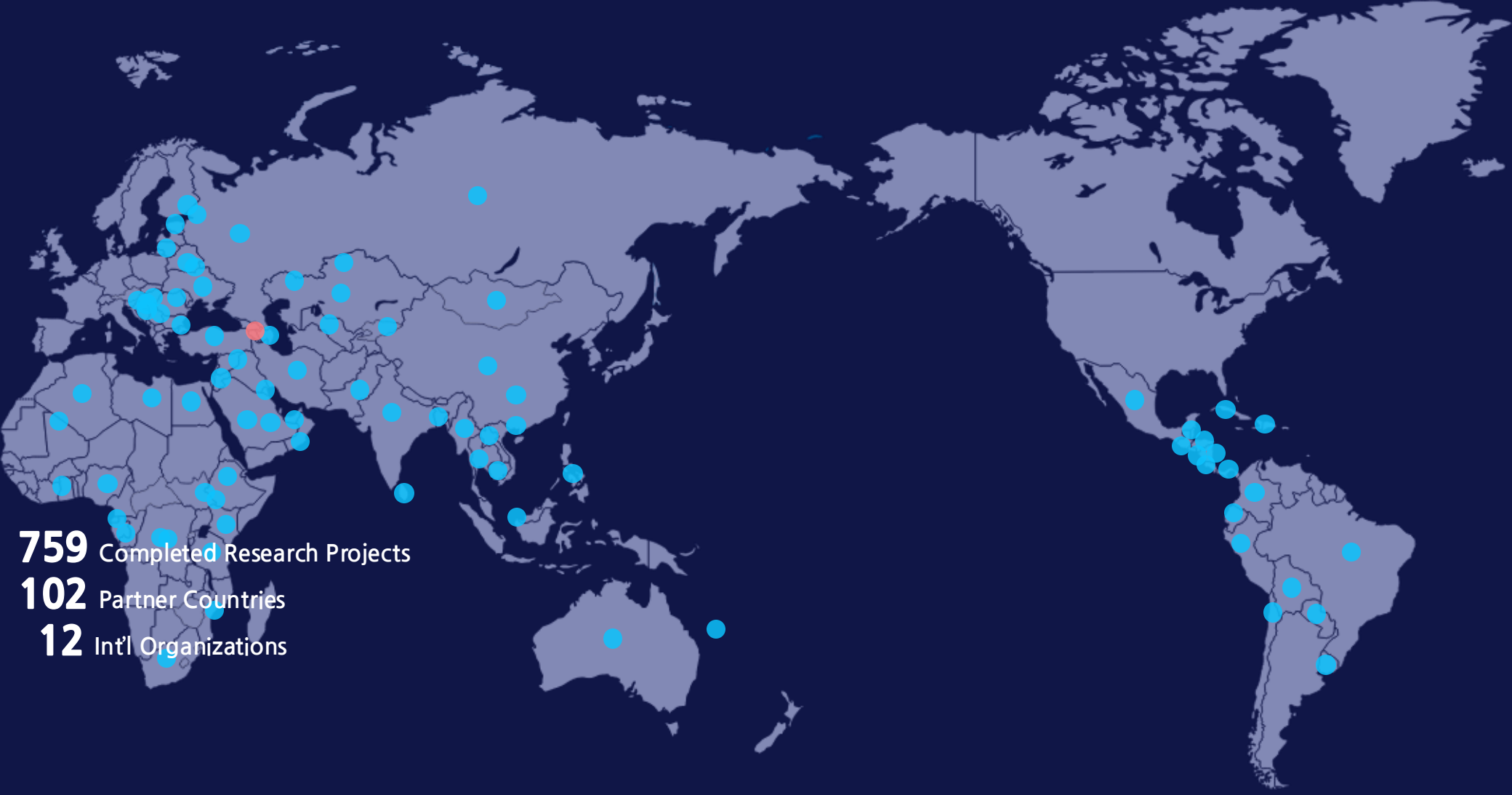


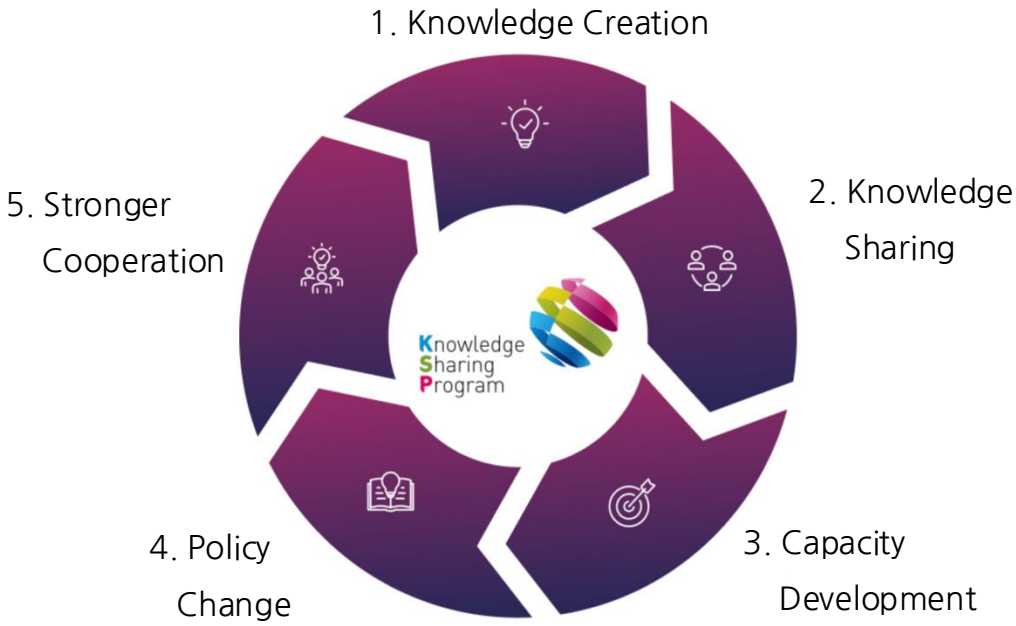
(2024/25 KSP-ADB Joint Consulting)
Armenia Green Urbanization : Advancing Energy Efficiency in Building
Partnership Seminar _ CBS (Care Building Service)

2025. 03. 04 (Tue)

