	g-value (%)	SQHEAT	SQCOOL	TOTAL	RATE
1.0	20	40,862,801	37,481,412	78,344,212	-21.14%
	30	38,828,485	39,453,132	78,281,617	-21.20%
	40	34,996,839	43,797,980	78,794,819	-20.68%
	50	30,800,730	49,451,715	80,252,445	-19.21%
2.0	20	44,156,900	37,052,337	81,209,236	-18.25%
	30	40,593,035	40,464,110	81,057,145	-18.40%
	40	36,389,179	45,237,566	81,626,745	-17.83%
	50	33,192,252	49,537,922	82,730,173	-16.72%
3.0	20	47,044,262	36,990,259	84,034,521	-15.41%
	30	43,464,514	40,321,838	83,786,352	-15.66%
	40	38,117,389	46,442,040	84,559,429	-14.88%
	50	35,460,953	50,015,082	85,476,035	-13.96%
5.7	80	36,129,137	63,211,185	99,340,322	0.00%

- Fixed u-value, Changed g-value

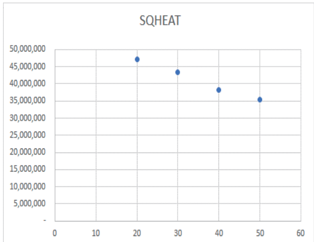
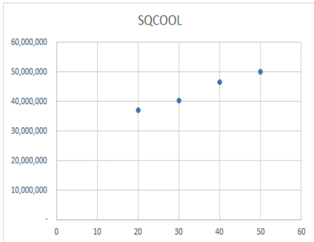
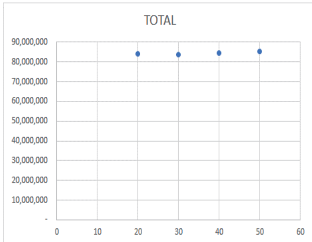
[Figure. u-value 1.0 (W/m²·K)]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

[Figure. u-value 2.0 (W/m²·K)]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

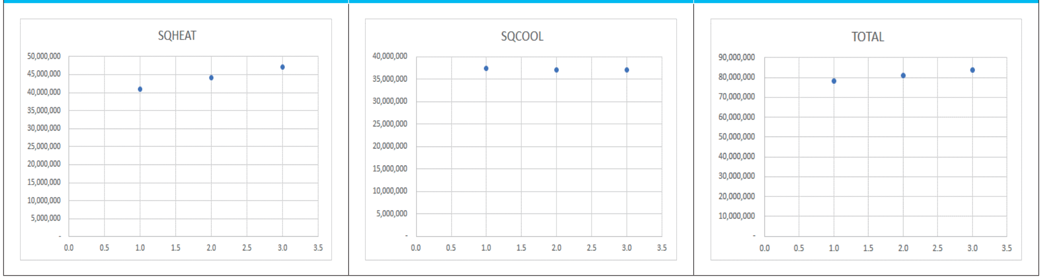
[Figure. u-value 3.0 (W/m²·K)]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- Fixed g-value, Changed u-value

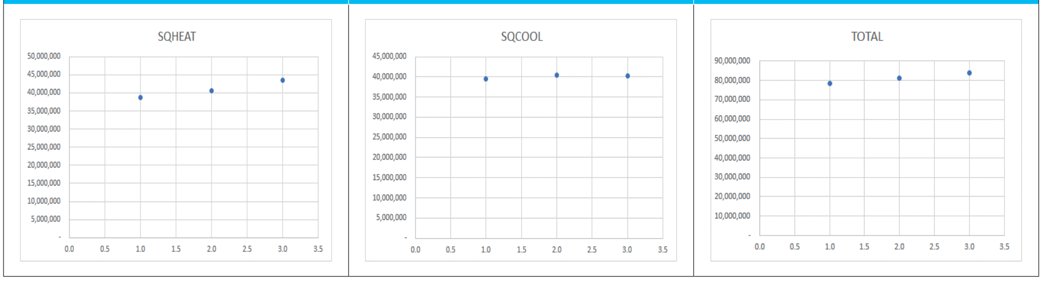
[Figure. g-value 20%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)



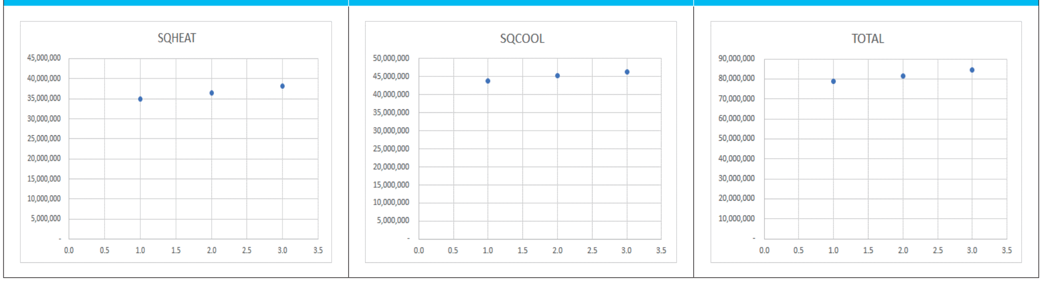
[Figure. g-value 30%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)



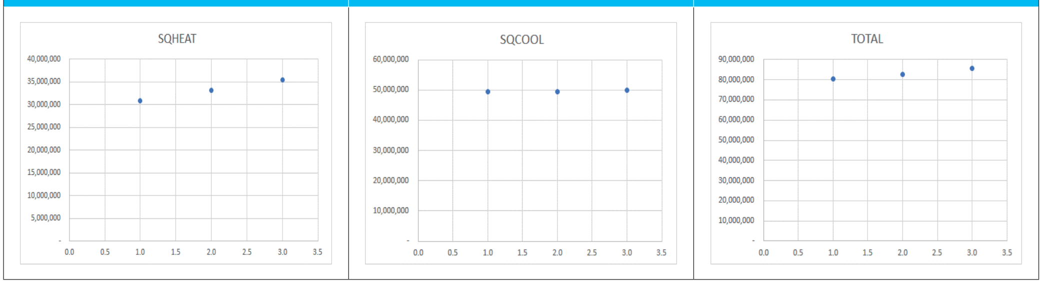
[Figure. g-value 40%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)



[Figure. g-value 50%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)



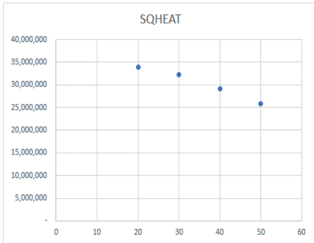
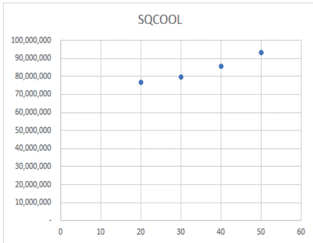
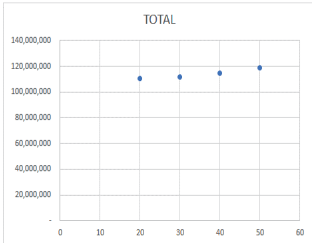
□ Ruwaished

<Simulation result>

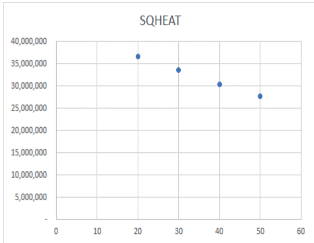
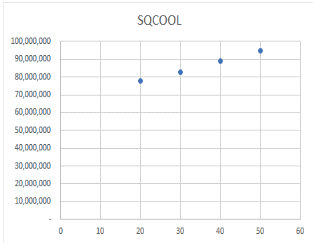
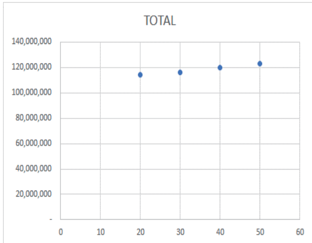
u-value (W/m²·K)	g-value	SQHEAT	SQCOOL	TOTAL	RATE
1.0	20	33,859,544	76,847,116	110,706,660	-25.51%
	30	32,222,820	79,668,613	111,891,432	-24.71%
	40	29,149,972	85,747,690	114,897,661	-22.69%
	50	25,773,757	93,290,695	119,064,452	-19.88%
2.0	20	36,604,176	77,755,891	114,360,068	-23.05%
	30	33,730,555	82,607,280	116,337,835	-21.72%
	40	30,344,228	89,236,880	119,581,108	-19.54%
	50	27,768,046	94,938,060	122,706,106	-17.43%
3.0	20	39,019,532	79,193,323	118,212,855	-20.46%
	30	36,125,099	83,914,502	120,039,601	-19.23%
	40	31,810,794	92,436,570	124,247,364	-16.40%
	50	29,668,121	97,106,926	126,775,046	-14.69%
5.7	80	30,427,981	118,185,807	148,613,788	0.00%

