Technology Commercialization and Market Expansion According to the ZEB Roadmap

October 27th, 2020

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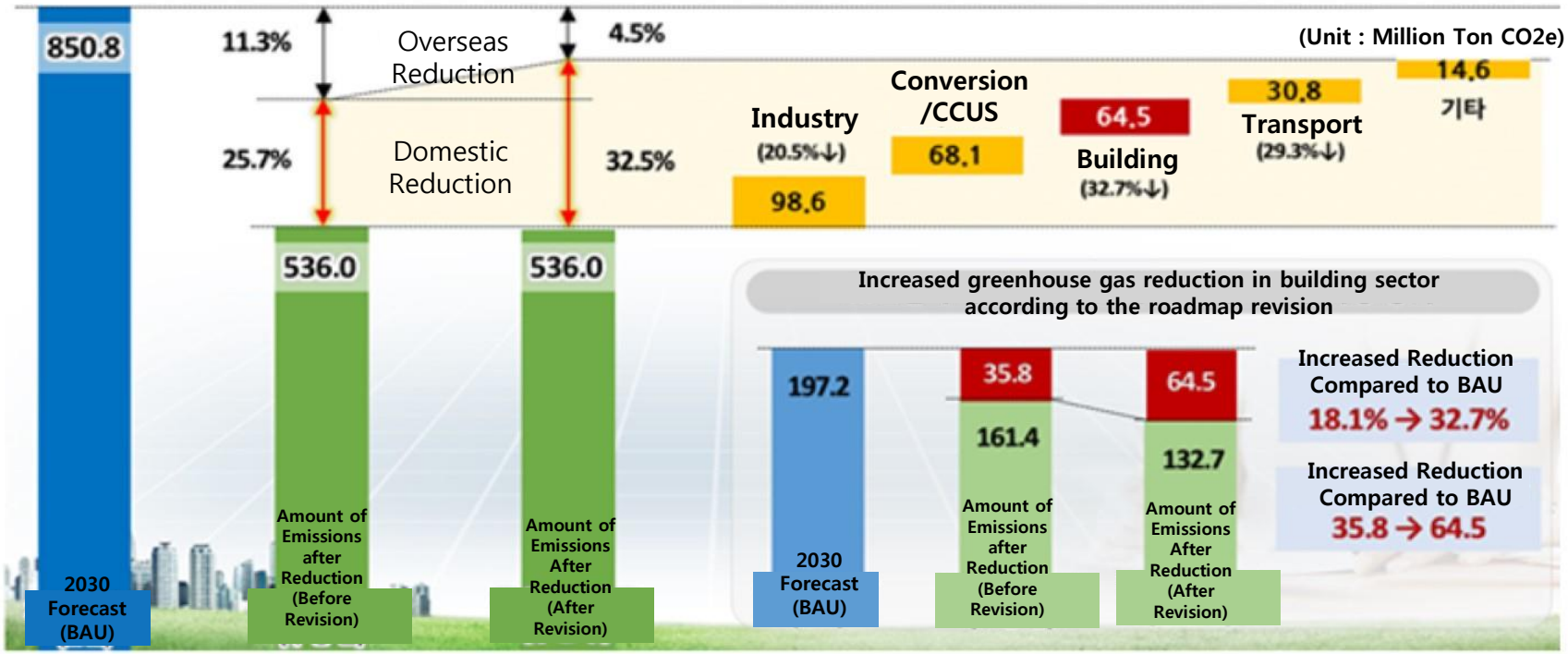
The Direction and Implications of Korea's ZEB Roadmap

1 The Direction and Implications of Korea's ZEB Roadmap

Key Measures for New Construction Sector to Achieve National 2030 Greenhouse Gas Reduction Goals



Building Sector Classification (Bureau In Charge)	Emission Reductions	Reduction Measures
New Building (Ministry of Land, Infrastructure&Transport)	5.4 million tons	• Strengthening the standards step-by-step for new buildings such as making zero energy goal mandatory
Existing Building (Ministry of Land, Infrastructure&Transport)	9.6 million tons	• Activating green remodeling • Expanding linkage with urban regeneration projects
Improving Consumption (Ministry of Land, Infrastructure&Transport)	5.8 million tons	• Improving building energy efficiency • Developing BEMS technology, and data-based services
Facility & Renewable Energy (Ministry of Trade, Industry&Energy)	15.2 million tons	• Improving energy efficiency of home appliances office equipment • Expanding LED lighting • Expansion of renewable energy supply such as solar and geothermal energy

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Accelerating Zero Energy through the Second Basic Plan for Green Buildings (2020-2024)

>>> To improve the quality of citizen's lives through green architecture, promote innovative growth, and lead a low-carbon/low-energy society,
five major initiatives, 12 major policy tasks, and detailed practical tasks are presented

Vision

Green Architecture Contributing to Improving Citizens' lives, Realizing Innovative Growth and Leading Low-Carbon/Low-Energy Society

Basic Direction

Pre-emptive Implementation of Enhanced National Greenhouse Gas Reduction Goals + **Securing New Growth Engines for Green Building Industry and Enhancing International Competitiveness**