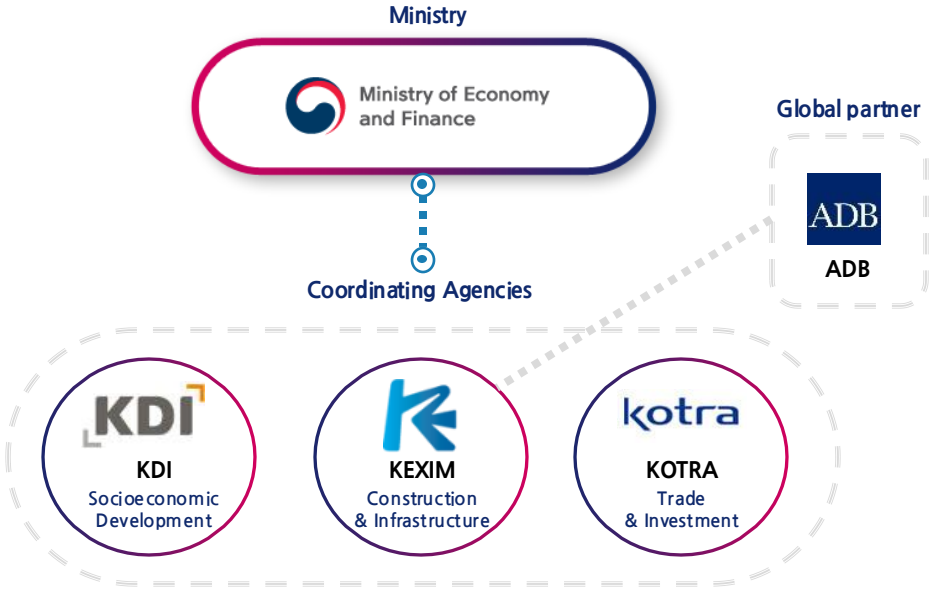
Contents

1. KSP(Knowledge Sharing Program)

From knowledge to action



Organization



- **Knowledge Sharing Program (KSP)** is **a platform for development cooperation**, aiming to share knowledge with partner countries and develop a solid foundation for the expansion of economic and political cooperation
- **Our mission** is to **contribute to the inclusive socio-economic development of partner countries** and **promote strong and close economic**

Overview

KEXIM
Construction & Infrastructure

Korea Exim bank The Export-Import Bank of Korea

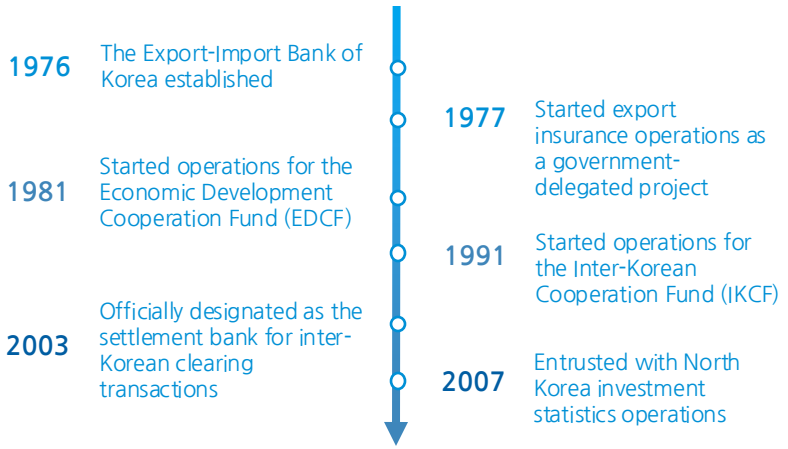
NAME | The Export-Import Bank of Korea (Korea Exim bank)

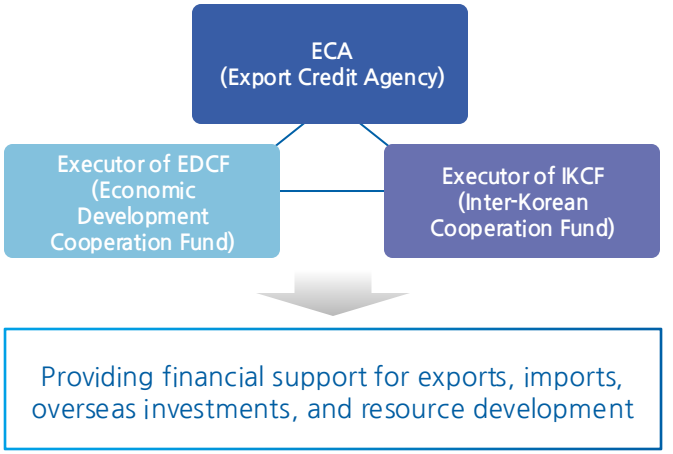
Introduction | A financial institution that provides long-term, low-interest policy financing for exports, imports, and overseas investments, which are difficult for general financial institutions to handle

Year of Establishment | 1976

- The Export-Import Bank of Korea was established to promote the sound development of the national economy by providing financial support for exports, imports, overseas investments, and overseas resource development, as well as other international economic cooperation activities

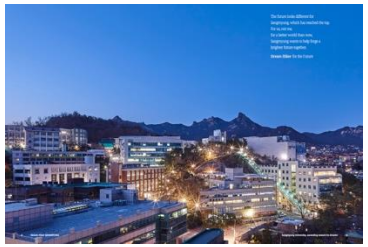
The History and Roles





Sangmyung university

Sangmyung university



02-2287-5114

20 Hongjimun 2-gil, Jongno-gu, Seoul, Korea

https://www.smu.ac.kr/

Cultural education that fosters harmonious character

Civic education that places emphasis on cooperation and service

SANGMYUNG UNIVERSITY

Major-based education with a creative and practical orientation

Globalization education for leading future society

- **1937** Sangmyung High School of Performance Arts established
- **1945** Sangmyung Schools established
- **1965** Sangmyung Women's College of Education established
- **1987** Sangmyung Women's University became a collegiate university
- **1996** Sangmyung Women's University renamed Sangmyung University and became coed
- **2025** 88th anniversary of the establishment of Sangmyung Academy

Project execution organization

Project execution organization

Principal Investigator

LEE SOON MYUNG

• Degree

- Ph.D. in Energy Grid Engineering, Sangmyung University (Specialization: Power and Energy Engineering), February 2019
- M.S. in Architecture, Seoul National University (Specialization: Architectural Environmental Systems), February 2011
- B.S. in Architecture, Seoul National University, February 2004

