

Zero Energy Architecture's Role in Green New Deal

Zero Energy Architecture as New Industry: A Step toward Green New Deal

Keynote Announcement

I Technology/policy sharing for development and spread of private-led ZEB system I



KICT

한국건설기술연구원
KOREA INSTITUTE OF CIVIL ENGINEERING AND BUILDING TECHNOLOGY

Lee Seung-Eun



Table of Contents

- I. Carbon Neutrality and Green New Deal
- II. Reduction of GHG Emissions and ZEB/Market Cost
- III. Conclusions



I. Carbon Neutrality (Net-Zero) and Green New Deal



1-1 Carbon Neutrality (Net-Zero) and Green New Deal (Overseas Trend)



Strengthened target for GHG emissions reduction Emergence of Carbon Neutrality Framework

Carbon neutrality announcement by major countries

The agenda of 2050 Carbon Neutrality emerged at the UN Climate Summit
(Sept. 2019)

Each country formed Climate Ambition Alliance for climate target and led to
membership expansion (121 countries)



EU

Europe Green Deal (Dec. 2019): Announced 2050 Climate Neutral Target
- EUR 1 trillion invested in research of low-carbon technology (European Investment Bank)



USA

Biden, the presidential candidate of the Democratic Party: Announced 2050 Carbon Neutrality
- If elected, groundbreaking climate policies are expected such as 2035 Decarbonization in the power plant sector (Investment of USD 2 trillion)



China

2020 UN General Assembly (September): Announced to achieve carbon neutrality (by 2060)
- Implement to achieve emission peak before 2030 (invest 1.2% of annual GDP; USD 130–350 billion/year)

The future generation demands Real Zero, going beyond Net-Zero

1-2 Carbon Neutrality (Net-Zero) and Green New Deal (Overseas Green New Deal)



National strategy to foster environment and growth

Global Expansion of Green New Deal Policy

Green New Deal Announcement (expectations and fears)

Passed US House of Representatives in January 2019

Trump derogated Green New Deal as disaster that will bring unrealistic budgetary waste

Is the Green New Deal Dead?

By Joel Stronberg, originally published by [Civil Notion](#)

April 9, 2019

**A NEW DEAL
FOR CLIMATE JUSTICE**
“This is the only path towards a future
in which humanity defeats the climate
crisis, while upholding the principles
of social and international justice”

**GN
DE** ►► **DiEM25**

gndforeurope.com

Green New Deal Promises (GNDE (Green New Deal for Europe))

LIVING COSTS	PUBLIC SERVICES	JOB SECURITY	QUALITY OF LIFE
NATURAL DISASTERS	VOLUNTARY MIGRATION	OUR PAST	OUR FUTURE

For Green New Deal to be successful, it must be a concrete Green Real Deal.

1-3 Carbon Neutrality (Net-Zero) and Green New Deal (a Korean New Deal)

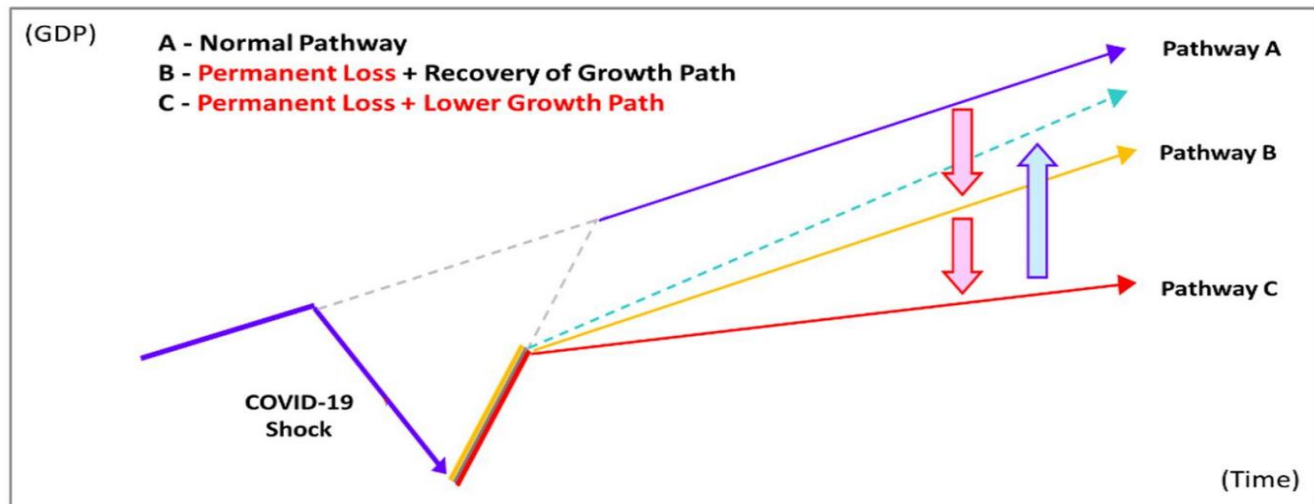


To overcome economic growth slowdown due to COVID-19 The Start of Korean New Deal Projects

Secure economic resilience to the economic downturn by COVID-19

The 2020 world economic growth is forecasted to be -4.5% following the shock of COVID-19. Korea forecasts -1%, which is the highest among OECD countries, but a strategy to combat long-term recession is still required.

Economic Impact due to COVID-19 and Expected Recovery Pathways



“Sustainable growth engine and future food source; Green Deal, a digital deal.”

1-4 Carbon Neutrality (Net-Zero) and Green New Deal (Korean New Deal)



Smart, Green, Safe Korean New Deal

Going to the direction of national change with the Korean New Deal project

Strengthen competitiveness of digital technology based on data, network, artificial intelligence (DNA) infrastructure

Harmony among people, nature, and growth for net-zero GHG emissions
Investment in human resources for strong job creation and establishment of social safety net

The Korean New Deal seeks to transform Korea into:

- **a smart country** that is at the center of a digital transition based on data, network and artificial intelligence (DNA) infrastructure¹;
- **a green country** that achieves a balance among people, nature and growth through a green transition towards net-zero emissions as a responsible member of the global community; and
- **a safe country** that invests in human resources for a strong employment and social safety net.