- Fixed u-value, Changed g-value

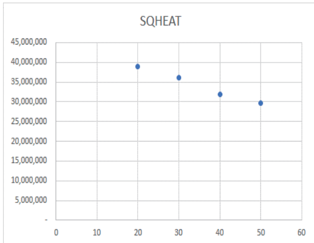
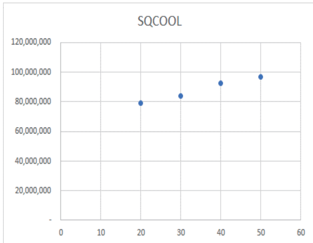
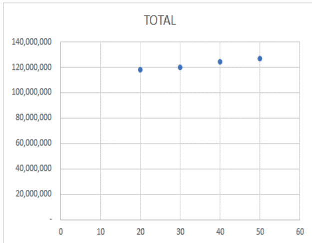
[Figure. u-value 1.0 (W/m^2·K)]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

[Figure. u-value 2.0 (W/m^2·K)]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

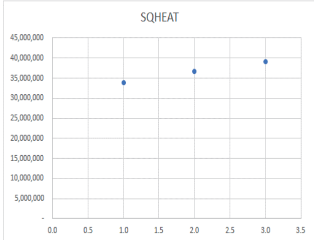
[Figure. u-value 3.0 (W/m^2·K)]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

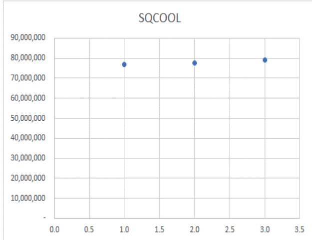
• Fixed g-value, Changed u-value

[Figure. g-value 20%]

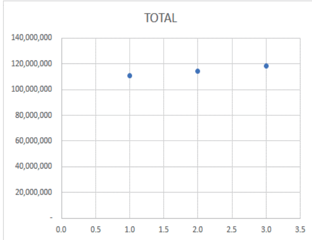
Annual Heat Demand (kJ)



Annual Cool Demand (kJ)

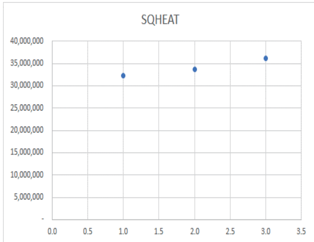


Annual Total Demand (kJ)

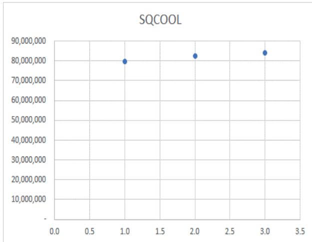


[Figure. g-value 30%]

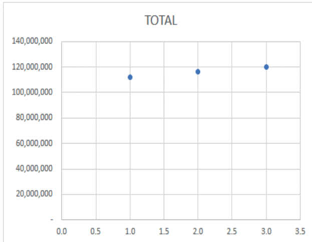
Annual Heat Demand (kJ)



Annual Cool Demand (kJ)

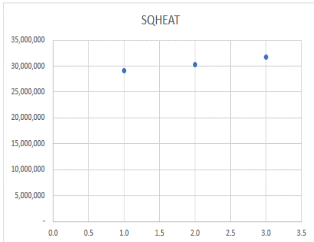


Annual Total Demand (kJ)

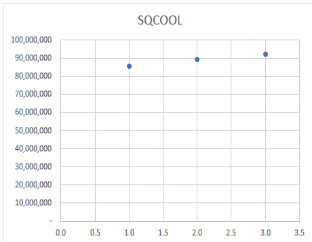


[Figure. g-value 40%]

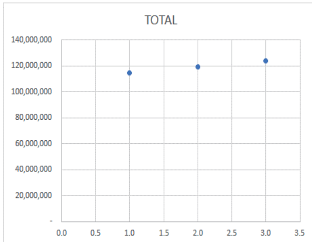
Annual Heat Demand (kJ)



Annual Cool Demand (kJ)

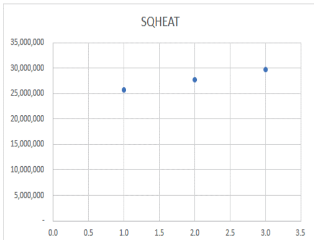


Annual Total Demand (kJ)

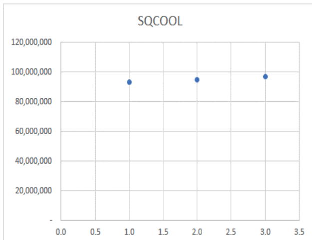


[Figure. g-value 50%]

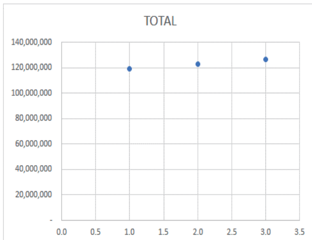
Annual Heat Demand (kJ)



Annual Cool Demand (kJ)



Annual Total Demand (kJ)



□ Hasan

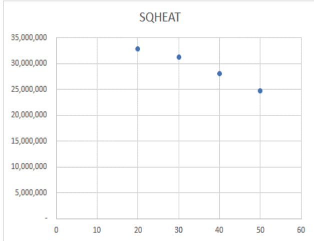
<Simulation result>

u-value ($W/m^2 \cdot K$)	g-value	SQHEAT	SQCOOL	TOTAL	RATE
1.0	20	32,865,431	71,368,509	104,233,940	-25.82%
	30	31,207,522	74,205,307	105,412,829	-24.98%
	40	28,087,933	80,297,233	108,385,167	-22.87%
	50	24,673,409	87,857,480	112,530,889	-19.92%
2.0	20	35,583,718	72,048,878	107,632,596	-23.40%
	30	32,672,861	76,928,795	109,601,655	-22.00%
	40	29,235,072	83,566,550	112,801,623	-19.72%
	50	26,623,178	89,269,168	115,892,347	-17.52%
3.0	20	37,962,721	73,257,416	111,220,137	-20.85%
	30	35,031,569	78,016,978	113,048,547	-19.55%
	40	30,648,413	86,541,363	117,189,776	-16.60%
	50	28,469,561	91,195,610	119,665,171	-14.84%
5.7	80	28,931,258	111,584,983	140,516,241	0.00%

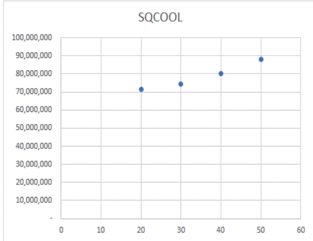
- Fixed u-value, Changed g-value

[Figure. u-value 1.0 (W/m²·K)]

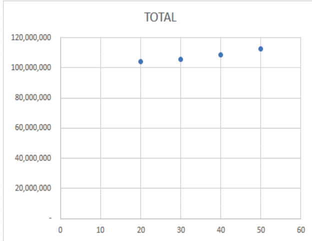
Annual Heat Demand (kJ)



Annual Cool Demand (kJ)

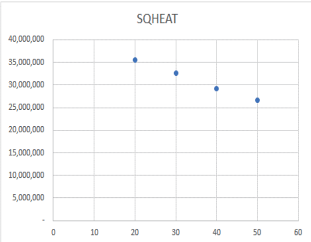


Annual Total Demand (kJ)