Implementation Strategy

- **Strategy 1** Reinforcing Energy Performance in New Building
- **Strategy 2** Promoting Greening of Existing Buildings
- **Strategy 3** Improving Innovative Growth Capacity in the Green Building Industry
- **Strategic 4** Expanding Green Architecture
- **Strategic5** Expanding Green Building Market Infrastructure

Policy Tasks

1. Accelerating the supply of zero-energy buildings
2. Elevating the energy performance standards of new buildings
3. Activating Green Remodeling of Deteriorated Buildings
4. Energy efficient operation and management of buildings
5. Creating a new business linked with the 4th Industry
6. Advancing the green building industry
7. Inventing new green building projects
8. Making green building services more accessible to citizens
9. Increasing incentives
10. Strengthening domestic & international cooperation
11. Systematic training of human resources
12. Strengthening local capacity

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Progress of Mandatory Implementation of Zero Energy Building and Future Roadmap

- **2009** Announcement of Mandatory Zero Energy Building Plan: Zero Energy Building Construction becomes mandatory by 2025
- **2010** Enforcement of the obligation to obtain Grade 1 energy efficiency certification for buildings (business facilities over 3,000m2) in public institutions
- **2011** Announcement of strategies for promoting green building and reinforcement of building insulation standards (Wall U-Value 0.36W/m2・K)
- **2012** Enactment and promulgation of the Green Building Construction Support Act
- **2013** Enforcement of mandatory first-class energy efficiency certification for all public institutions and strengthening standards for building insulation
- **2014** Announcement of the Zero Energy Building Revitalization Plan, Selection of Low-rise Pilot Project, and Announcement of the 1st Basic Plan for Green Buildings
- **2015** Zero Energy Building High-rise Pilot Project Selection (2 locations)
- **2016** Selection of pilot projects for complex types, educational research facilities (4 locations), reinforcement of building insulation standards
- **2017** Implementation of Zero Energy Building Certification System
- **2018** Reinforcement of Building Insulation Standards (Wall U-Value 0.15W/m2・K)
- **2019** Announcement of the Roadmap for Mandatory Modification of Zero Energy Buildings, Announcement of the 2nd Basic Plan for Green Buildings
- **2020** Enforcement of Zero Energy Building obligations when constructing new public buildings (larger than 1,000m2, excluding multi-family housing) or extending their annex buildings
- **2025** Enforcement of Zero Energy Building obligations when constructing new public buildings (larger than 500m2), private buildings (larger than 1,000m2), and an apartment house (more than 30 households)
- **2030** Enforcement of Zero Energy Building obligations for Public and Private Buildings (larger than 500m2)

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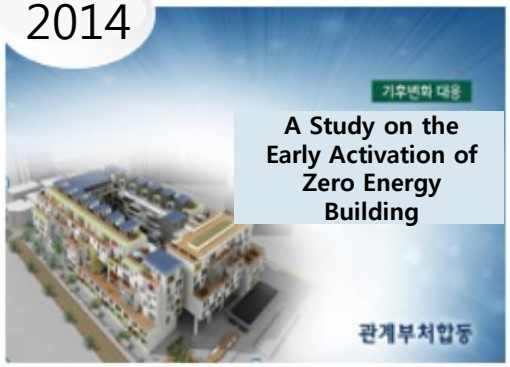
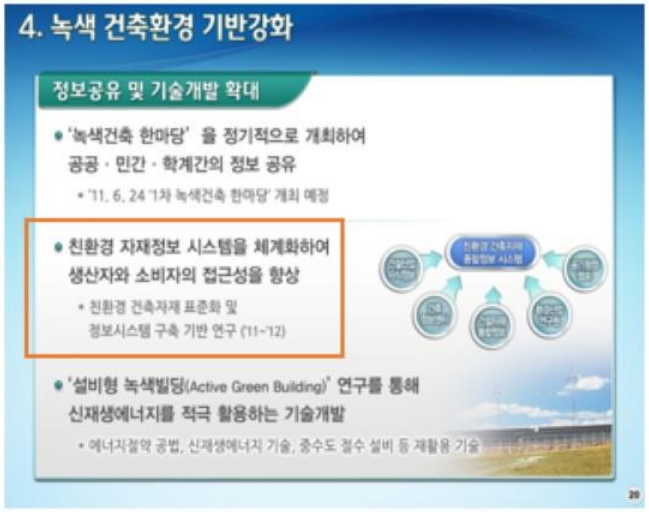
Market and Policy Implications for Zero Energy Buildings

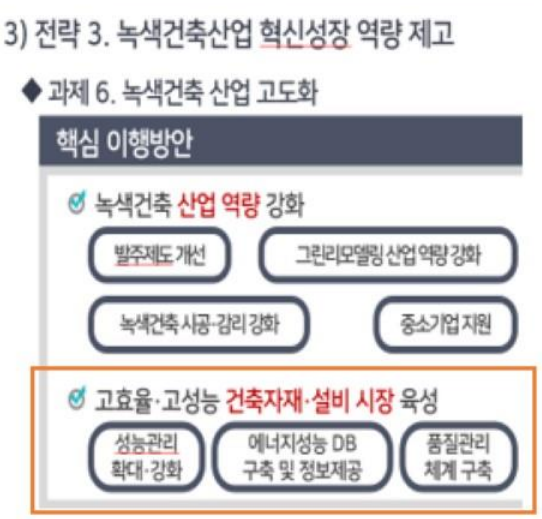
2011

2014



2019





Information on materials and market-related plans have been mentioned in the government plan since 2011, however the fact that effective management of data and establishment of system have yet to be achieved implies the further need to develop a strategy to promote market and industry.