“Smart, Green, Safe”: A country that provides a smart, green, and safe environment for sustainability

1-5 Carbon Neutrality (Net-Zero) and Green New Deal (Korean New Deal)



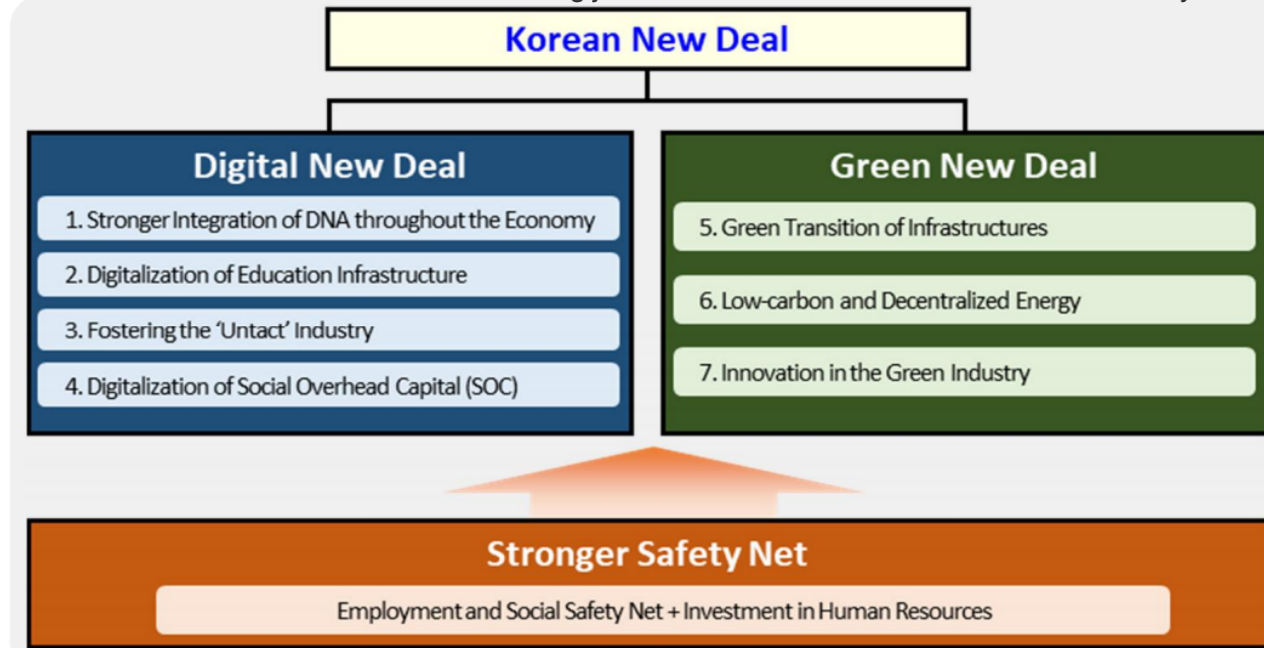
Digital, Green Korean New Deal

Going to the direction of national change with the Korean New Deal project

Strengthen competitiveness of digital technology based on data, network, artificial intelligence (DNA) infrastructure

Harmony among people, nature, and growth for net-zero GHG emissions

Investment in human resources for strong job creation and establishment of social safety net



Economic growth, creation of high-quality jobs,
and realization of safe, open-minded, human-centered society

1-6 Carbon Neutrality (Net-Zero) and Green New Deal (a Korean New Deal)



Digital, Green

Input Cost of Korean New Deal

Invest a total of KRW 160 trillion by 2025 and create 1.9 million jobs

Input KRW 73.4 trillion to Green New Deal, KRW 58.2 trillion to Digital New Deal, and KRW 28.4 trillion to strengthen safety net
(KRW 114.1 trillion of government expenditure, KRW 25.2 trillion of regional expenditure, and KRW 20.7 trillion of private expenditure)



From carbon-reliant to low-carbon economy, from unequal to tolerant society, and from pursuit economy to leading economy

1-7 Carbon Neutrality (Net-Zero) and Green New Deal (Korean New Deal)



Implement with focus on transforming public facilities into Zero Energy buildings

Overview of Korean Green New Deal

(trillion won, thousand jobs)

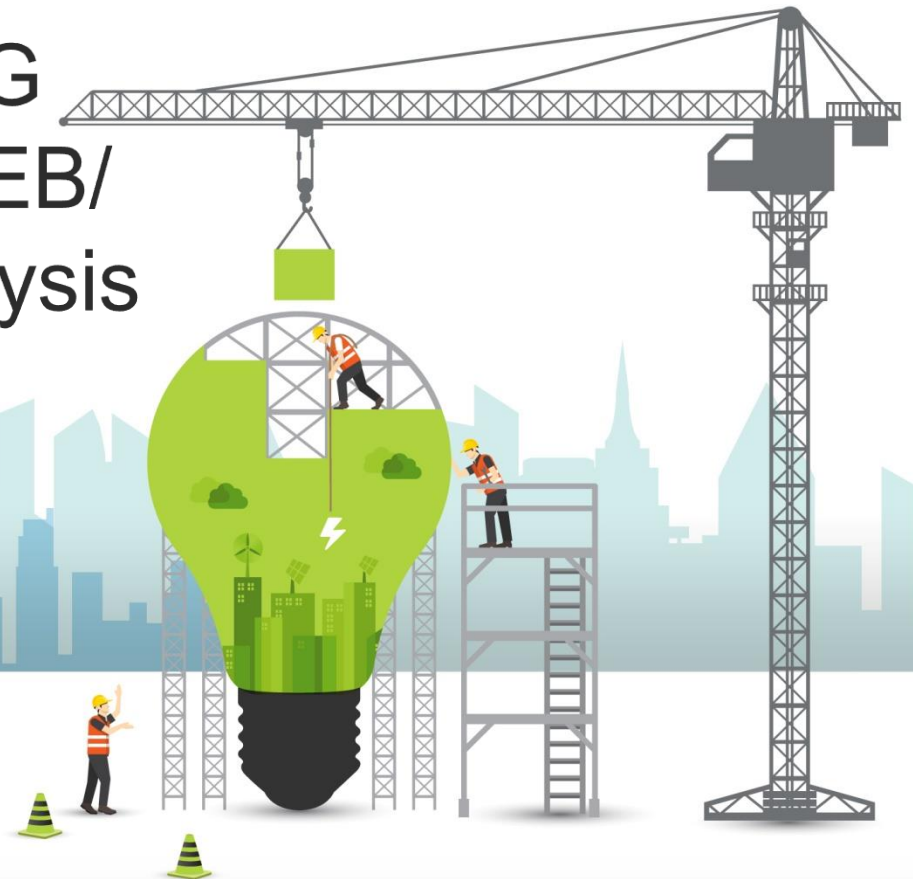
	Focus Areas	Projects	2020 SB -2022	2020 SB -2025	# of Jobs
Green New Deal	Total		19.6	42.7	659
	5. Green Transition of Infrastructures	Sub-total	6.1	12.1	387
		13) Turning public facilities into zero-energy buildings	2.6	6.2	243
		14) Restoring the terrestrial, marine and urban ecosystems	1.2	2.5	105
		15) Building a management system for clean and safe water	2.3	3.4	39
	6. Low-carbon and Decentralized Energy	Sub-total	10.3	24.3	209
		16) Building a smart grid for more efficient energy management	1.1	2.0	20
		17) Promoting renewable energy use and supporting a fair transition	3.6	9.2	38
		18) Expanding the supply of electric and hydrogen vehicles	5.6	13.1	151
	7. Innovation in the Green Industry	Sub-total	3.2	6.3	63
		19) Promoting prospective businesses to lead the green industry and establishing low-carbon and green industrial complexes	2.0	3.6	47
		20) Laying the foundation for green innovation via the R&D and financial sectors	1.2	2.7	16