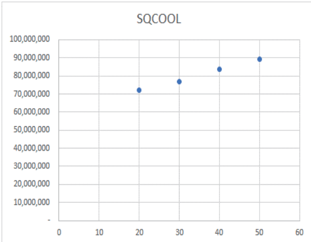


[Figure. u-value 2.0 (W/m²·K)]

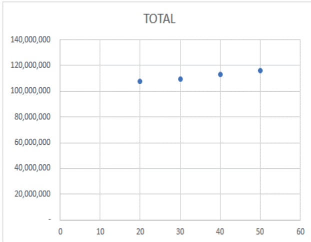
Annual Heat Demand (kJ)



Annual Cool Demand (kJ)

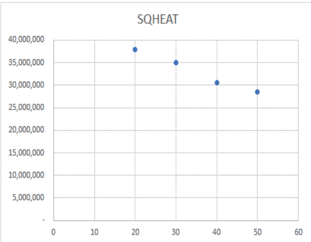


Annual Total Demand (kJ)

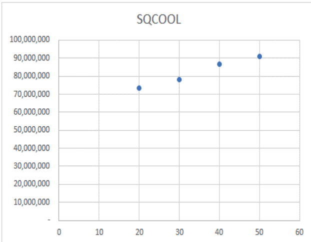


[Figure. u-value 3.0 (W/m²·K)]

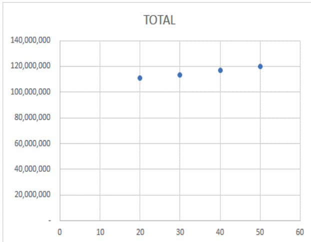
Annual Heat Demand (kJ)



Annual Cool Demand (kJ)



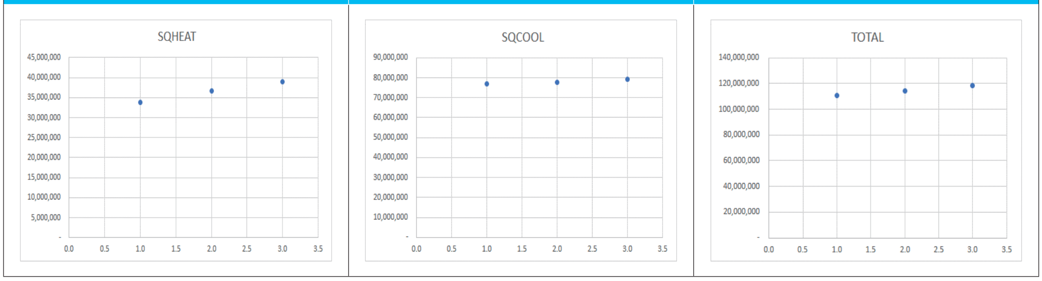
Annual Total Demand (kJ)



- Fixed g-value, Changed u-value

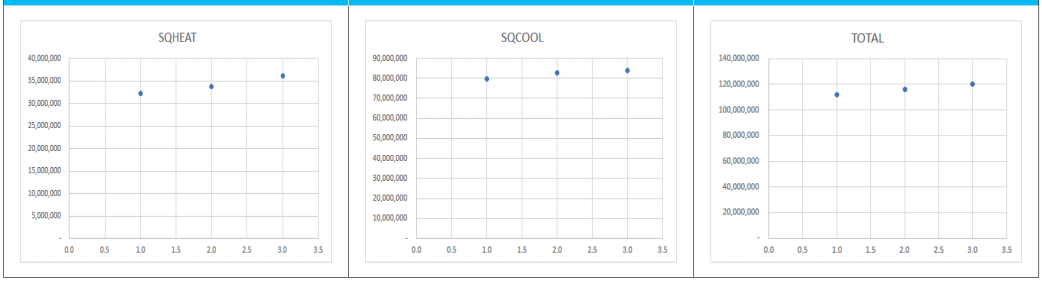
[Figure. g-value 20%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)



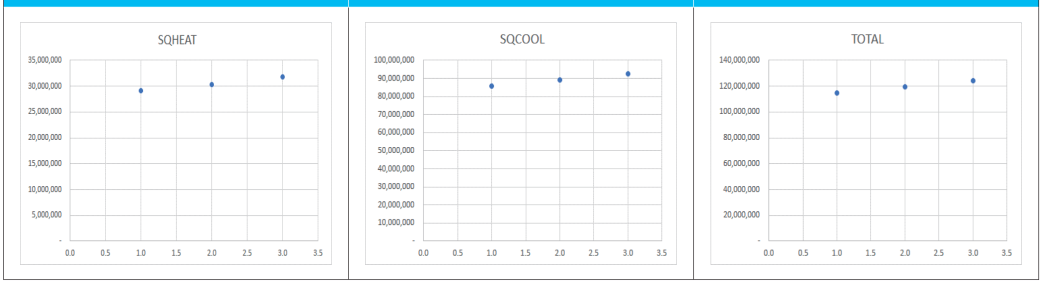
[Figure. g-value 30%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)



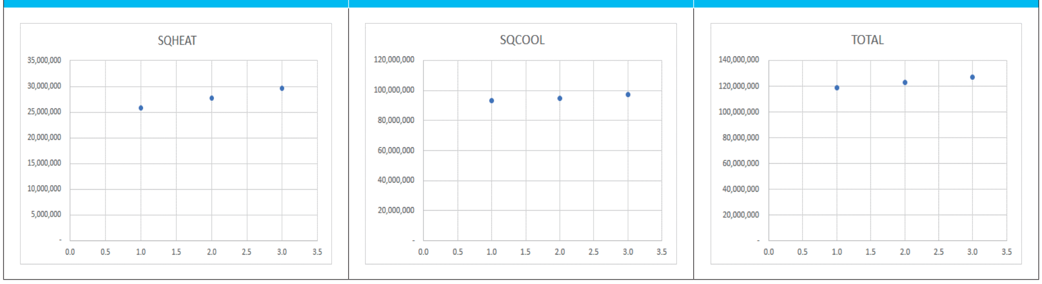
[Figure. g-value 40%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)



[Figure. g-value 50%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)



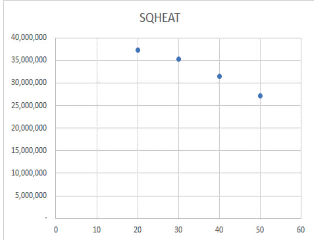
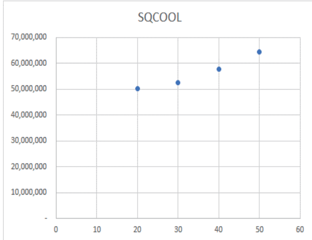
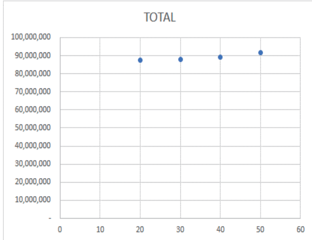
□ Ma’an

<Simulation result>

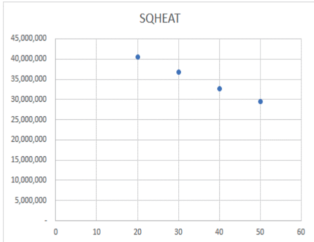
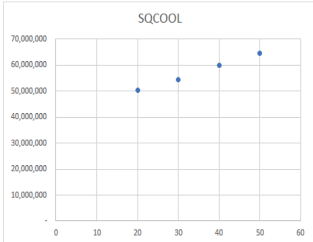
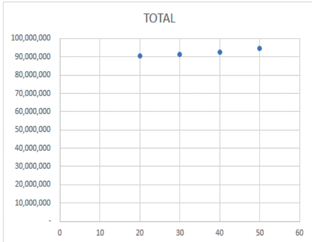
u-value ($W/m^2 \cdot K$)	g-value	SQHEAT	SQCOOL	TOTAL	RATE
1.0	20	37,330,672	50,306,498	87,637,170	-22.98%
	30	35,299,215	52,652,370	87,951,585	-22.70%
	40	31,462,432	57,850,501	89,312,933	-21.51%
	50	27,243,862	64,536,450	91,780,312	-19.34%
2.0	20	40,428,394	50,280,390	90,708,784	-20.28%
	30	36,869,519	54,343,076	91,212,595	-19.84%
	40	32,649,065	60,074,230	92,723,295	-18.51%
	50	29,434,517	65,136,595	94,571,112	-16.89%
3.0	20	43,113,231	50,688,291	93,801,523	-17.56%
	30	39,534,957	54,659,792	94,194,749	-17.22%
	40	34,152,986	62,024,470	96,177,457	-15.48%
	50	31,478,435	66,191,445	97,669,880	-14.16%
5.7	80	31,311,121	82,475,687	113,786,808	0.00%