A New Market and Business of Zero Energy Building

- **Zero Energy Buildings lead a paradigm shift in promoting new convergence between the building industry, the energy industry, and the ICT industry in terms of solving global problems caused by energy, climate change and fine dust.**

탈탄소화 Decarbonization

Through simulation, energy requirements such as heating, cooling, and hot water and CO2 generation are assessed and oriented to achieve zero energy

분산화 Decentralization

Installing and linking optimized renewable energy such as PV, BIPV and fuel cell to each building is essential

디지털화 Digitalization

Evolution of new industries and services through the interface of new technologies such as AICBM to traditional services

Creating a ZEB Market Ecosystem and Expanding Market

Certification (Reliability, Suitability label) : Energy efficiency certification of new/ existing buildings, facility certification, BEMS certification, etc.

Supply (Good-quality products, Business proliferation): Support the dissemination of new technologies/new products, purchase and promote good-quality products in priority, and raise public interest.

Industrialization (Market, Economic Growth): Connecting front and rear industries related to zero-energy buildings and creating related ecosystems

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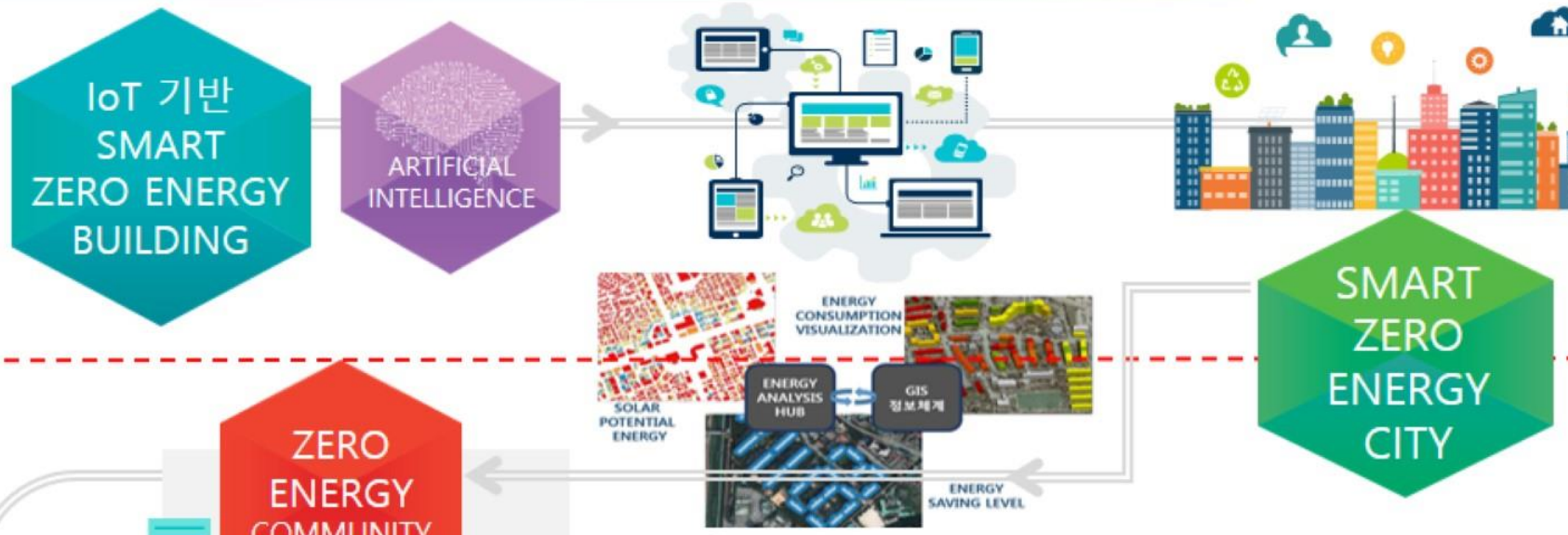
Zero Energy Smart Technology Leads Low Carbon Social Model



AICBM-linked Zero Energy City Building for Low Carbon Society

Avoid	Energy demand, CO2 emissions reduction, climate change mitigation
Shift	Transition to high energy efficiency, low CO2 emission systems
Improve	Smart technology expands healthy and pleasant life, low-carbon industries and jobs

Technology Innovation + Policy Measures + Market Economy

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Market Transformation and Policy Linkage for Zero Energy Building Ecosystem

Drive market transformation through a combination of various policy measures to improve energy efficiency.

- Changing market structure through active policy interventions to enhance the effectiveness of zero-energy buildings
- Mainstreaming high-efficiency buildings and expanding the market share of zero-energy buildings by adjusting the role of policy packages such as MEPS, building energy certification, incentive and training, R&D, and distribution of new technologies, depending on market acceptability

Changes in policy-to-policy links, inter-technology links, inter-industry links, policy-technology-to-industry links and detailed plans are necessary to expand the topic of zero energy buildings in urban and national levels.