Build green facilities and social infrastructure, low-carbon and decentralized energy systems, and innovative green industry

II.

Reduction of GHG Emissions and ZEB/ Market Cost Analysis



2-1 Korean Reduction of GHG Emissions and ZEB (2030 National Target Emissions)



2030 GHG Emissions Target by category

Building category reduced 24% by 2017 emissions, and 37% by BAU

(Unit: million ton CO₂, %)

Category		Emissions (2017)	Emissions forecast (2030, BAU)	Reduction target		
				Target Emissions	Per BAU Amount of reduction (reduction rate)	Key means to reduction
Target by domestic category		-	850.8.	574.3.	Δ276.4 ¹ (32.5%)	
Emission source Reduction	Industry	392.5.	481.0.	382.4.	Δ 98.5 (20.5%)	<ul style="list-style-type: none"> - Improve efficiency - Replace coolant - Change fuel/material - Recycle waste heat
	Building	155.0	197.2	132.7	Δ 64.5 (32.7%)	<ul style="list-style-type: none"> - Enhance insulation (new-existing) - Improve facilities - Expand BEMS
	Transportation	99.7.	105.2.	74.4.	Δ 30.8 (29.3%)	<ul style="list-style-type: none"> - Expand eco-friendly vehicles - Improve fuel efficiency - Supply eco-friendly ship - Bio-diesel
	Waste	16.8.	15.5.	11.0.	Δ 4.5 (28.9%)	<ul style="list-style-type: none"> - Expand recycling - Collect methane gas
	Public (others)	20.0.	21.0.	15.7.	Δ 5.3 (25.3%)	<ul style="list-style-type: none"> - LED lighting - Expand renewable energy
	Agriculture and livestock	20.4.	20.7.	19.0.	Δ 1.6 (7.9%)	<ul style="list-style-type: none"> - Turn excrements to energy - Water management in rice paddy
	Omissions, etc.	4.8.	10.3.	7.2.	Δ 3.1 (30.5%)	
Means of Reduction	Transition	(253.1)	(333.2) ²	(192.7)	(Δ140.5) ³ (42.2%)	<ul style="list-style-type: none"> - Improve electricity-nuclear power mix - Demand control
	E-New Industry CCUS		-	-	Δ10.3	- Carbon capture-use-packing
Overseas reduction, etc.			-	-	Δ38.3 (4.5%)	Absorption by forest + utilize international market
Means of Reduction	Source of absorption by forest	(-41.6)	-	-	Δ22.1	<ul style="list-style-type: none"> - Create economic forest complex - Expand urban forests
	Overseas reduction, etc.		-	-	Δ16.2	<ul style="list-style-type: none"> - Mutual cooperation - SDM
Total		709.1 ⁴	850.8.	536.0.	Δ 314.8 (37%)	Domestic (32.5%)+ Overseas (4.5%)



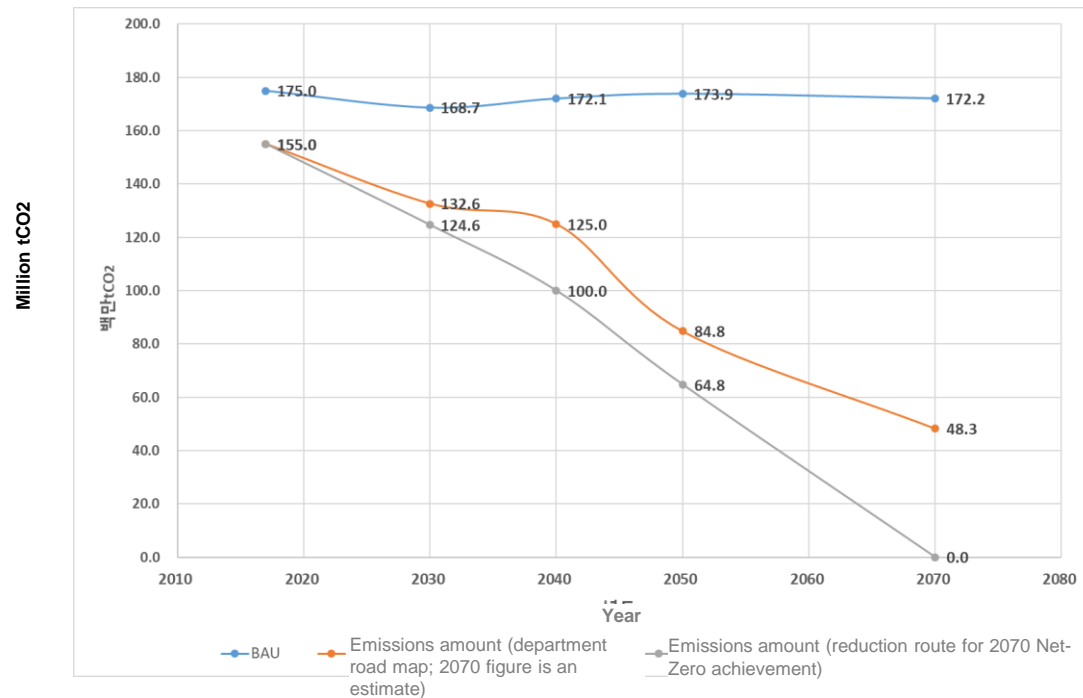
2-2 Korean GHG Emissions Reduction Road Map (Net-Zero Scenario)