- Fixed u-value, Changed g-value

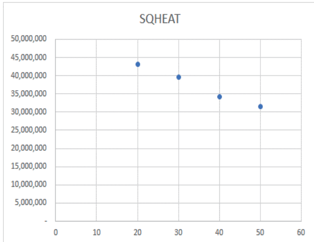
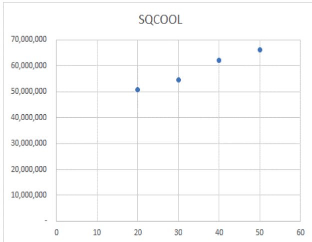
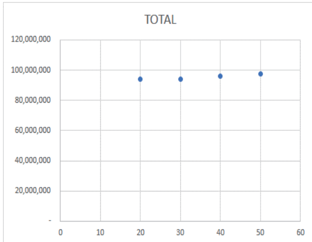
[Figure. u-value 1.0 (W/m²·K)]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

[Figure. u-value 2.0 (W/m²·K)]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

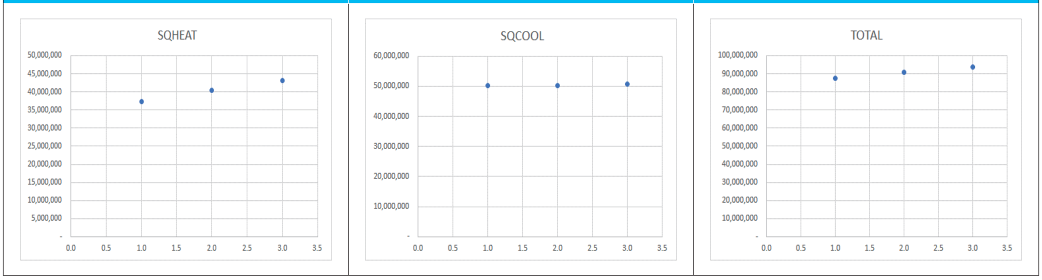
[Figure. u-value 3.0 (W/m²·K)]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- Fixed g-value, Changed u-value

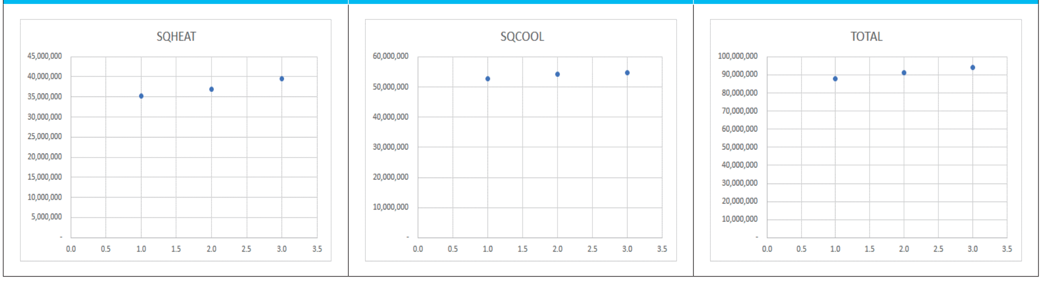
[Figure. g-value 20%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)



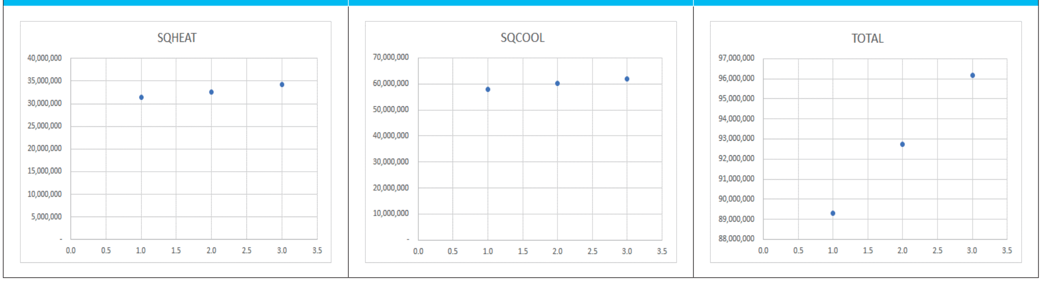
[Figure. g-value 30%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)



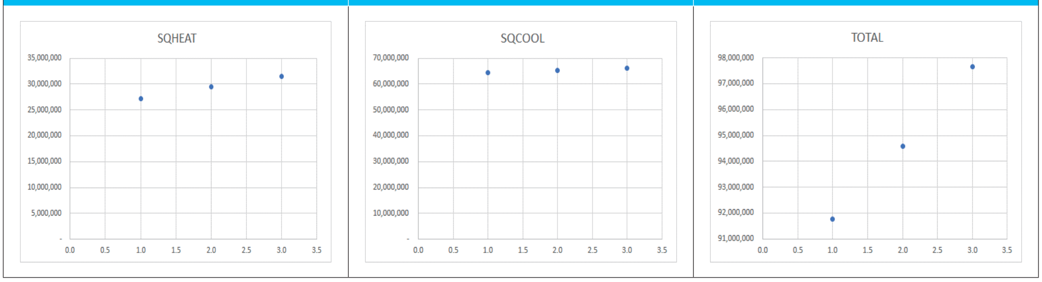
[Figure. g-value 40%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)



[Figure. g-value 50%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)



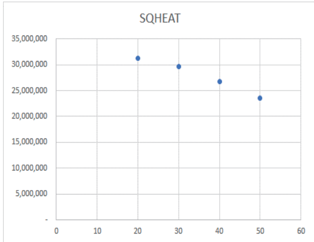
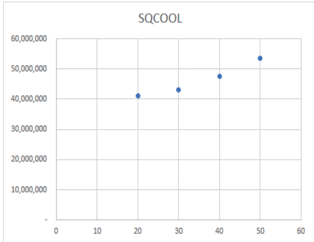
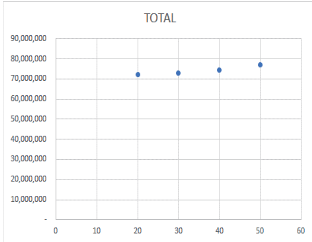
□ Irbid

<Simulation result>

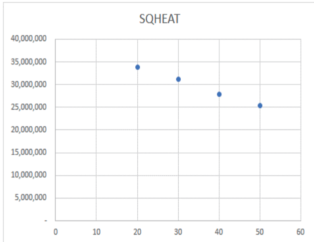
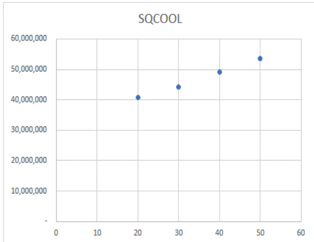
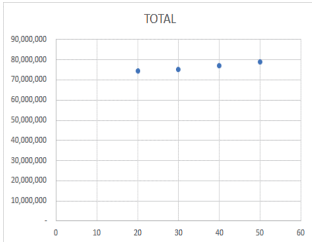
u-value (W/m²·K)	g-value	SQHEAT	SQCOOL	TOTAL	RATE
1.0	20	31,285,331	41,054,971	72,340,302	-24.29%
	30	29,702,004	43,076,887	72,778,890	-23.83%
	40	26,753,836	47,589,226	74,343,061	-22.19%
	50	23,572,328	53,461,883	77,034,212	-19.37%
2.0	20	33,893,929	40,659,170	74,553,100	-21.97%
	30	31,118,369	44,165,503	75,283,872	-21.21%
	40	27,880,284	49,128,782	77,009,066	-19.40%
	50	25,450,647	53,574,923	79,025,570	-17.29%
3.0	20	36,166,797	40,640,243	76,807,039	-19.61%
	30	33,367,292	44,065,802	77,433,094	-18.96%
	40	29,245,551	50,427,283	79,672,834	-16.61%
	50	27,217,073	54,100,366	81,317,439	-14.89%
5.7	80	27,872,548	67,672,381	95,544,929	0.00%