- **(Inter-department collaboration)** Collaboration with related departments in charge of materials, facilities, construction, distribution of renewable energy, improvement of energy efficiency, EMS, and greenhouse gas.
- **(Collaboration between policies)** Conceptualizing "low-carbon" in various policies and projects that encompass housing, architecture, urban and national development
- **(Platform proliferation)** A platform where information, technology, business, and policies interact, and create and develop services.

The Fourth Industrial Revolution is linked to multiple energy sectors, leading the future growth.

Super-connected society, the Fourth Industrial Revolution rapidly transforms energy and ICT convergence, induce digitalization, connect future technology and Biztech to smart energy supply and use, lead intelligent product production without the limitation of time and space.

A Study on the Development of Innovative Industrial Ecosystem to Expand Zero Energy Building Market

Direction of Change in Innovating Zero Energy Building Industry

Creating new businesses through technology innovation and convergence

Developing and converging technologies such as innovative technologies and ICT	• Creating new businesses through conversion of innovative technologies • Link AICBM technology to traditional technology and industry
A new arena of inter-sector, inter-industry competition	• The boundaries between architecture, machinery, electricity generation, and renewable energy is becoming more ambiguous • Software and ICT companies are actively engaging in different sectors
Simple, single -> aggregate, Transition to the Service Market	• Link energy, safety and convenience industries • Comprehensive solutions, service providers lead the market

Market Expansion

Energy Saving

Cost Saving

[Intelligent Energy Demand Management] Optimized Energy Management Solution Using Big Data
[3D Printing, PRE-FAB.] Automation and optimization of manufacturing production, including solar modules, building structures, and cladding
[Smart City] Distributed power using the Internet of Things, metropolitan-level intelligent energy management system, etc.

- Improve market structure so that new technology companies with ZEB-related technical skills and expertise can thrive
- GHG reduction goals are not mere regulations, but a shift to a system where specialized companies can thrive and settle in the market

Risk and Limits of Industrializing ZEB Innovative Technology

Expectations for reducing greenhouse gas emissions and revitalizing the economy through developing new technology are high. However, market demand is still relatively insufficient, highly dependent on the government budget support, and entry barriers exist.

Ex) In the case of the solar power market, the market relies heavily on the government's renewable energy policy and budget support (subsidies, etc.) Also, there are challenges to promote industrial ecosystems, such as intensifying global competition and insufficient technology development to improve efficiency, requiring breakthroughs in the market and industrial development.

There is a risk in investing in new technologies to create new growth engines

- Although the scale of the investment is significant, it may take a long time to recover the investment.

Difficulty in activating the market exists due to uncertainty and information asymmetry.

Financial Fund

- Diversity in financial funds and insufficient actual application
- Difficulty in systematically investing to the industrial sector

Financial Institution

- Lack of pre-commercialization technical evaluation capacity
- Lack of risk management system

Need more detailed technical information and analysis on future growth engines
Evaluation of new technologies is not reflected in ZEB certification assessment

M&V (Measurement & Verification)


中 저가공세에 무너진 韓 태양광 소재 산업

조선비즈 | 이재은 기자

입력 2020.02.15 08:00

中 저가공세에 韓 태양광 기업 곡도산
OCI, 국내 폴리실리콘 생산 포기…판매도 위기
국내 태양광 산업, 중국 의존도 높아지나

한국 태양광 소재 산업이 고사 위기에 처했다. 중국의 저가 공세가 이어지면서 국내 태양광 소재 기업들은 곡도산했다.

국내 유일 잉곳 웨이퍼 생산업체였던 웅진에너지는 지난해 5월 기업회생절차에 들어갔다. 폴리실리콘 업체 한국실리콘도 2018년 법정관리를 신청했다. 그나마 버텨왔던 OCI와 한화솔루션도 관련 사업을 대폭 축소하거나 중단할 상황에 놓였다. 태양광 모듈의 원재료인 폴리실리콘을 만드는 두 회사가 사업을 접을 경우 국내 태양광 산업의 중국 의존도가 높아질 것이란 우려가 나온다.

Policy Value-Chain Strategies to Create the ZEB Market Ecosystem

Building Value-Chain with the goal of creating an industrial ecosystem where Start-ups can innovate

Examinations, Certifications

- Establishing testing standards and quality standards, and promoting certification
- Reflecting ZEB certification when evaluating building performance etc.

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Technology Development

- Development of new smart converged materials
- Integrated technology for equipment and materials, etc.

ILLUSTRATIVE

Supply

- Piloting innovative procurement
  * linking to new technology certification system, etc.
- Providing subsidies for new products, new technology, and tax support

Industrialization

- Developing more accessible ZEB model
- Developing a diffusion model for performance guarantee
- Creating local jobs

Preemptive Challenges To Promote and Position ZEB Innovative Products in the Market