Net-Zero Scenario linked to the national road map (2070 Net-zero) Extension of national GHG emissions reduction road map (until 2030)

2070 Net-Zero achievement scenario based on the National GHG Emissions Reduction Road Map

2030 emissions target is 132.6 million tons (confirmed); 2050 emissions target is 84.8 million tons
To realize Net-Zero by 2070, overall scenario including current 2030 target must be amended
(Picture below is an example of the reduction route.)



At present, LEDS (Long-term Low GHG Emission Development Strategy) is in preparation, and strengthened reduction target is expected to be presented.

2-3 ZEB Business Model Targets



Technology, Market, Target Building, Cost, Player Categorization of Functions and Roles of ZEB New Industry

To realize accurate Zero Energy buildings, technology categorization and role must be precise

All buildings cannot be turned into ZEBs simultaneously; a gradual approach by priority of each country is required

Generally starts in the public sector; technology starts passive then processes to active and, eventually, to renewable energy

Target Building	Technology	Market	Cost Optimal	Player (Fair)
New Buildings	Passive	Materials (Passive)	Initial Cost	Company
Existing Buildings	Active	Systems (Active)	Finance	Government
Residential	Renewables	Renewables	Maintenance	Architect
Commercial	Control	Design	Lifespan of Systems	Owner
Public	Smart Grid	Construction	Tax	Tenants
Private	Data, Network, AI	Real Estate	Utility Bill	Consultants



Setting clear targets, providing customized solutions, and developing fair market

2-4 GHG Emissions Reduction of Existing Buildings



Buildings older than 30 years account for 37.8% of all buildings (2,740,000 buildings)

Categorization of Deteriorated Buildings

Set the remodeling priority of existing buildings

While it is true that old buildings lose energy efficiency, individual diagnosis is required to determine renovation
To determine suspicious buildings such as facilities with confirmed COVID-19 cases, a data-based diagnostic tool needs to be developed

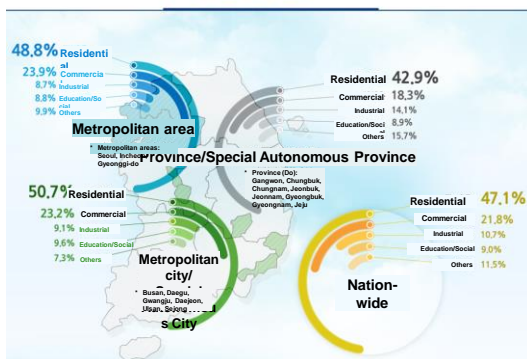
[Status of Deteriorated Buildings by Purpose of Construction (as of the end of 2019)]

(Unit: %)

Category		Total		Residential		Commercial		Industrial		Education/Social		Others	
		Number of buildings	Gross area	Number of buildings	Gross area	Number of buildings	Gross area	Number of buildings	Gross area	Number of buildings	Gross area	Number of buildings	Gross area
Nation-wide	Less than 10 years	17.4	25.4	13.7	24.3	22.3	27.8	29.9	30.9	19.2	21.4	25.4	23.8
	10 to 19 years	16.9	27.8	12.2	28.0	23.4	28.5	31.7	29.0	29.4	32.1	24.7	20.9
	20 to 29 years	20.5	28.9	18.3	29.4	22.9	24.9	22.0	23.1	24.3	24.4	28.1	43.3
	More than 30 years	37.8	15.7	47.0	16.7	27.0	17.5	13.5	14.2	19.4	16.3	16.7	9.3
	Others	7.3	2.2	8.8	1.6	4.4	1.3	2.8	2.8	7.7	5.8	5.1	2.7
Metropolitan area	Less than 10 years	19.2	24.7	16.1	23.2	22.4	27.2	31.1	35.2	18.2	21.7	26.5	19.7
	10 to 19 years	20.9	29.9	16.3	31.3	25.4	30.6	37.8	32.3	31.0	32.8	27.7	17.1
	20 to 29 years	23.5	29.6	24.0	30.5	21.3	23.3	19.1	18.3	25.7	24.4	28.9	54.7
	More than 30 years	29.0	14.2	34.9	14.0	26.1	17.7	9.6	12.4	17.6	16.3	10.0	6.4
	Others	7.3	1.5	8.7	1.0	4.9	1.1	2.4	1.8	7.4	4.8	6.8	2.1
Province	Less than 10 years	16.7	26.0	12.8	25.2	22.2	28.4	29.2	28.4	19.6	21.3	25.1	26.3
	10 to 19 years	15.4	26.0	10.7	25.1	22.4	26.3	28.0	27.1	28.7	31.5	24.0	23.4
	20 to 29 years	19.4	28.3	16.2	28.4	23.7	26.5	23.7	25.9	23.7	24.4	27.9	36.0
	More than 30 years	41.2	17.0	51.5	19.1	27.5	17.3	15.9	15.3	20.2	16.3	18.3	11.2
	Others	7.3	2.7	8.9	2.2	4.1	1.4	3.1	3.4	7.9	6.6	4.7	3.1

Source: Ministry of Land, Infrastructure and Transport, press release, 2020.02.27

Status of buildings by purpose of construction (2019)



As the current existing buildings' energy diagnoses show high costs, low-cost

- Short-term, smart, low-cost Building Energy Performance Diagnosis -
diagnosis techniques need to be developed

2-5 Renovation Market for Existing Buildings (General Market)