• Career

- Assistant Professor, Sangmyung University (September 2022 - August 2024)
- Director, LG Electronics / BS Division / Solution Business Unit / Vertical Business Office (January 2015 - August 2022)
- Senior Consultant, LG CNS / Entrue Consulting Division / Industry Department / Smart Green Group (January 2011 - December 2014)
- Director of Research Institute, RainbowScape Co., Ltd. / Environmental & Ecological Research Institute (October 2005 - December 2010)

Research Assistant

PARK SEONG HO

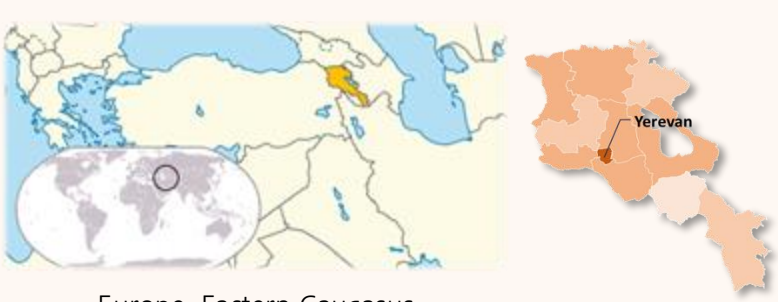
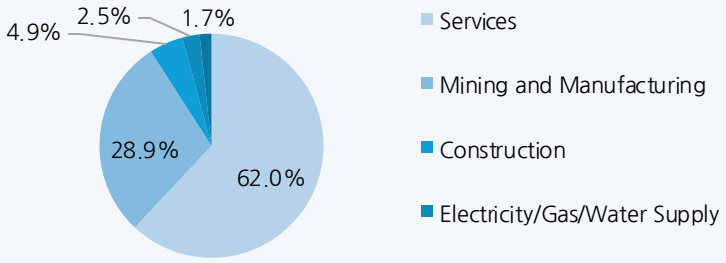
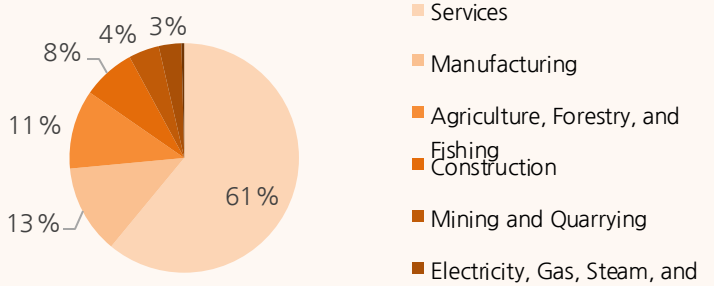
Research Assistant

LEE SUNG HYUN

• Degree

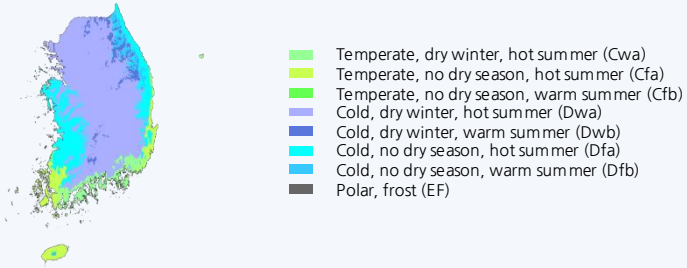
- M.S Program in Energy Grid Engineering, Sangmyung University
- B.S. in Electrical Engineering Sangmyung University, August 2024

Overview

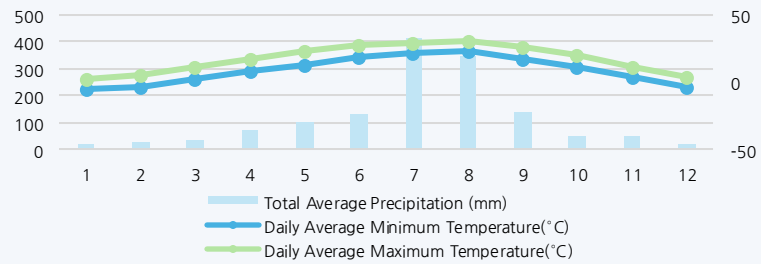
Republic of Korea		Republic of Armenia
 - East Asia -	Location & capital	 - Europe, Eastern Caucasus -
100,449 ㎢	Country area	29,743 ㎢ (13.5% of the Korean area)
51,774,521 (45% lives in Seoul and neighbor)	Population	2,991,201 (37% lives in Yerevan)
33,121 USD	Per capita GDP	8,715 USD
 ※ Korea's mining ratio: Approximately 1.8%	GDP proportion by economic activity	

Climate

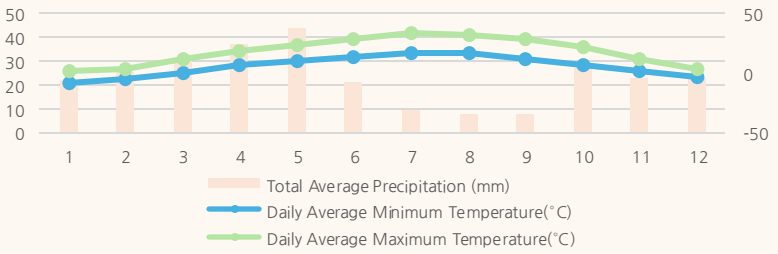
Republic of Korea



Köppen Climate Classification



Climate Characteristics



- Located in a mid-latitude temperate zone with four seasons
- Large temperature differences exist between summer (Jun.–Aug.) and winter (Dec.–Feb.); Summer highest temperature 27–30°C, while winter lowest temperature -5 – -3°C
- Annual precipitation: 1,306.3 mm; July and August are the wettest months

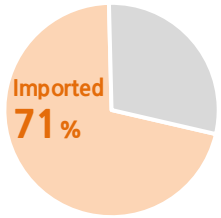
Republic of Armenia

- Armenia's highland climate varies from dry to subtropical and cold alpine due to complex terrain
- Large temperature differences exist between summer (Jun.–Aug.) and winter (Dec.–Feb.); Summer highest temperature 29–33°C, while winter lowest temperature -8 – -4°C
- Annual precipitation is low at 526 mm; May and June are the wettest months

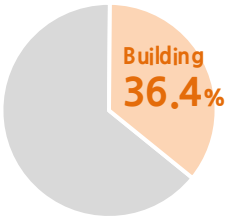
KSP Armenia 24/25

Backgrounds

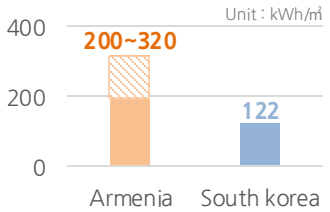
Economic burden caused by high energy import dependency and energy consumption in buildings