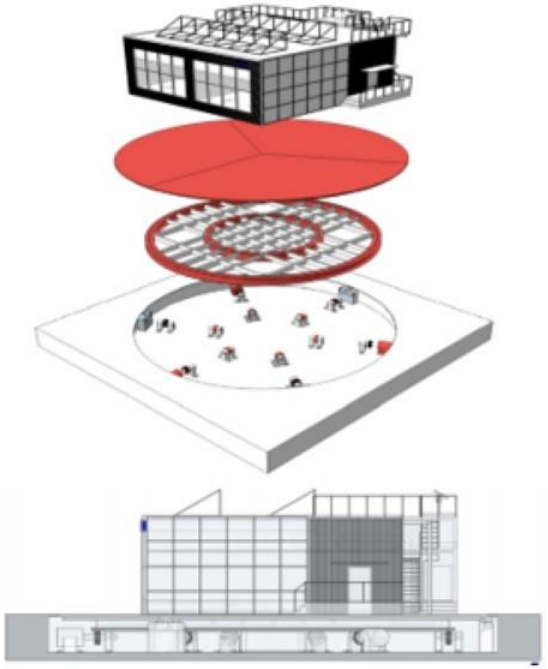
- Systematic and professional verification is essential to ensure product performance reliability (low carbon performance such as energy saving, securing quality) to institutions in demand (large corporations, etc.) in order to ease the initial access to market through such as private contracts for low-carbon innovative products.
  - Consumer want verified technology, and the provider is not familiar with standardized verification procedures for quantified performance.
- The evaluation methods and adequacy of low carbon performance, such as energy-saving, vary by committee performing evaluation of various new technology certifications, leading to the decrease in market credibility
  - Need to secure expertise in performance evaluation to expand market

Specializing in performance evaluation and promoting systemic approach

Technology Companies	Proposing methods of Evaluating Performance and Application of New Low Carbon Technologies
Testing agency	In-depth review of the proposed application of new technologies and the suitability through demonstration.
Specialized Committee	Reviewing and deliberating on the methods and effectiveness of evaluating the application of new technologies
Government	Drafting policies to reflect evaluation methods and revision of standards

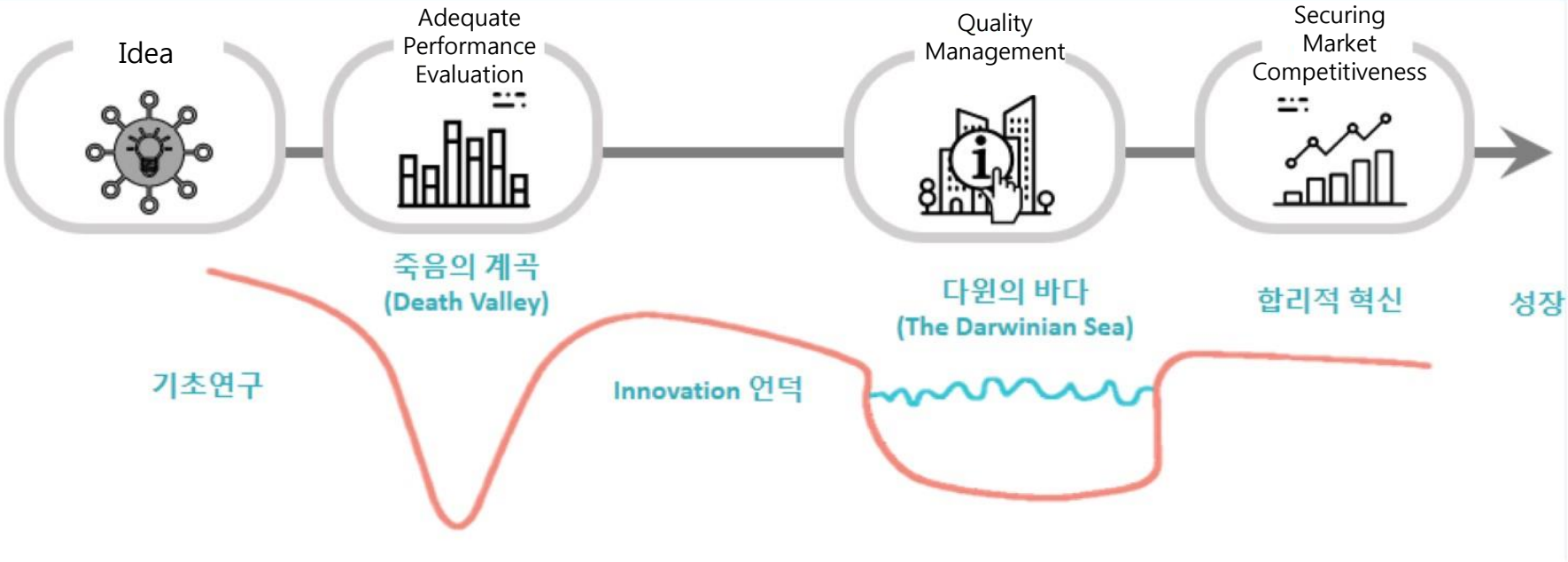
The direction of ZEB new technology and products review (example)

- Support consulting on product and technology performance evaluation (test, evaluation)
- Calculating energy saving effect and implementing verification test
- Adopting quantitative evaluation methods and reviewing GHGs reduction effects
- Product, technical evaluation standards, and certification system



Supporting commercialization of innovative technologies and fostering SMEs

- The need for a comprehensive and holistic industrial ecosystem approach to systematically foster industries leading to the new growth
- In order for various funding policies to be of practical help to SMEs, a detailed support system, such as capacity building in evaluating product commercialization is important.
- Systematic technology, budget support, and information delivery infrastructure are necessary to achieve objective quantitative performance through the production of Prototype, Trial Manufacturing Goods, and performance evaluation



Cases of Supporting Technology Commercialization in SMEs

Case1 (Company C)