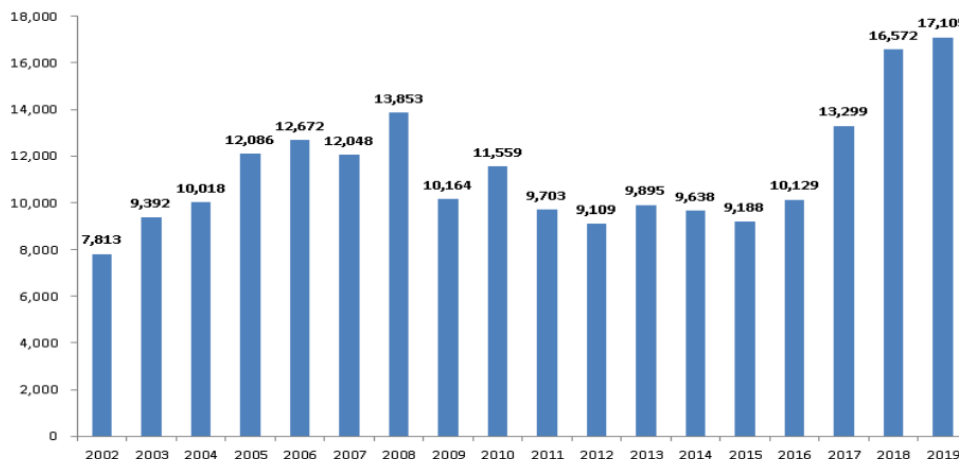
Current trends and forecast of building renovation market

As of 2019, Korea's building renovation market is worth KRW 17.1 trillion
Forecasted to grow into KRW 23.3 trillion by 2025, and KRW 29.3 trillion by 2030 (Park Yong-Seok)

The renovation market presented is calculated by extension/reconstruction/transfer/major repair/change of purpose of use.

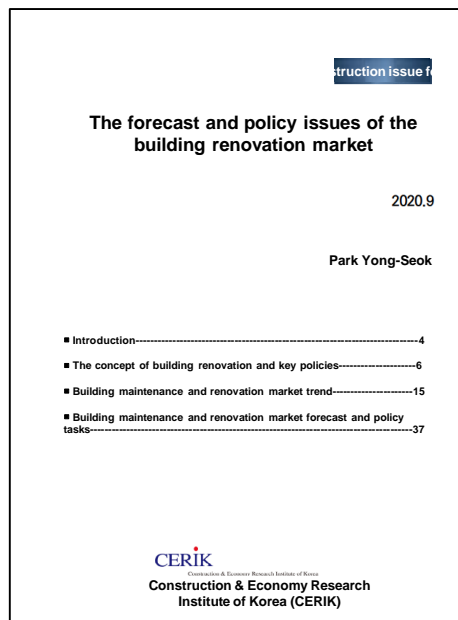
[Size of the building renovation market (actual price per 2015)]

(Unit: KRW billion)



Category	2020 years	2050 years	2030 years	Average annual growth rate
Building maintenance market	12,795	13,795	14,723	1.4
Building remodeling market	17,293	23,321	29,350	5.4
Total	30,088	37,080	44,073	3.8

Source: Park Yong-Seok, The forecast and policy issues of the building renovation market (p31), CERIK, Sept. 2020.



The key to energy renovation is implementing it simultaneously with general building deterioration renovation.

2-6 Annual Renovation Supply (Residential Buildings)



Existing buildings

Annual Renovation Result (nonresidential buildings per total supply)

Residential annual energy improvement rate is 0.7% on average, which does not meet the IEA recommendation of 3%

90% of energy improvement of residential buildings is implemented in their reconstruction/redevelopment

However, demand for reconstruction/redevelopment of buildings is expected to fall; therefore, the development of promotional policies and support techniques for general renovation-type energy improvements is needed

Category	2015		2016		2017		2018		Average	
	Area [1,000m ²]	Ratio ⁶⁾	Area [1,000m ²]	Ratio ⁶⁾	Area [1,000m ²]	Ratio ⁶⁾	Area [1,000m ²]	Ratio ⁶⁾	Area [1,000m ²]	Ratio ⁶⁾
Total area of housing ¹⁾	1,713,000	100%	1,761,000	100%	1,784,000	100%	1,840,000	100%	1,774,000	100%
Extension/reconstruction/transfer/major repair/change of purpose of use ²⁾	791.	0.05%	804.	0.05%	744.	0.04%	621.	0.03%	740.	0.04%
Reconstruction/redevelopment ³⁾	11,213.	0.65%	9,949.	0.56%	12,874.	0.72%	12,173.	0.66%	11,552.	0.65%
Residential environment improvement project (completed projects) ⁴⁾	240.	0.01%	425.	0.02%	629.	0.04%	11.	0.00%	326.	0.02%
Total area of repaired housing ⁵⁾	12,468.	0.71%	11,273.	0.63%	14,383.	0.80%	12,841.	0.70%	12,619.	0.71%

1) Extracted from EAIS, building register.

2) Aggregated relevant parts in the construction permissions and construction commencement statistics, and construction status by city and province (cited figures from Park Yong-Seok, The forecast and policy issues of the building renovation market (Sept. 2020)).

3) Data provided by Real Estate 114 (Maeil Business Nov. 12, 2020 Re-cited from the following article: <https://www.mk.co.kr/news/realestate/view/2019/11/933550/>).

4) Applied the estimation derived from the completed projects of the Ministry of Land, Infrastructure and Transportation statistics portal, Urban Redevelopment Project Statistics, Yearly Residential Environment Improvement Project Status (No. of yearly project housing statistics × projects completed/total no. of projects).

5) The sum of 2) + 3) + 4).

6) Ratio of each repair project on the total area of the residential building in the relevant year (EU recommends 3% as the energy repair target for annual building enhancement).

2-7 Annual Renovation Supply (Nonresidential Buildings)



Existing buildings


Annual Renovation Supply (nonresidential buildings per total supply)

Nonresidential annual energy improvement rate is 1.7% on average which does not meet the IEA recommendation of 3%

Renovation rate of nonresidential buildings is on average 1.5% which is higher than that of residential buildings

Nonresidential commercial buildings have high change of renovation due to the frequent change of the purpose of use by the change of business type the building is leased for. Energy improvement is implemented basically as the building is under energy regulation even after the change of the purpose of use.

However, guidance and support are required for more proactive energy improvement in the future.