Energy import dependency



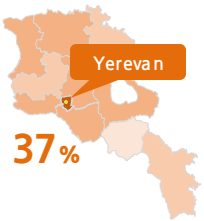
Electricity consumption by sector

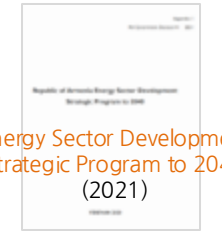


Energy consumption per unit area

Need for policies and systems to achieve carbon reduction target and sustainable urban development

to 2030



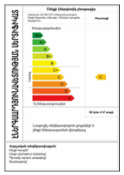


Energy Sector Development Strategic Program to 2040 (2021)

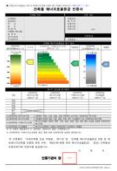
Limited policies and systems and insufficient technical capacity

NEEAP ∞ CEPA

EED & EPBD



Building energy Passport (ARM)



Building Energy Efficiency Certification (KOR)

International Green Building Certification

Objectives

Urban Development Committee

Knowledge Sharing Program

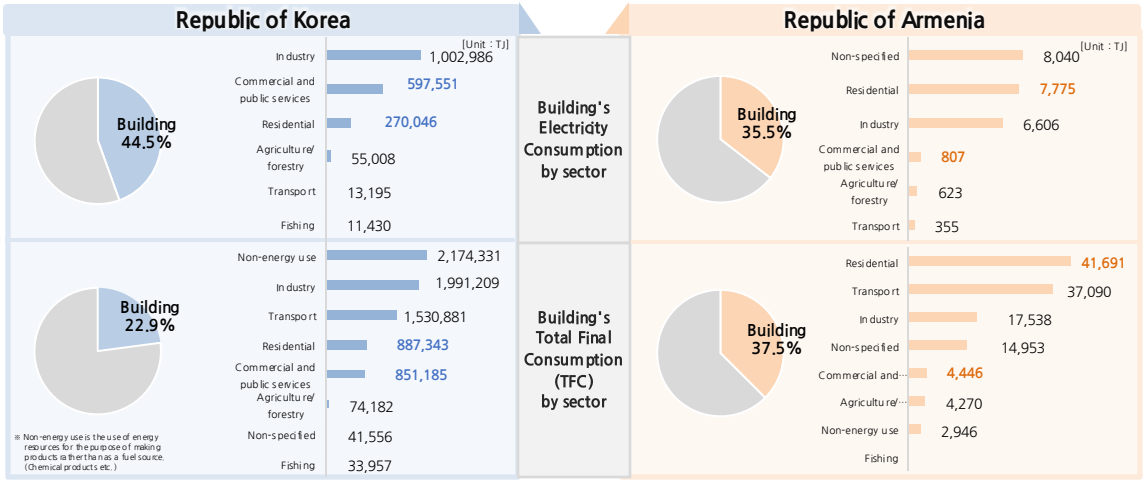
Issue : Developing sustainable energy resource and ensuring energy security

- Sharing the Korea's knowledge and policy
- Analyzing Armenia's technical and financial barriers
- Proposing policy improvements and strategies
- Sharing Key Case Practice

Developing a plan to improve building energy efficiency

Strengthening socio economic cooperation partnership

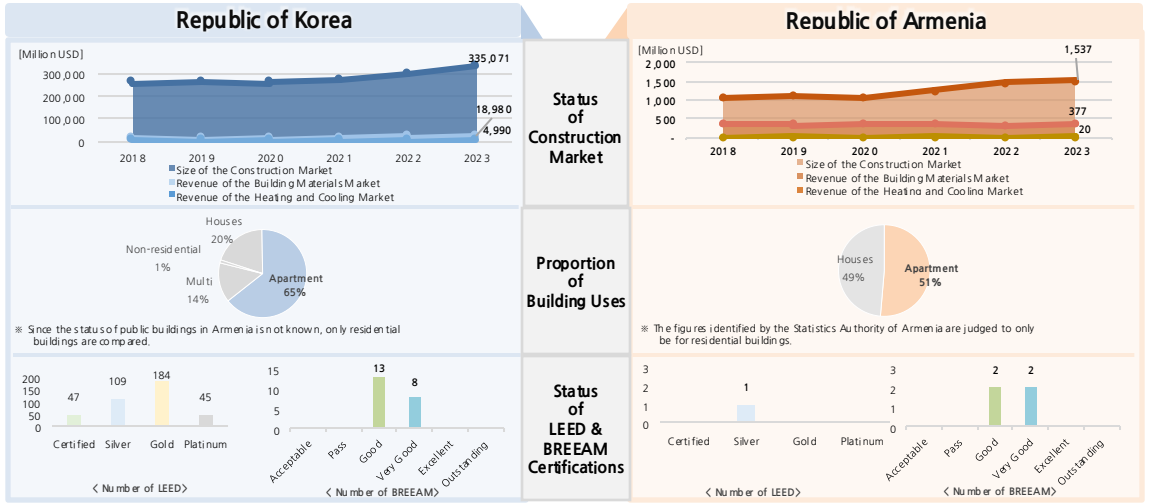
Building Energy



Check Point

- In **South Korea**, the **residential sector** accounts for **11.7%** of total energy consumption. The **commercial and public services sector** accounts for **11.2%**, making the building sector's total share **22.9%**.
- In **Armenia**, the **residential sector** accounts for **33.9%** of total energy consumption. The **commercial and public services sector** accounts for **3.6%**, making the building sector's total share **37.5%**.
- It can be observed that **both countries have high electricity consumption** and **TFC in buildings**.

Building and construction market



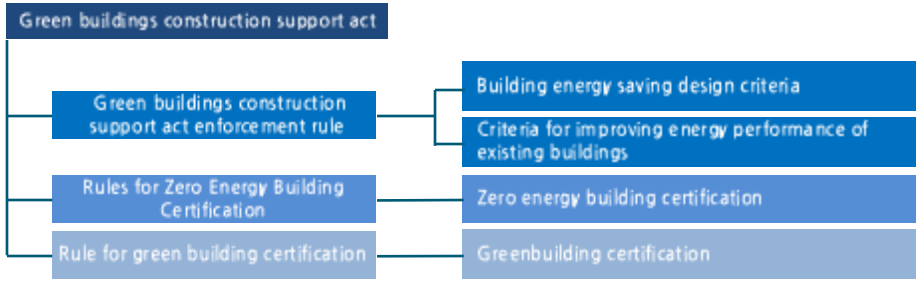
Check Point

- **South Korea's construction**, **building materials**, and **HVAC markets** are significantly **larger than Armenia's**, with the construction market about **218 times**, building materials market **56 times**, and HVAC market **249 times** bigger in 2023.
- In both **South Korea and Armenia**, **over half of the buildings** are **apartments** (**65% vs. 51%**).
- **South Korea** has significantly **more LEED (385 vs 1) and BREEAM (21 vs 4) certified buildings than Armenia**, showing that South Korea is more developed in building energy efficiency certifications than Armenia.