- Major Products: Home IoT System, Smart Home System, CCTV, etc.
- Name of Business: Digitization of production sites
- Sales: (2015) 114.6 billion won -> (2016) 130.8 billion won
- Employees: 198 (2015) -> 210 (2016) -> 229 (2017)
- Smart home service that links IoT devices and sensors and collects information into the cloud to provide customized services

Differentiated aspects from Home IoT service provided by Telecommunications companies are that all systems of parking management, energy management, elevators, as well as gas, fire, and intrusion detection are all connected

Case2 (Company H)

- Major Products: Gas Compression Equipment and Equipment
- Name of Business : Start-up growth technology development project
- Sales: 0.5 billion won (2014) -> 1.53 billion won (2016)
- It is the first domestic company producing compressor, with 50% market share in Korea and a 38% share in export.

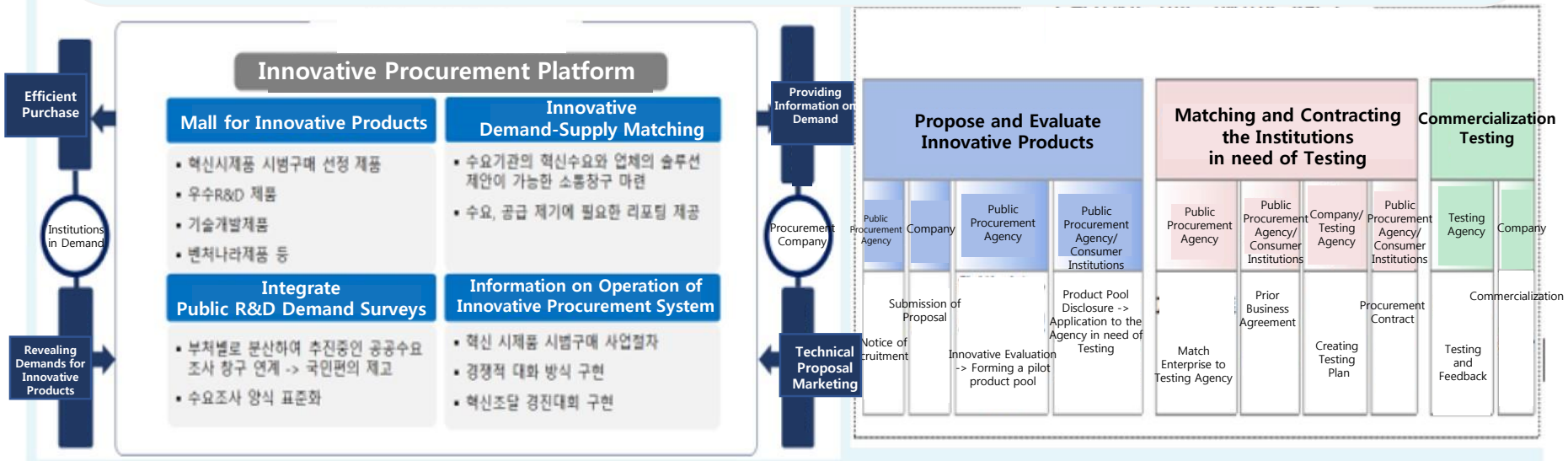
The company could overcoming the Death Valley, where half of start-ups close their businesses in three years, through R&D projects conducted by the Ministry of SMEs and Startups.
The product was commercialized through the R&D project of the Ministry of SMEs and Startups.

Support for Commercialization of Innovative Technologies and Fostering SMEs

- Challenges will exist until SMEs secure stable market demand
  : Expanding the market is not even easy for large companies, and many of SMEs lack marketing strategy

- It is necessary to support SMEs to secure a stable supply route through the activation of technology development under procurement conditions of public institutions and large companies: 1. (public institutions acting as the first procurer of innovative products); 2. (Large companies in partnership with with SMEs) to provide incentives for leading contributions.

- Recently, the Ministry of Economy and Finance and the Public Procurement Agency are promoting innovation-oriented public procurement to explore demands and create tangible results for public procurement.



- Need to establish a reliable performance evaluation and assurance system that ensures new product buyers are confident
- Securing stable quality such as performance evaluation methods and minimizing defects in various environments, not just under specific environments

Support for commercialization of innovative technologies and fostering SMEs

- Technical verification support to resolve technical uncertainty of products and services developed by innovative companies
  : Pre-validation of new technologies, possibilities of technology implementation before introducing products to market, performance verification and commercialization.
- Supporting R&D for commercialization, in conjunction with attracting private investment to verify new business models and promote market proliferation
- Implementing R&D linked with procurement from companies (client) in demand of technology,
  Planning of R&D projects accompanied by the client companies and certification bodies
  The requirements and procurement conditions of the companies should be specified in the task RFP
- Incentives such as domestic and overseas marketing, financing, and other support for good-performing innovative technology companies, giving preferential treatment and additional points for participating in public-supported projects

Explore Overseas Demand and Expansion of SDM

Using ODA and EDCF to explore demand in developing countries and promote expansion of domestic demand

Develop SDM projects linked to overseas greenhouse gas reduction projects

Expansion of private investment financing, such as funds and capital

Overcoming the initial barrier of private investment due to risk and uncertainty in energy saving performance