- Fixed u-value, Changed g-value

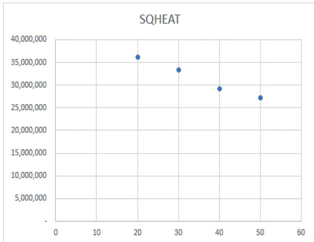
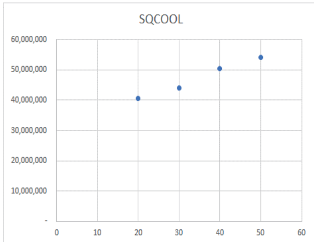
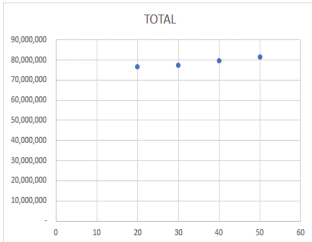
[Figure. u-value 1.0 (W/m²·K)]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

[Figure. u-value 2.0 (W/m²·K)]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

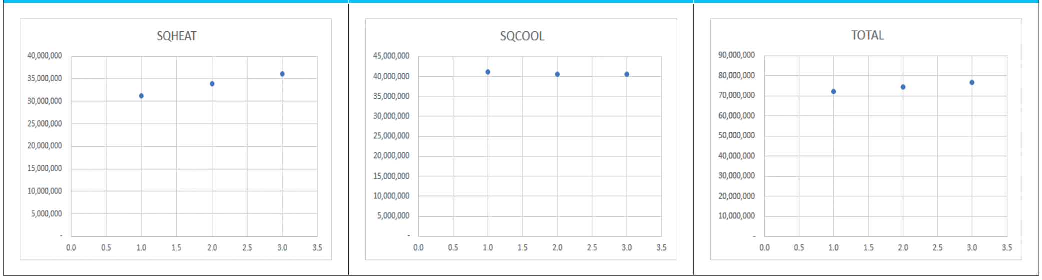
[Figure. u-value 3.0 (W/m²·K)]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

- Fixed g-value, Changed u-value

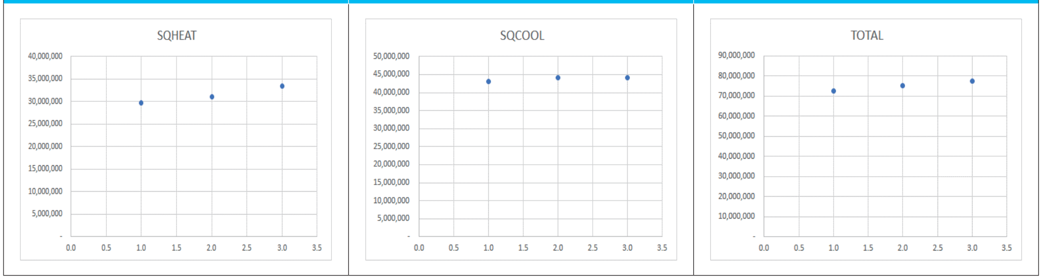
[Figure. g-value 20%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)



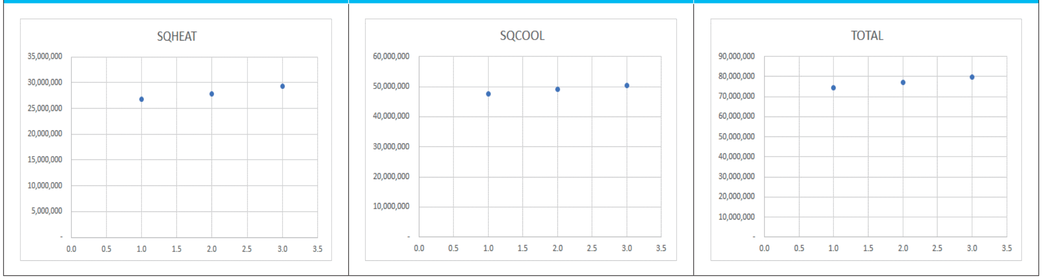
[Figure. g-value 30%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)



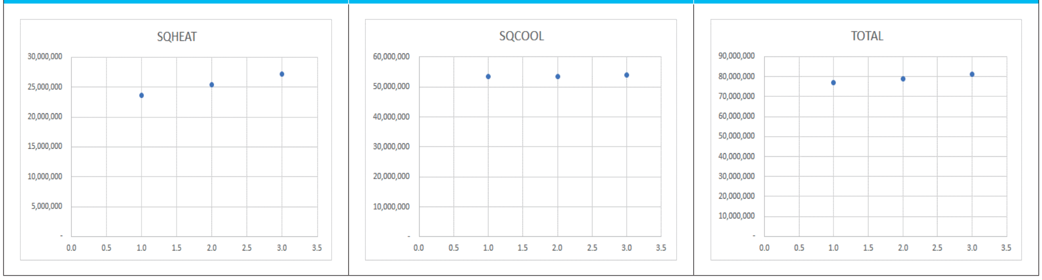
[Figure. g-value 40%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)



[Figure. g-value 50%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)



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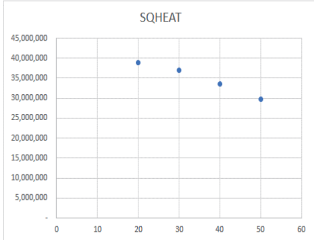
<Simulation result>

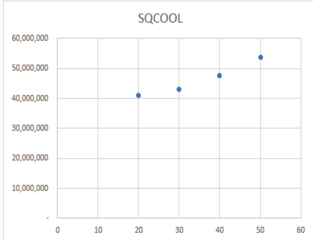
u-value (W/m^2·K)	g-value	SQHEAT	SQCOOL	TOTAL	RATE
1.0	20	38,828,426	41,005,196	79,833,623	-22.60%
	30	36,987,324	43,120,530	80,107,854	-22.33%
	40	33,521,407	47,759,322	81,280,729	-21.20%
	50	29,710,585	53,714,468	83,425,054	-19.12%
2.0	20	41,944,788	40,596,781	82,541,570	-19.97%
	30	38,716,091	44,249,574	82,965,665	-19.56%
	40	34,905,962	49,334,260	84,240,223	-18.33%
	50	31,998,042	53,833,419	85,831,461	-16.78%
3.0	20	44,685,717	40,586,342	85,272,059	-17.33%
	30	41,438,608	44,148,067	85,586,675	-17.02%
	40	36,592,124	50,665,152	87,257,276	-15.40%
	50	34,171,714	54,368,268	88,539,981	-14.16%
5.7	80	35,071,989	68,070,835	103,142,824	0.00%

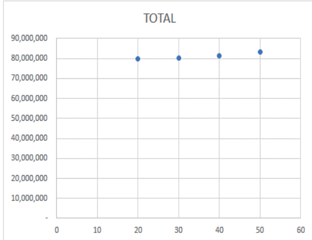
- Fixed u-value, Changed g-value

[Figure. u-value 1.0 (W/m²·K)]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)