Category	2015		2016		2017		2018		Average	
	Area [1,000 m ²]	Ratio ³⁾	Area [1,000 m ²]	Ratio ³⁾	Area [1,000 m ²]	Ratio ³⁾	Area [1,000 m ²]	Ratio ³⁾	Area [1,000 m ²]	Ratio ³⁾
Total area of nonresidential building ¹⁾	1,031,878	100%	1,082,817	100%	1,115,263	100%	1,153,987	100%	1,095,986	100%
Extension/reconstruction/transfer/major repair/change of purpose of use ²⁾	16,978	1.65%	14,987	1.38%	15,647	1.40%	19,844	1.72%	16,864	1.54%

1) Extracted from EAIS, building register.

2) Aggregated relevant parts in the construction permissions and construction commencement statistics, and construction status by city and province (cited figures from Park Yong-Seok, The forecast and policy issues of the building renovation market (Sept. 2020)).

3) Ratio of each repair project on the total area of the nonresidential building in the relevant year (EU recommends 3% as the energy repair target for the annual building enhancement).

Some countries implement lease and sales restriction policies
for buildings with low energy efficiency.

2-8 Renovation Fulfillment Rate Enhancement Plan (Regulatory and Nonregulatory)



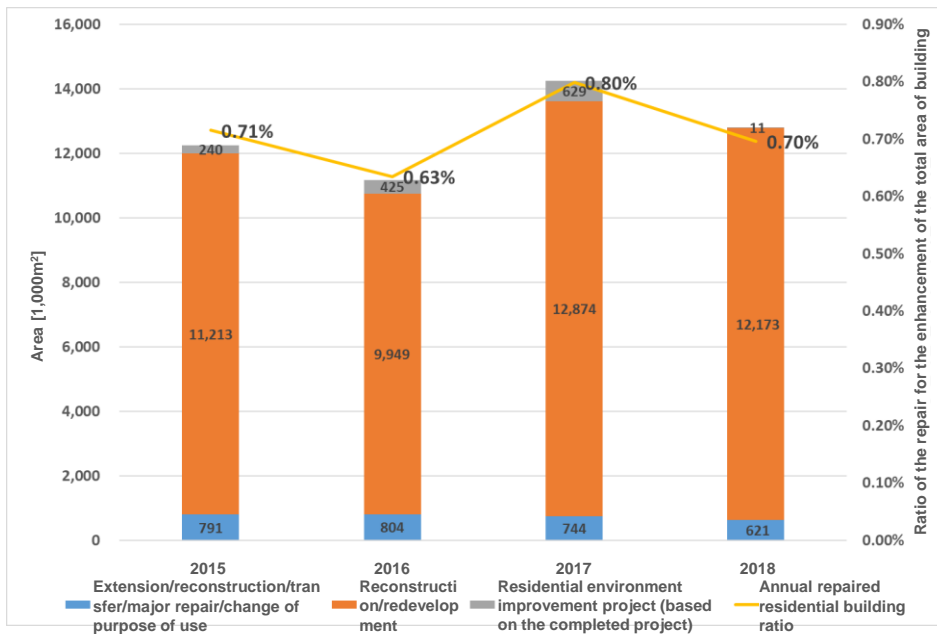
For enhancement of low renovation fulfillment Building Energy Renovation Expansion Effort

Residential buildings 0.7%, nonresidential buildings 1.5% -> Need to establish a plan to expand to 3% level

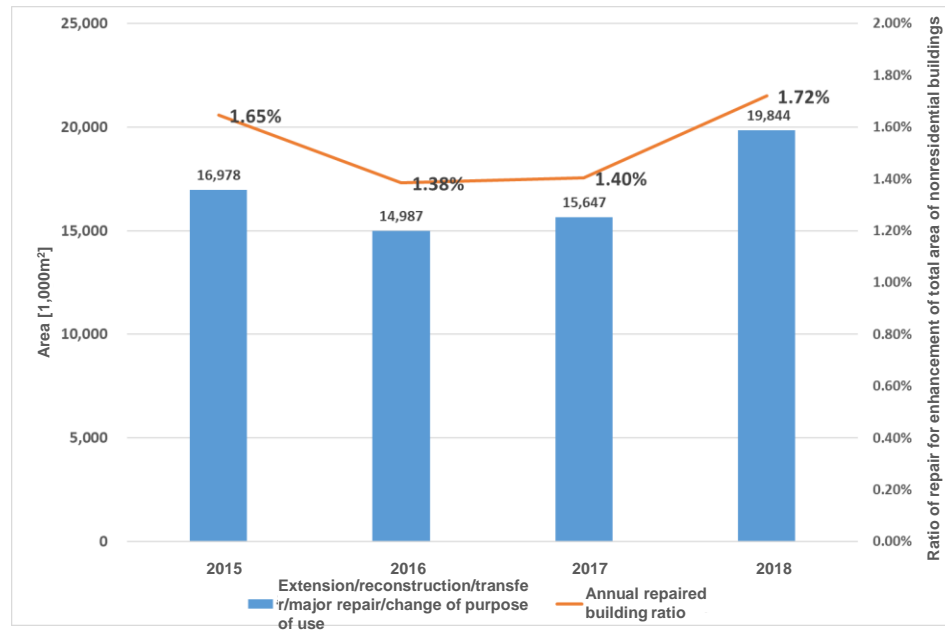
Should materialize strategy whether to proceed to the energy renovation regulation or nonregulation on existing buildings

- Europe implements a support policy called Building Renovation Passport
- US (New York City) and some other countries implement obligatory policy that limits energy use

[Renovation fulfillment rate of residential buildings]



[Renovation fulfillment rate of nonresidential buildings]



Promotional policy that considers “carrot and stick” approach needed for renovation of existing buildings