Supporting the operation of consultative bodies that include enterprise-supporting institutions, financial institutions

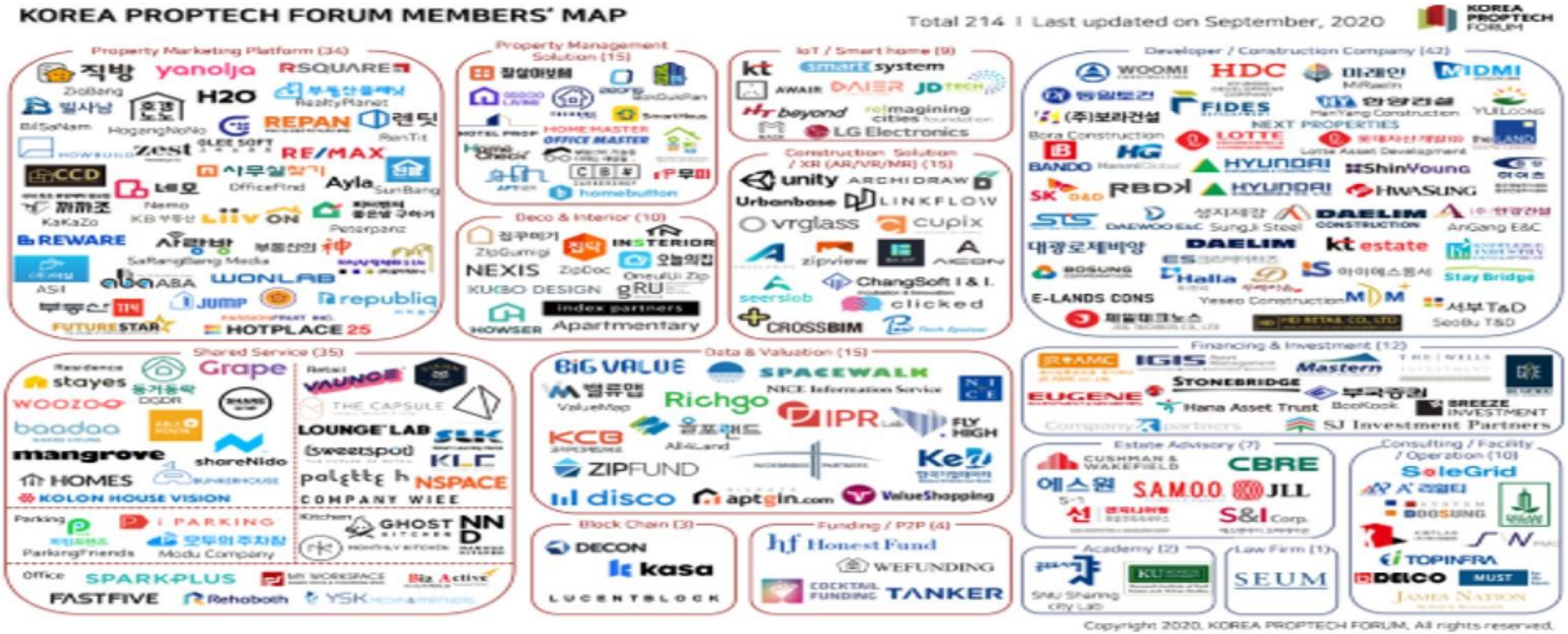
Needs in the Innovative Technologies Market and the Business Trend

- In 2021, the government announced that it would invest 13.3 billion won in the field of demonstration of blockchain utilization in 19 Areas, including Real Estate Transactions without Brokerage.
- New market platform operators emerge to improve existing real estate brokerage market : local real estate stocks have been normally shared in the regional market through joint brokerage. However, the limitation exists as the current platform operators need to operate independently

Expected proliferation of demand-driven businesses that improve information asymmetry by providing objective data to all areas, where consumer choice cannot be guaranteed due to information monopoly and supply asymmetry.

Engaging PROPTECH Startups in Creating a New Market

Voluntary inter-industry linkage movement is taking place, such as creating a "Proptech Forum" comprised of real estate companies and technology start-ups seeking new industries. They are trying to create a PROPTECH ecosystem in Korea.



Interest in creating new markets in various sectors, including marketing platforms, real estate management solutions, IoT/Smart Home, AR/VR/MR, construction companies, shared economy services, data, block chain, financial companies, and investment consulting companies.

New Businesses of PROPTECH Start-ups and Challenges in Entering Market

Korea's PROPTECH industry has evolved from an early shared office business and online brokerage platform to a variety of areas, including real estate value analysis using big data, construction site management, and interior design.

U사

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A.I. Architect

Indoor VR

Development of a technology that automatically converts architectural drawings on paper into 3D in seconds based on machine learning technology
With a simple click, most of the apartments in Korea can be reproduced in virtual space by housing type, enabling interior design such as home appliances, furniture layout, floor liners, and wallpaper.

S사

Based on big data, the scale and business feasibility of small-scale land development can be analyzed in short time frame to help determine development value, and support the review of small-scale reconstruction projects through AI-based building design programs.