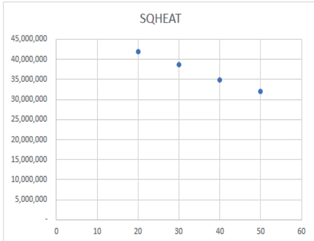


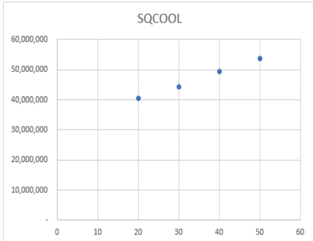


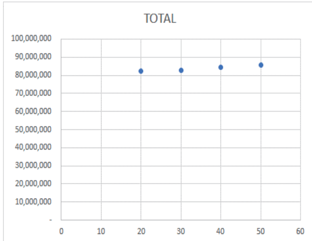


[Figure. u-value 2.0 (W/m²·K)]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)

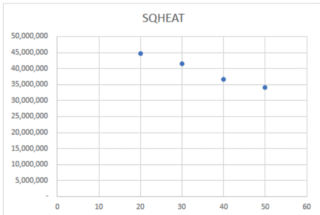


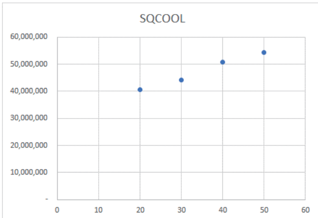


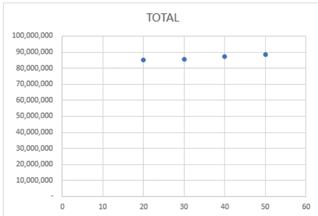


[Figure. u-value 3.0 (W/m²·K)]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)



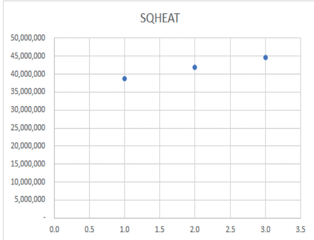


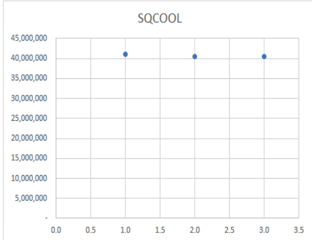


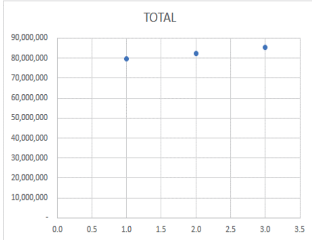
- Fixed g-value, Changed u-value

[Figure. g-value 20%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)

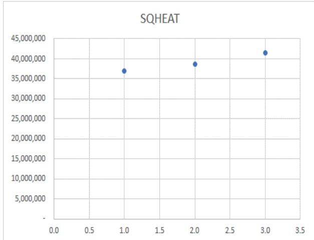


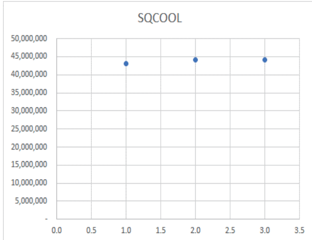


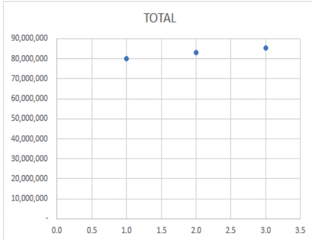


[Figure. g-value 30%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)

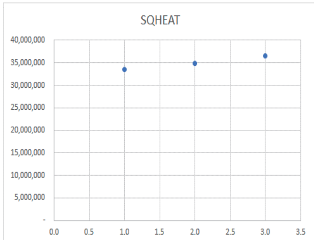


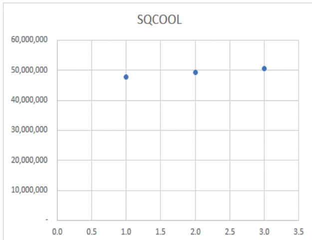


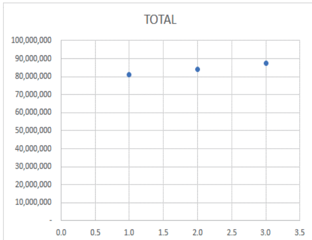


[Figure. g-value 40%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)

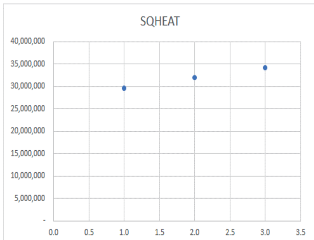


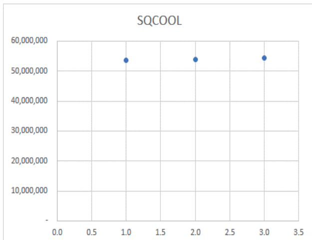


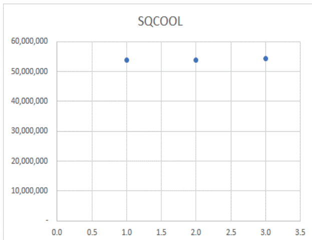


[Figure. g-value 50%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)







□ Wadi

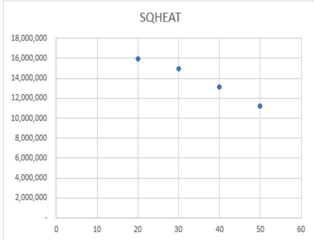
<Simulation result>

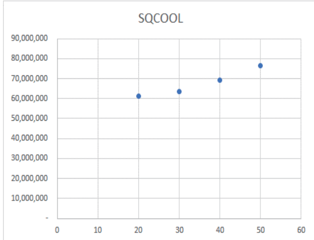
u-value ($W/m^2 \cdot K$)	g-value	SQHEAT	SQCOOL	TOTAL	RATE
1.0	20	15,954,907	61,075,558	77,030,465	-29.88%
	30	14,957,420	63,657,831	78,615,252	-28.44%
	40	13,135,596	69,275,593	82,411,189	-24.99%
	50	11,225,821	76,384,251	87,610,072	-20.25%
2.0	20	17,426,848	61,381,179	78,808,028	-28.27%
	30	15,673,899	65,819,729	81,493,629	-25.82%
	40	13,670,318	71,957,076	85,627,394	-22.06%
	50	12,208,192	77,320,098	89,528,291	-18.51%
3.0	20	18,683,584	62,165,146	80,848,731	-26.41%
	30	16,905,325	66,485,672	83,390,997	-24.10%
	40	14,345,626	74,354,972	88,700,598	-19.26%
	50	13,121,974	78,741,143	91,863,117	-16.38%
5.7	80	13,056,978	96,805,726	109,862,705	0.00%

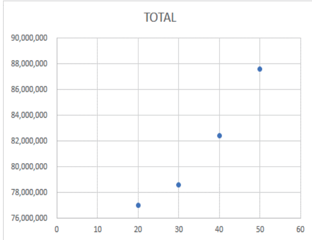
• Fixed u-value, Changed g-value

[Figure. u-value 1.0 (W/m²·K)]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)

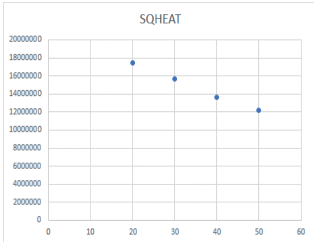


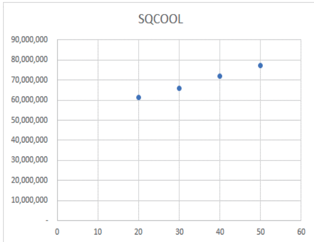


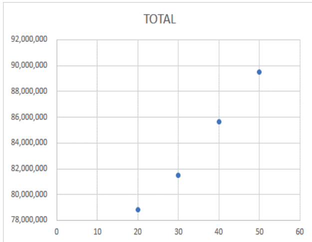


[Figure. u-value 2.0 (W/m²·K)]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)