2-9 Obligatory Zero Energy Building Implementation Market Cost Analysis Scenario

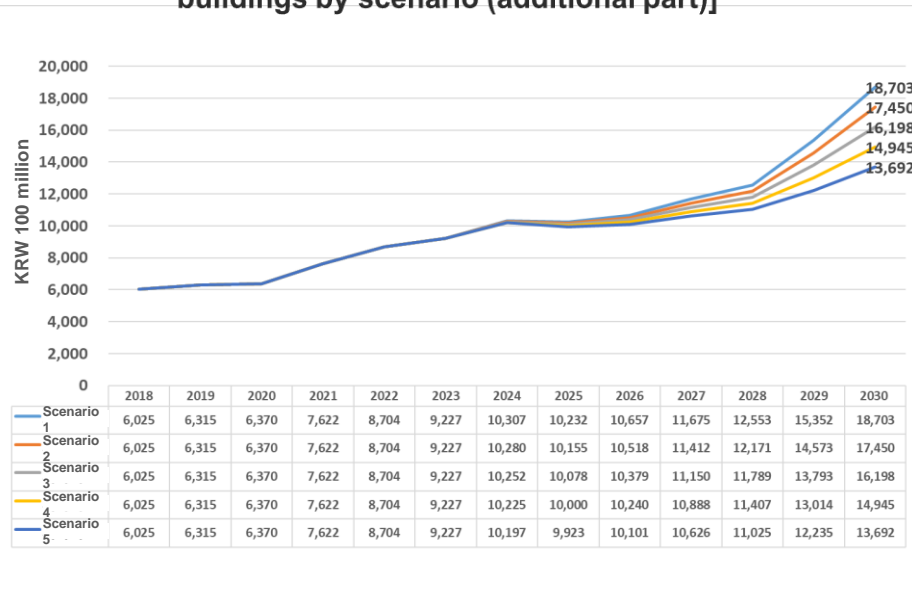


For expansion of Zero Energy buildings Cost Analysis (Residential Building Category, New Buildings)

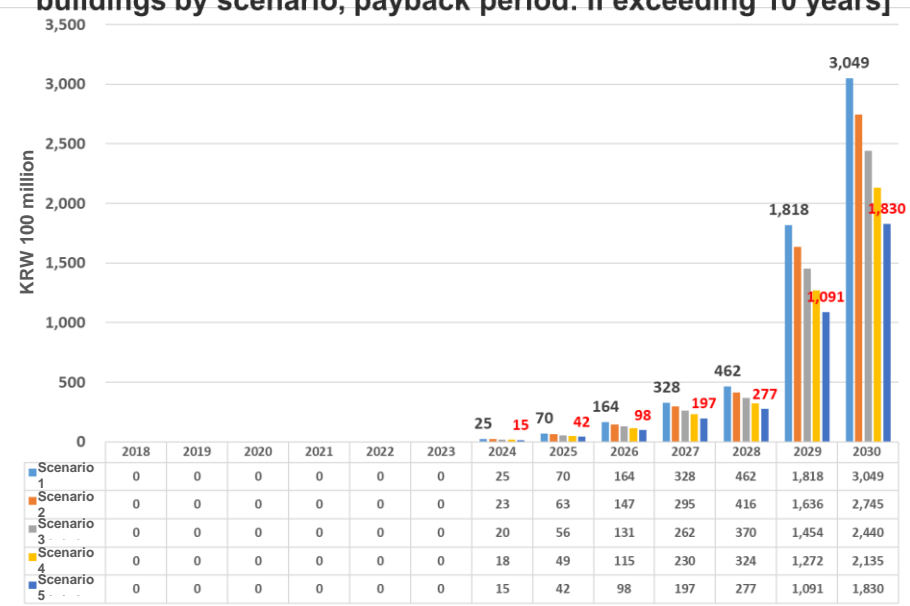
Estimation of cost increment by the expansion of Zero Energy housings
(residential buildings)

If the cost of 1st grade Zero Energy 85 m² apartment is KRW 20 million
Gradual reduction by 10% to reach minimum KRW 10 million
For government support, if initial investment cost exceeds 10 years, assume that
compensation will be made by government support.

[Market cost of implementing Zero Energy to new residential buildings by scenario (additional part)]



[Cost of providing support for Zero Energy of new residential buildings by scenario, payback period: If exceeding 10 years]



Assume that the additional cost incurred by mandatorization
is set within average 5% of the construction cost

2-9 Obligatory Zero Energy Building Implementation Market Cost Analysis Scenario



For expansion of Zero Energy buildings Cost Analysis (Nonresidential Building Category, New Buildings)

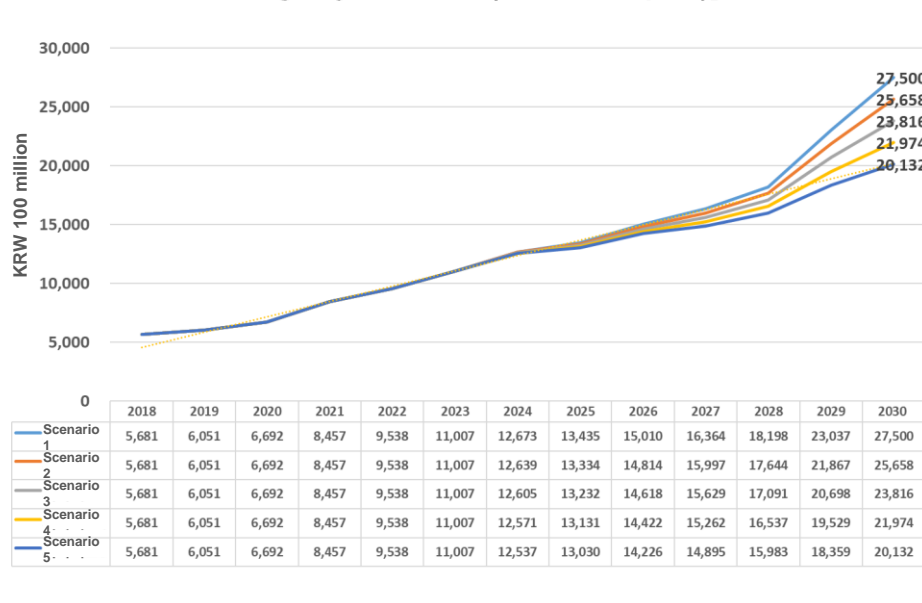
Estimation of cost increment by expansion of Zero Energy housings (nonresidential buildings)

Apply the scenario with the assumption of 1st grade Zero Energy cost as KRW 250,000/m²