Legislation & certfication system

Republic of Korea

- Legislation



- Certification system

Building energy efficiency certification

- The grade is calculated by evaluating the building's energy consumption for heating, cooling, and hot water supply, as well as CO_2 emissions

Class	Annual primary energy consumption per unit area (kWh/m²year)	
	Residential	Non-residential
1+++	less than 60	less than 80
1++	60 ≤, < 90	80 ≤, < 140
1+	90 ≤, < 120	140 ≤, < 200
1	120 ≤, < 150	200 ≤, < 260
2	150 ≤, < 190	260 ≤, < 320
3	190 ≤, < 230	320 ≤, < 380
4	230 ≤, < 270	380 ≤, < 450
5	270 ≤, < 320	450 ≤, < 520
6	320 ≤, < 370	520 ≤, < 610
7	370 ≤, < 420	610 ≤, < 700

Zero energy building certification

- Zero-energy building certification is granted from 1 to 5 grades based on energy self-sufficiency rate

Class	energy self-sufficiency rate
ZEB 1	Morr than 100%
ZEB 2	80% ≤, < 100%
ZEB 3	60% ≤, < 80%
ZEB 4	40% ≤, < 60%
ZEB 5	20% ≤, < 40%

Greenbuilding certification

- Certification is granted to buildings that contribute to energy conservation and environmental pollution reduction throughout the entire process, including design and construction

Green Grade	Residential		
	New	Existing	Green remodeling
1	74 ≤	69 ≤	69 ≤
2	66 ≤	61 ≤	61 ≤
3	58 ≤	53 ≤	53 ≤
4	50 ≤	45 ≤	45 ≤

Republic of Armenia

- Legislation

- Certification system

Energy Efficiency Assessment Indicators

- Class is calculated based on heating and ventilation energy consumption and deviations from the reference values

Building	Class	Class name
New	A++	Very high
	A+	
	A	
	B+	High
	B	
	C+	Normal
	C	
	C -	
Existing	D	Low
	E	Very low

EE Class

- Class is calculated based on final energy consumption per 1m² and deviations from the reference values

Class Mard	Class name
A	Very high
B	High
C	Average
D	Normal
E	Low
F	Slightly low
G	Very low

Energy Efficiency Rating Systems for Buildings

Building Energy Efficiency Certification		RAMN 24-02-2022 (EE Class) 'Ensuring Energy Efficiency of Buildings. Energy Efficiency Assessment Indicators'
A system for evaluating and certifying the energy performance of buildings, which assesses energy requirements for heating, cooling, and hot water supply, as well as CO_2 emissions, based on building design documents, and assigns grade	Overview	This construction norm is applied to evaluate the total energy consumption of buildings through calculations and measurements, calculate energy efficiency, and assess the suitability of primary energy or final energy indicators
• New and existing residential buildings • New and existing non-residential buildings	Target	• Newly constructed residential and public buildings and their complexes • Residential, public, and industrial facilities reconstructed or undergoing energy modernization based on state budget funds
• Evaluation of energy requirements for heating, cooling, and hot water supply, as well as CO_2 emissions, to determine the building's grade	Energy efficiency class	• Class is calculated based on final energy consumption per 1㎡ and deviations from the reference values
1. New and existing residential buildings - Floor Area Ratio (FAR) - Building Height Limit 2. Property tax: 5 years after Certification 3. Acquisition Tax	Incentive	—

Class / Annual primary energy consumption per unit area (kWh/㎡year)

Class	Residential	Non-residential
1+++	less than 60	less than 80
1++	60 ≤, < 90	80 ≤, < 140
1+	90 ≤, < 120	140 ≤, < 200
1	120 ≤, < 150	200 ≤, < 260
2	150 ≤, < 190	260 ≤, < 320
3	190 ≤, < 230	320 ≤, < 380
4	230 ≤, < 270	380 ≤, < 450
5	270 ≤, < 320	450 ≤, < 520
6	320 ≤, < 370	520 ≤, < 610
7	370 ≤, < 420	610 ≤, < 700

Class	Class name	Deviations from Energy limit and the reference values[%]
A	Very high	< - 50
B	High	-50 ≤, < -20
C	Average	-20 ≤, < 0
D	Normal	0 ≤, < 20
E	Low	20 ≤, < 35
F	Slightly low	35 ≤, < 50
G	Very low	50 ≤