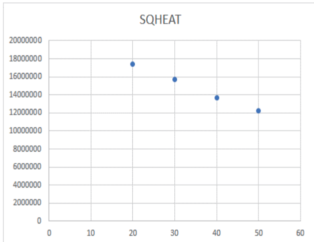


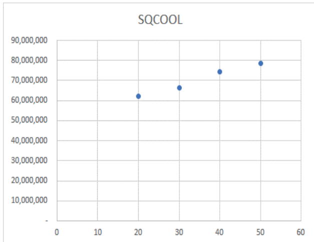


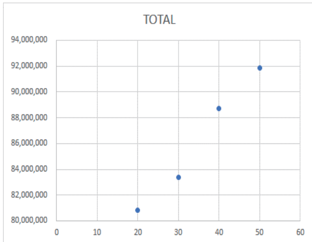


[Figure. u-value 3.0 (W/m²·K)]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)

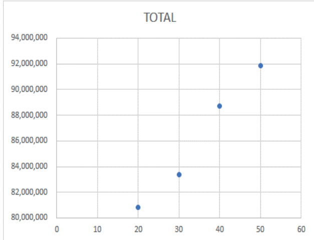
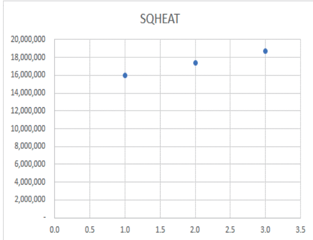
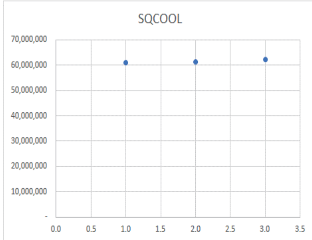




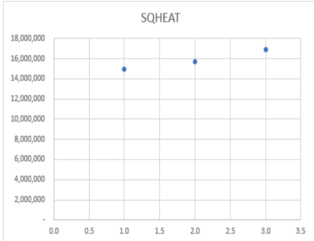
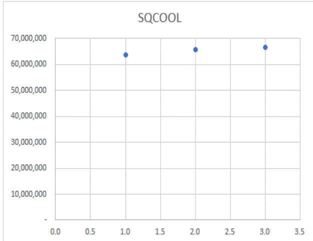
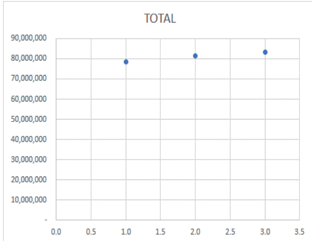


- Fixed g-value, Changed u-value

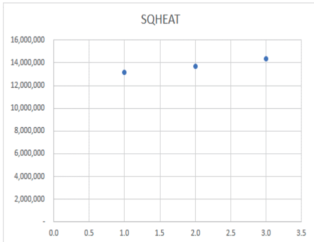
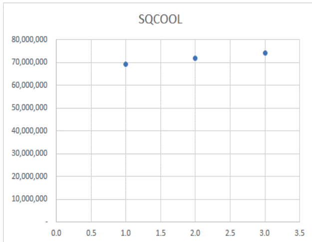
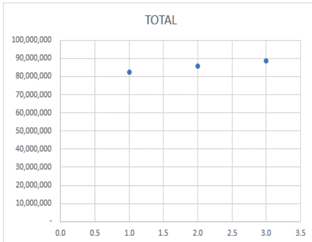
[Figure. g-value 20%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

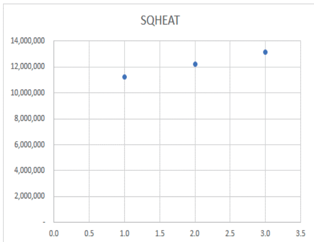
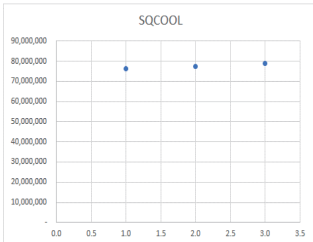
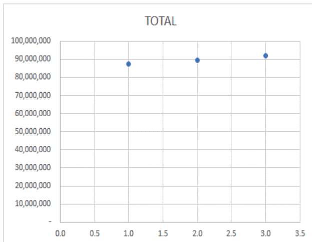
[Figure. g-value 30%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

[Figure. g-value 40%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

[Figure. g-value 50%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

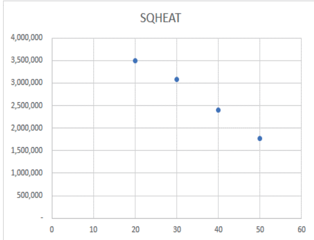
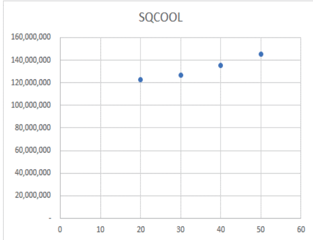
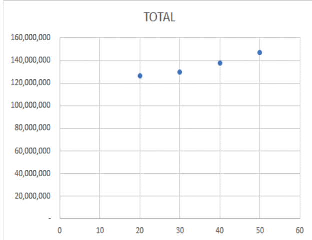
□ Aqaba

<Simulation result>

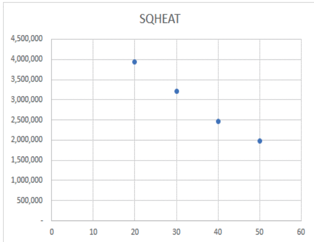
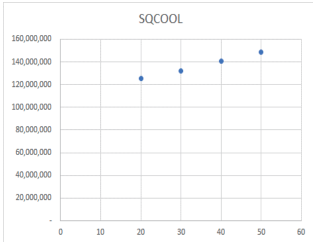
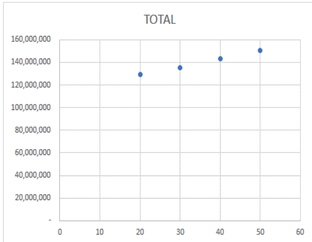
u-value (W/m²·K)	g-value	SQHEAT	SQCOOL	TOTAL	RATE
1.0	20	3,496,401	123,017,044	126,513,445	-31.75%
	30	3,082,634	126,900,299	129,982,932	-29.88%
	40	2,393,534	135,204,091	137,597,625	-25.77%
	50	1,772,416	145,502,672	147,275,088	-20.55%
2.0	20	3,936,477	125,168,032	129,104,509	-30.36%
	30	3,207,194	131,790,301	134,997,495	-27.18%
	40	2,458,352	140,844,148	143,302,500	-22.70%
	50	1,983,473	148,633,161	150,616,634	-18.75%
3.0	20	4,285,438	128,024,699	132,310,137	-28.63%
	30	3,534,462	134,432,778	137,967,240	-25.57%
	40	2,567,687	146,085,639	148,653,326	-19.81%
	50	2,170,342	152,422,501	154,592,843	-16.61%
5.7	80	1,857,007	183,519,048	185,376,056	0.00%

- Fixed u-value, Changed g-value

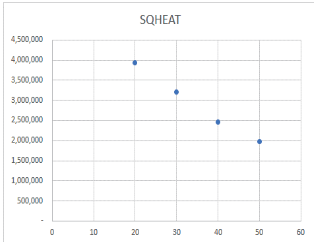
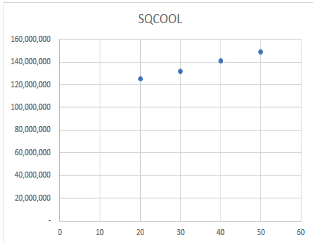
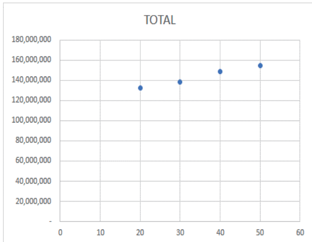
[Figure. u-value 1.0 (W/m²·K)]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

[Figure. u-value 2.0 (W/m²·K)]

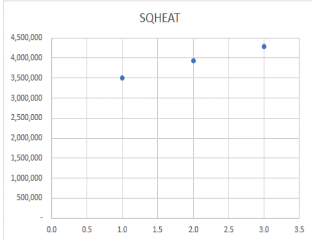
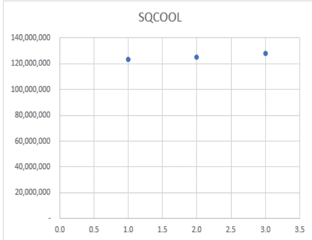
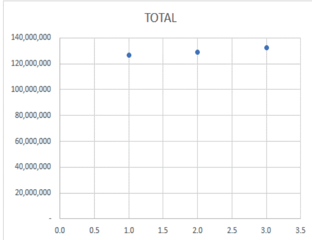
Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