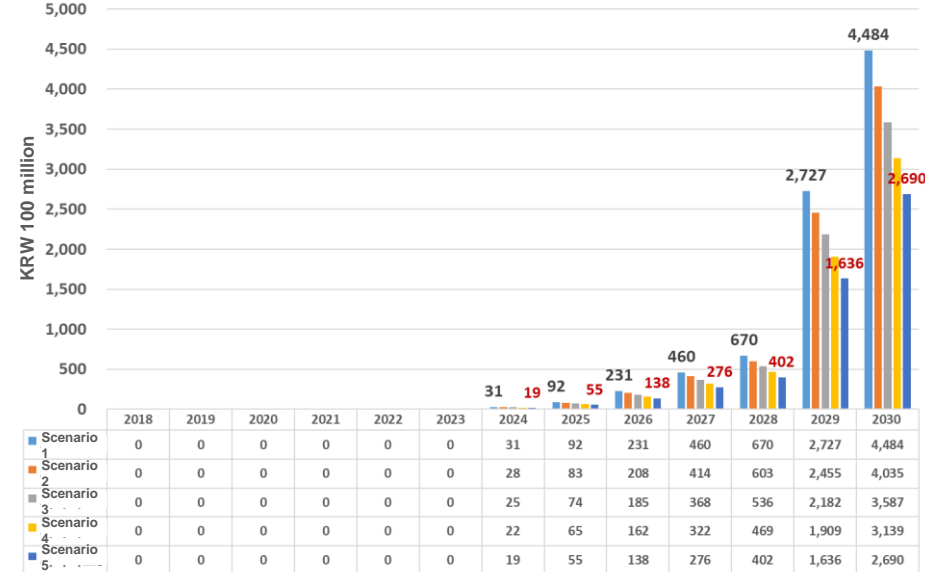
Gradual reduction by 10% to reach minimum KRW 150,000

For government support, if the initial investment cost exceeds 10 years, assume that compensation will be made by government support.

[Market cost of implementing Zero Energy to new nonresidential buildings by scenario (additional part)]



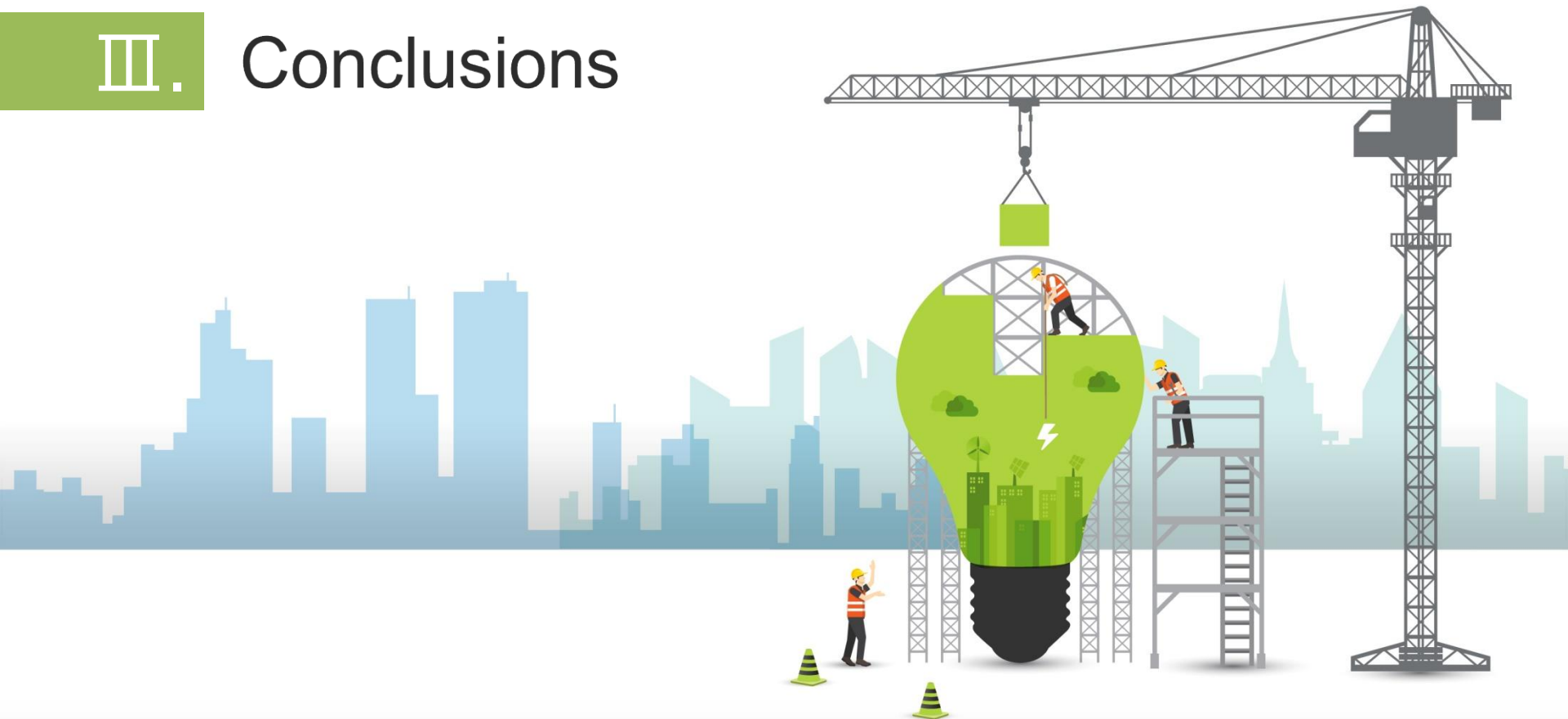
[Cost of providing support for Zero Energy of new nonresidential buildings by scenario, payback period: If exceeding 10 years]



Obligatory distribution of Zero Energy starts from cost analysis

III.

Conclusions





Conclusions

- **Prepare to transit from Nearly Zero to Net-Zero (link to LEDs and National GHG Emissions Reduction Policy)**
- **Materialize Zero Energy implementation plan on existing buildings (regulatory or nonregulatory focus)**
- **For Net-Zero energy of individual building units, implement regional unit cost optimization strategy, rather than high-cost/building unit (strengthen interdivisional synchronization)**
- **Detailed grouping of new industry by ZEB (exit heat energy devices excluding electricity-based devices; mid- to long-term basis)**
- **Barriers to Zero Energy implementation on existing buildings must be approached with consideration for technical, cost, and time issues. Zero Energy renovation is viable when all three elements are justifiable. (Review real estate market intervention policy in leases and sales)**

For distribution and dissemination of low-energy buildings Development of integrated support system for building energy

Thank you!