Relaxation Conditions	Maximum Relaxation Rate
1++	6%
1+	3%

	G-SEED Green1 class	G-SEED Green2 class
1+	10%	7%
1	7%	3%

	G-SEED Green1 class	G-SEED Green2 class
1+	10%	7%
1	7%	3%

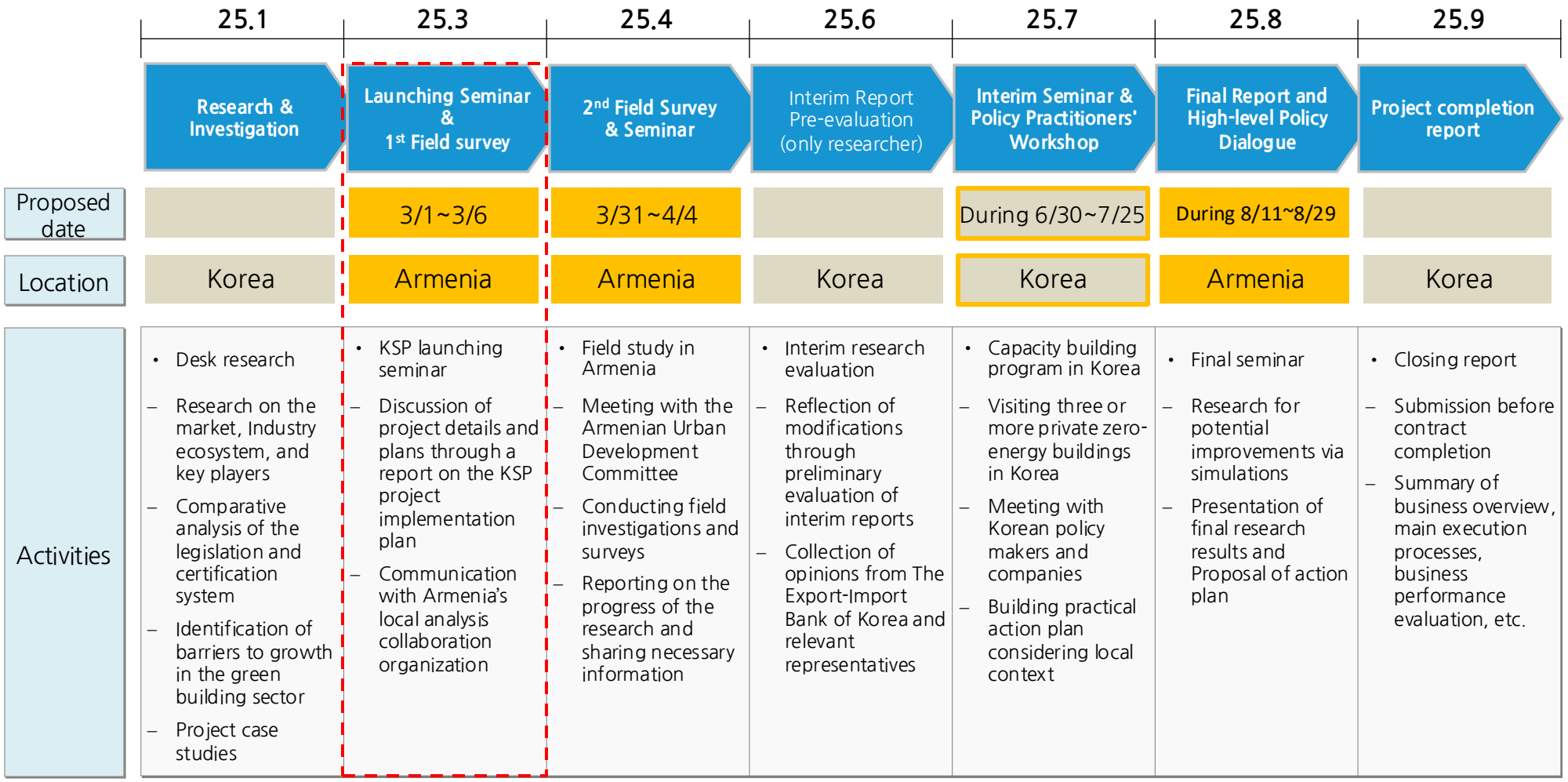
Building Energy saving design criteria

Country	Republic of Korea		Republic of Armenia
Law	Building Energy saving design criteria		RAMN 24-01- 2016 'Thermal Protection of Buildings'
Applicable	Buildings with a total floor area of 500㎡ or more		Residential, public, industrial, agricultural and storage buildings and warehouses with an area of 50㎡ or more under construction and reconstruction
Construction sector	Mandatory	• General Insulation Measures	• Insulation conditions of buildings and storage structures • Dew point requirements • Amplitude of temperature fluctuations in cladding structures in summer • Standard values of heat transfer coefficients for UV protection equipment • Standard values of air permeability of external skins • Floor surface finishes (standard heat absorption index) • Energy performance assessment of buildings (standard values of heat energy for heating and ventilation) for buildings by purpose
		• Measures to prevent confidentiality and condensation	
		• Installation of insulation in floor heating	
	Recommended	• Site Planning	• Allowable thickness of insulation
		• Floor plan	
		• Insulation plan	
		• Airtight plan	
		• Natural Lighting Plan	
Mechanical sector	Mandatory	• Design Outdoor Conditions	• Air circulation in buildings (Standards for air permeability of cladding structures)
		• Heat Sources and Transmission Equipment	
	Recommended	• Design Indoor Temperature Conditions	
		• Heat Sources facilities	
		• Ventilation and control facilities	
		• Transfer facility	
		• Air conditioning equipment	
Electrical equipment sector	Mandatory	• Substation Equipment	
		• Transmission and Power Equipment	
		• Lighting Equipment	
	Recommended	• Substation Equipment	
		• Transmission and Power Equipment	
		• Lighting Equipment	
		• Control facility	
		• Building Energy Management System (BEMS)	
New and renewable energy equipment sector	Mandatory	• When installing new and renewable energy facilities in a building, comply with the 'Regulations on Support for New and Renewable Energy Facilities' announced by the Ministry of Trade, Industry and Energy.	
	Recommended	• When designing heating, cooling, hot water supply and lighting energy supply, new and renewable energy is selectively adopted in accordance with the provisions of Article 15.	

5 key activities

	Details
Key activities (5)	**1. Research on the Institutional Status of Armenia and Korea and Proposal for Improvement Strategies** • Research on legislation and systems related to energy efficiency and building evaluation in Armenia - Including a comparative analysis of legislation and systems in Armenia and Korea • Proposal of development strategies for Armenia based on analysis of legislation and systems in Armenia and Korea
	2. Analysis of the Armenian market and comparative research with Korea • Market research on building energy efficiency enhancement sector and recycling resources green building sector • Market research and comparative analysis of Armenia and Korea - Including analysis of industrial ecosystem and key stakeholders in green building sector
	3. Analysis of barriers to green building expansion • Analysis of barriers to green building expansion in Armenia, including financing, technological capabilities, and market awareness • Proposal of strategies for green building sector expansion based on barrier analysis
	4. Publish a collection of project case studies and benchmarking • Research of successful green building project cases in Armenia and related regions • Proposal of practical solutions for achieving energy efficiency
	5. Hosting Armenia policy practitioners' workshop in Korea • Invitation of experts from the Armenian Urban Development Committee and related fields for training • Midterm progress report on domestic research and collection of feedback from the Armenian Urban Development Committee and fie ld experts • Field visits to domestic sites related to building energy efficiency and green buildings • Meetings with institutions and companies related to building energy efficiency (e.g., solar power, heat pumps, EMS, etc.)