[Figure. u-value 3.0 (W/m²·K)]

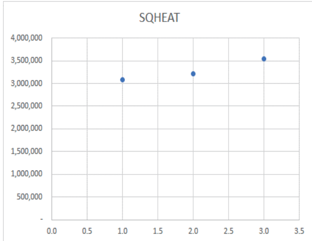
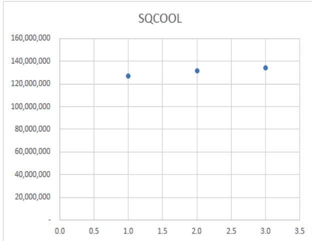
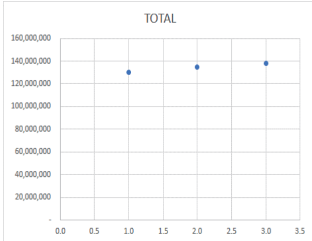
Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

• Fixed g-value, Changed u-value

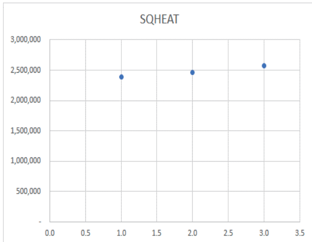
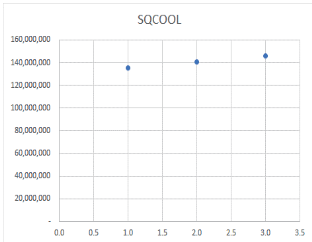
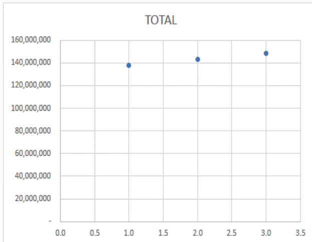
[Figure. g-value 20%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

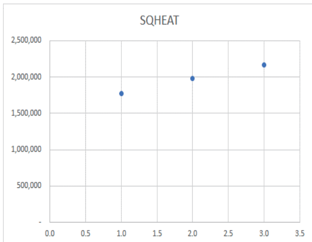
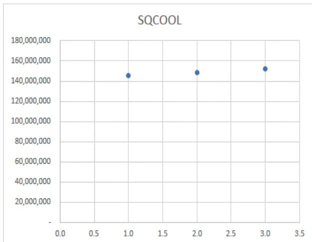
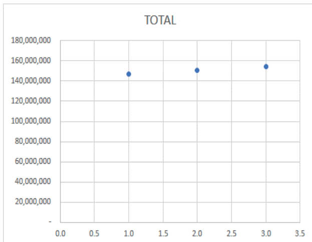
[Figure. g-value 30%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

[Figure. g-value 40%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

[Figure. g-value 50%]

Annual Heat Demand (kJ)	Annual Cool Demand (kJ)	Annual Total Demand (kJ)
		

Attachment 6 List of attendees at Jordan KSP Final reporting Seminar

□ List of major attendees in Korea

No.	Name (Kor)	Affiliation & Position (Kor)	Name (Eng)	Affiliation & Position (Eng)	Note
1	홍영표	수석고문 前 수출입은행 수석부행장	Hong Young Pyo	Senior Advisor & Head of 2021/22 KSP Consultation with Jordan	
2	김동기	주요르단한국대사	Kim Dong Gi	Ambassador, Embassy of the Republic of Korea	
3	맹수진	주요르단한국대사관 서기관	Maeng Su Jin	First Secretary, Embassy of the Republic of Korea	
4	박철호	KOTRA 개발협력실 실장	Park Chul ho	Director General, Development Cooperation Office, KOTRA	
5	장덕환	KOTRA 개발협력실 과장 (요르단 KSP PM)	Jang Duk Hwan	Project Manager, Development Cooperation Office, KOTRA	
6	정윤재	KOTRA 개발협력실 대리 (요르단 KSP 업무보조)	Chung Yoon Jae	Assistant Manager	
7	이영희	KOTRA 암만무역관 관장	Lee Young Hee	General Director, KOTRA Amman	
8	김찬열	KOTRA 암만무역관 부관장	Kim Chan Youl	Deputy Director, KOTRA Amman	
9	이호빈	KOTRA 암만무역관 차장	Lee Ho bin	Deputy Director, KOTRA Amman	
10	이정현	KOTRA 암만무역관 마케팅 팀장	Lee Junghyun	Marketing Team Leader, KOTRA Amman	
11	왈라 얀센	KOTRA 암만무역관 무역 프로모션 전문가	Wala Yassen	Trdae Promotion Specialist KOTRA Amman	
12	이스라 알쿠르디	KOTRA 암만무역관 무역 프로모션 전문가	Esraa Alkurdi	Trdae Promotion Specialist KOTRA Amman	
13	이순명	상명대학교 융합공과대학 교수	Lee SoonMyung	College of Convergence Engineering, Seoul Sangmyung University	
14	유병천	(주)레플러스 대표이사	Yoo ByungChun	President&CEO, REPLUS Co.,Ltd.	
15	김길중	상명대학교 융합공과대학 연구원	Kim GilJung	College of Convergence Engineering, Seoul Sangmyung University	
16	이성현	상명대학교 융합공과대학 연구원	Lee SungHyun	College of Convergence Engineering, Seoul Sangmyung University	

□ List of major attendees in Jordan

No.	Name	Affiliation	Position
1	Mr. Rasmi Hamza	Ministry of energy and mineral resources	Executive Director Jordan Renewable Energy and Energy Efficiency Fund
2	Eng. Reem Al-Bzour		Engineer in RE & EE Directorate
3	Eng. Marwa Al-Mefleh		
4	Eng. Arwa Abu Kashef		
5	Eng. Ziad Hammoudeh		Head of RE & EE studies department
6	Eng. Nedal Jaber		Engineer in JREEEF
7	Eng. Omar Nawysheh		
8	Eng. Karam Ajarmeh		
9	Eng. Waleed Nedal		Head of Crisis Management Section
10	Eng. Omar Barqawi		Head of Innovation and Knowledge Management Department
11	Jasmin		Business Developer in JREEEF
12	Dr. Omaimah A. M. Al arja	German Jordanian University	dean of school of architecture and bulit environment, associate professor in buliding sciences
13	Arch. Tala Samir Awadallah		Deans Assistant for Graduate Studies
14	Eng. Mo	Jordan Green Building Council	Team Leader (Acting Executive Director)
15	Eng. Rawan Al-Qudah	The National Energy Research Center(RSS)	Manager of Campus Development
16	Eng. Mo'tasem Safi		Specialist/ Studies
17	Eng. Iyad Abdel-Hadi	Izzat Marji Group	Technical Director
18	Eng. Anas Al-Dalabeeh		Product Development
19	Eng. Mohammad Dado	ETA MAX for Energy & Environmental Solutions	CEO
20	Osama Al-Masri	ETA MAX for Energy & Environmental Solutions	Operations Manager
21	Dr. Abdelrahman Al-Attili	Al Hussein Technical University	Chair of Energy Engineering department
22	Dr. Khalid Al Zareer		Energy professor of Energy Efficiency course
23	Eng. Hamzeh Buqaei		Director of German Energy Academy

No.	Name	Affiliation	Position
24	Prof. Ahmad AlSalaymeh	Jordan University	
25	Dr. Jamal Othman	Al-Balqa` Applied University	Professor at the College of Engineering Technology

※ Antecedents of key Jordanian personnel

Photo	name	Position	Main antecedents
	Rasmi A. Hamzeh	Executive Director	• Worked as a business development consultant for 25 years - JREEEF strategy, plan design - More than $100 million raised through international organization/NGO cooperation - Participation in designing renewable energy laws and regulations