New Businesses of PROPTECH Start-ups and Inducing the Creation of New Market

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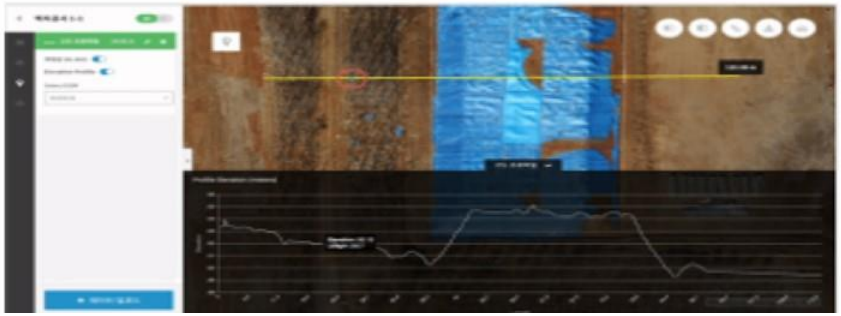
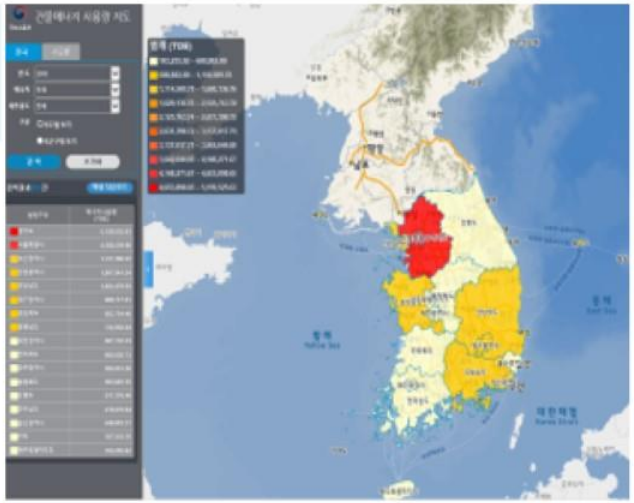


3D edited aerial photographs taken by drones at large construction sites effectively shows the status of progress. This data can be linked with CAD and BIM. The drone can complete the measurements that previously required 14 days to complete when performed by humans (14 days required for two people to complete 1km2)

- Development of building data analysis technology and creation of new business models by further disclosing integrated building and energy data to the private sector.



"As the construction and real estate industries are not digitized enough so far, there is a possibility of growth in this sector. Since there are more than 20 PROPTECH unicorn companies (non-listed companies with corporate value of more than 1 trillion won) overseas, it is expected to emerge in Korea within two to three years."

Creating a Culture of Preference on Low-Carbon Industrial Products and Expanding the Market from Consumers' Perspective

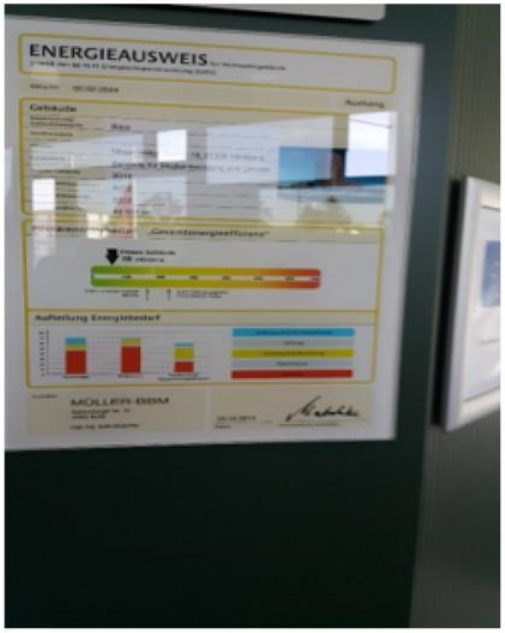
- The consumer has the right to know detailed quality information (performance values and test conditions, installation and manuals for performance implementation, etc.) about the products purchased (ordered) and the level to which the building's performance increases under certain circumstances.
- Establish a transparent and reliable market that not only promotes the qualitative image of the low-carbon industry to consumers, but also provides sufficient quantitative, low-carbon, energy-performance information according to the relevant testing methods.
- Supporting energy-efficient design through the establishment of performance database and information support for materials and facilities related to building energy performance
  Providing detailed performance information of construction and operation conditions by materials and facilities.

- Transforming the market to which performance-related information that consumers need are properly provided and guaranteed transparently
- Strong rules to maintain fair competition and cooperation in the market and the public's role to strictly manage and supervise these rules are necessary

A Transformation of the Real Estate Market by Disclosing Energy Rating Information for Demand-Oriented Buildings

ZEB and building energy efficiency rating certification for buildings includes passive technology (heated materials, windows and doors, hot cross-cuts, shading, etc.) and active technology (heating, ventilation, lighting, hot water supply, renewable facilities, etc.) and monitoring and controlling technology (BEMS, sensors, etc.) and evaluation of primary energy requirements.

- Upgrading the evaluation method of the system that certifies the integrated energy performance of various technologies applied to buildings
- Establish an energy efficiency rating system to ensure zero-energy of various new technologies and new products



The Lobby of Public Building in Germany

Real Estate Brokerage Office in Germany

Real Estate Brokerage Office in Spain

- Disclose information on energy efficiency ratings and energy use of public and multi-use buildings
- Market transformation for building owners and tenants to provide information on the energy efficiency rating of buildings to buyers and tenants.

Thank You!