4 Major event (proposed)



Care Building Services LLC

CBS
Care Building Services LLC

+374 (60) 617 617 | +374 (77) 57 17 57

cbs@cbs-construction.am

Malkhasyants 4, Yerevan, Armenia

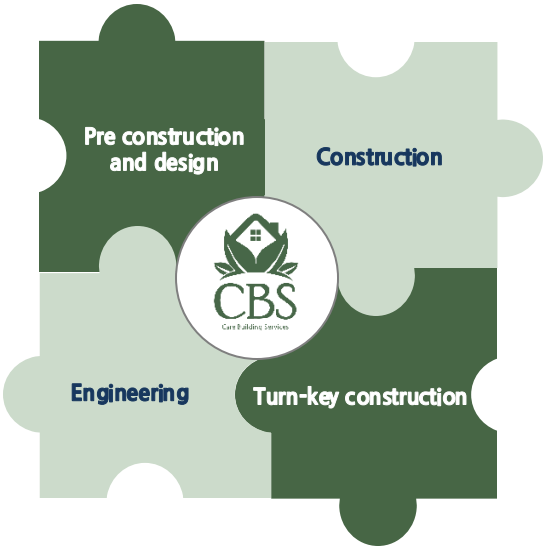
Cbs-construction.am

Company Overview

- Established in 2012, providing a wide range of services as a general construction company
- Originally established as an engineering company specializing in HVAC and building automation control systems, quickly expanding into all areas of construction and engineering. Acquired specialists and resources to handle projects of any complexity, evolving into a full-fledged construction firm
- Experience and interest in green construction, including projects related to LEED, BREEAM, and building energy performance evaluation in Armenia

Services

- CBS offers comprehensive construction solutions, covering all project phases from pre-construction planning and design to engineering, construction, and turn-key project delivery
- CBS has a large team of specialists across various fields, with one of its key differentiators being deep expertise in engineering infrastructures as well as civil construction, providing a wide range of services from residential to industrial construction



III. Cooperation - CBS (Care Building Services LLC)

Major players in construction industry (Top 3 by revenue in 2023)

	Republic of Korea			Republic of Armenia		
Construction	SAMSUNG C&T SAMSUNG C&T $ 28,620 [million] Develop construction, civil, and energy solutions	HYUNDAI ENGINEERING CO., LTD. HYUNDAI E&C $ 20,250 [million] Provides full-range construction solutions	DAEWOO E&C DAEWOO E&C $ 7,960 [million] Builds apartments, plants, civil, power	MLL INDUSTRIES MLL Industries $ 66 [million] Provides solutions for the construction industry	SAHAKYAN SHIN SAHAKYAN SHIN $ 34 [million] Manages construction sites and large-scale projects	CBS Care Building Service $ 26 [million] Operates in HVAC, ventilation, construction
Materials	KCC KCC $ 4,296 [million] Manufactures building, electronics materials	LX Hausys LX Hausys $ 2,408 [million] Produces architectural materials and auto parts	EUGENE EUGENE $ 1,006 [million] Supplies construction materials and distributes	ARMBAS Argel CJSC $ 25 [million] Produces basalt fiber from basalt materials	MIKMETAL Mikmetal CJSC $ 19 [million] Wholesales steel frames and wire rods	PROF AL PROF AL $ 14 [million] Manufactures aluminum doors and windows
Heating& Cooling	LG Electronics LG Electronics $ 57,535 [million] Operates B2C and B2B (air conditioners, TV)	KYUNGDONG NAVIEN KYUNGDONG NAVIEN $ 823 [million] Manufactures and sells boilers and HVAC systems	Carrier AUTECH GROUP $ 376 [million] Supplies and air conditioning for residential	CBS Care Building Service $ 26 [million] Operates in HVAC, ventilation, construction	onsel Consel LTD $ 11 [million] Sells and installs HVAC system equipment	AR&AR DESIGN & CONSTRUCTION AR&AR Design Construction $ 5 [million] Designs and installs HVAC systems
Electricity (Solar Power)	Q CELLS a Hanwha company Hanwha Q Cell $ 4,519 [million] Provides global total solar solutions	LS ELECTRIC LS Electric $ 2,890 [million] Offers solar modules and inverters for buildings	Hansol Hansol Technics $ 890 [million] Develops energy solutions in solar assembly	SHTIGEN ENERGY SYSTEMS SHTIGEN $ 21 [million] Develops solar energy systems and solutions	ecoVille energy EcoVile $ 14 [million] Builds solar power facilities	ECO STEP Eco Step Armenia $ 7 [million] Operates solar panel water treatment systems

III. Cooperation - CBS (Care Building Services LLC)

Projects

▪ Avedisian High School project

Armenia's First LEED-Certified Building

Achieved Silver certification in 2019

Start Date: October 10, 2012
Completion Date: August 31, 2014
Total Area: 8,400 ㎡

All major engineering and structural work was performed by CBS's in-house team

Solutions

- Application of efficient HVAC systems
- Introduction of a unique solar hot water system
- Use of polyurethane thermal insulation
- Installation of LED lighting
- Optimized architectural design with suitable windows and walls
- Light-colored roofing and green space development
- Installation of underground rainfall collection areas
- Recycling of concrete waste to produce concrete tiles
- Use of environmentally friendly materials for finishing, indoor air quality, and natural lighting




▪ Dilijan International School of Armenia


Armenia's First BREEAM-Certified Building

Be assigned a 'good' level in BREEAM rating of eco-efficiency of buildings.

CBS participated in this project and was contracted to design the electrical infrastructure, as well as all communication and control systems for the school and campus buildings

Solutions

- Design of Building Automation System (BAS)
- Design of electrical supply system
- Design of CCTV security
- Design of access control systems
- Design of fire alarm systems

III. Cooperation - CBS (Care Building Services LLC)

Projects

▪ Multi-story house at Malkhasyants 6/1

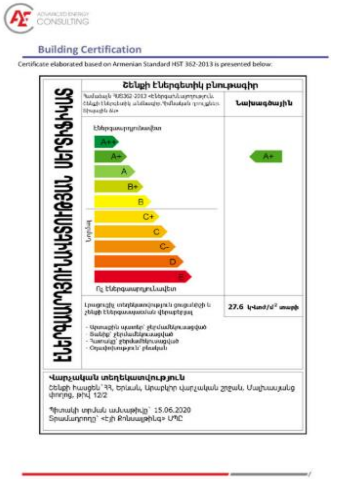
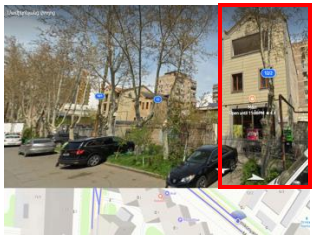
14-story residential building and A multi-level parking building	
	Malkhasyants 6/1 Street
CBS LLC	Developer / Designer / Main Contractor
Area of 1 Floor	1,131㎡
Area	28,000㎡
Construction Period	2021 Jun - 2024 Jun
Floors Above Ground	14
Floors Below Ground	1
Ceiling Height (m)	3

Features

- Participates in the national mortgage program
- A + class energy saving buildings, which allows to reduce energy costs by 50%
- Power supply station with 2 different power supplies,
- All apartments have floor-to-ceiling stained glass windows with aluminum thermal frames
- Only high-quality construction materials are used




▪ Building Certification Case

Building certification	Descrpition
	A Building Energy Efficiency Certification issued based on Armenian Standard HST 362-2013 **Rating** A+ Rating **Additional Information on Building Insulation and Energy Conservation** Exterior walls: Insulated Roof: Insulated Floor: Insulated Usage: Natural **Annual Energy Consumption of the Building** (27.6 kWh/㎡) **Building Address**: Republic of Armenia (RA), Yerevan, Arabkir Administrative District, Mamikonyants Street, Building No. 12/2 **Issuance Date**: June 15, 2020 **Issuing Organization**: 'AE Consulting' LLC
 Street view of address	

III. Cooperation - CBS (Care Building Services LLC)

Meeting agenda

Purpose
: Green building & Building Energy Efficiency Assessment case study and Gathering opinions

Key activities	**Assessment of Current Armenian Market Status and Comparative Survey with the Korean Market**				
Task	Market research on improving energy efficiency of buildings and recycling green buildings				
Related CBS projects	Avedisian High School project	Dilijan International School of Armenia	Multi-story house at Malkhasyants 6/1	Building certification case	
Main agenda	Analysis of the LEED certification process, application of eco-friendly technologies, and operational performance of the Avetisyan High School project	Expert consultation on key evaluation criteria and weightings for the introduction of a green building certification system in Armenia	Discussion on the expansion of green buildings and energy efficiency in Armenia from the perspective of construction and HVAC companies	Review of the possibility of including successful green building project cases and related data in the KSP casebook	Request for details on the operation, criteria, procedures, and market response of Armenia's building energy efficiency certification system

Questions

Agenda

Advised on Armenia's construction market, energy efficiency industry, major companies' performance, and market size analysis

Research Items : List of LEED and BREEAM certified buildings in Armenia

1. The Avetisyan High School project is the first building in Armenia to achieve LEED certification, and it has been confirmed that it complies with local and international environmental laws and standards.
   Specifically, it has been reported that efficient heating, ventilation, and air conditioning systems, solar water heating systems, insulation application, LED lighting, roof color adjustment and green space creation, rainwater collection space, concrete waste recycling tile utilization, and eco-friendly material use were implemented.
   We would like to know if there were any difficulties in this process and what the actual effects were.

2. LEED certification consists of evaluation categories such as sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, innovative design, and regional priority.
   Based on the experience of the Avetisyan High School project, we would like to hear your opinion on which category is expected to have a higher evaluation weight if a green building certification system exists in Armenia.

Questions 1, 2 Reference - Avetisyan High School Project

Agenda

Advised on Armenia's construction market, energy efficiency industry, major companies' performance, and market size analysis

- Avedisian High School project

Armenia's First LEED-Certified Building

Achieved Silver certification in 2019

Start Date: October 10, 2012

Completion Date: August 31, 2014

Total Area: 8,400 ㎡

All major engineering and structural work was performed by CBS's in-house team

Solutions

- Application of efficient HVAC systems
- Introduction of a unique solar hot water system
- Use of polyurethane thermal insulation
- Installation of LED lighting
- Optimized architectural design with suitable windows and walls
- Light-colored roofing and green space development
- Installation of underground rainfall collection areas
- Recycling of concrete waste to produce concrete tiles
- Use of environmentally friendly materials for finishing, indoor air quality, and natural lighting

Site Photo

Questions

Agenda

Advised on Armenia's construction market, energy efficiency industry, major companies' performance, and market size analysis

Research Items : List of LEED and BREEAM certified buildings in Armenia

3. To expand green buildings and improve building energy efficiency in Armenia, as a major company in the construction and HVAC sector with experience in green building and energy efficiency projects, we would like to ask if you could share your opinions on areas that need improvement or additional measures that should be considered.

4. As part of the KSP project, we plan to create a case study book benchmarking successful project cases. We would like to confirm whether it would be acceptable to include the Avetisyan High School project and other projects undertaken by your company in this study. If possible, could you share detailed materials on these projects?

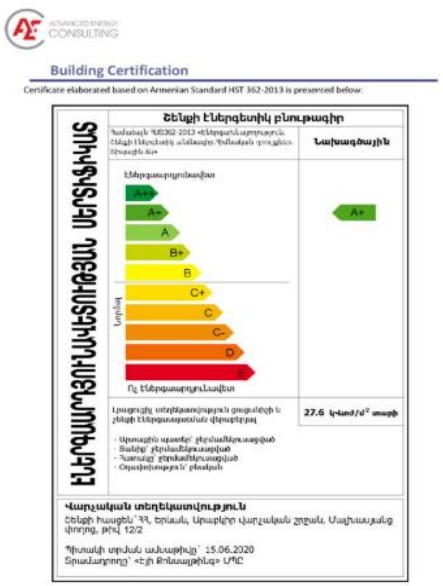
5. We have confirmed that energy efficiency certification documents for buildings in Armenia are posted in the References section of your company's website. We request explanations regarding the relevant projects and buildings, the background of certification issuance (e.g., client requests, provision of incentives), and the certification process.

Questions 5 Reference

Agenda

Advised on Armenia's construction market, energy efficiency industry, major companies' performance, and market size analysis

- Building Certification Case

Building certification	Descrpition
	A Building Energy Efficiency Certification issued based on Armenian Standard HST 362-2013 **Rating** A+ Rating **Additional Information on Building Insulation and Energy Conservation** Exterior walls: Insulated Roof: Insulated Floor: Insulated Usage: Natural **Annual Energy Consumption of the Building** (27.6 kWh/㎡) **Building Address**: Republic of Armenia (RA), Yerevan, Arabkir Administrative District, Mamikonyants Street, Building No. 12/2 **Issuance Date**: June 15, 2020 **Issuing Organization**: 'AE Consulting' LLC

Action item

No.	Item	Due date	Owner
1			
2			
3			
4			
5			