NAVER **TCFD**
Report 2021

Task Force on Climate-related Financial Disclosures
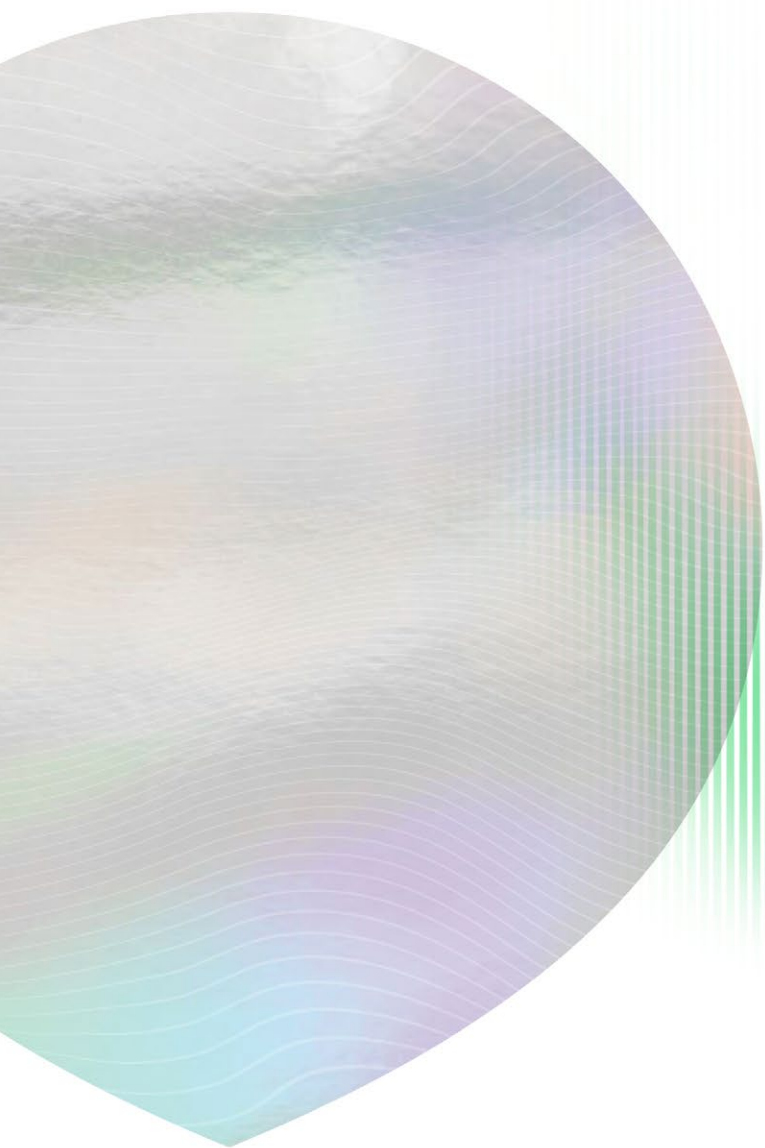
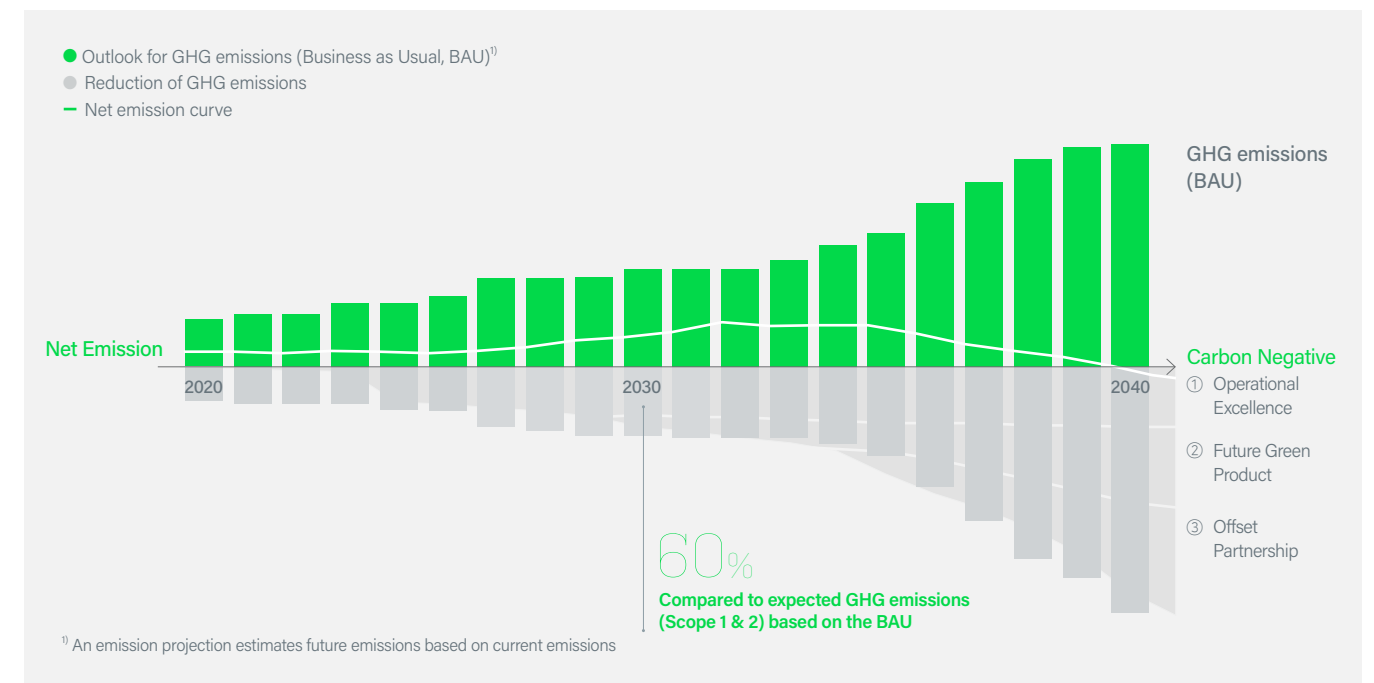**TCFD** | TASK FORCE ON CLIMATE–RELATED FINANCIAL DISCLOSURES

CONTENTS

2040 Carbon Negative

99% of NAVER's greenhouse gas (GHG) emissions is generated from electric energy consumption at our IDC and office building. In addition, our GHG emissions are forecast to rise over the next decade as our businesses steadily grow, and this may serve as a significant risk to easing climate change. However, we recognize the importance of the environment for sustainable business, and thus we established the "2040 Carbon Negative" strategy in 2020 to maximize eco-friendliness effects through business activities while minimizing negative environmental impact.

- ● Outlook for GHG emissions (Business as Usual, BAU)[1]
- ● Reduction of GHG emissions
- — Net emission curve

GHG emissions (BAU)

Net Emission

2020   2030   2040

Carbon Negative
① Operational Excellence
② Future Green Product
③ Offset Partnership

60%
Compared to expected GHG emissions (Scope 1 & 2) based on the BAU

[1] An emission projection estimates future emissions based on current emissions

Carbon Negative is a strategy of offsetting by reducing GHG more than the GHG amount that is emitted, thus making the net emissions amount 0 or less. To achieve this goal, we have set the following three detailed strategic directions and plan to expand relevant activities. By ① pursuing operational excellence that enables us to reduce our environmental impact; ② developing future green products and services; and ③ expanding external partnerships, we will actively take part in accelerating the transition to a low-carbon economy. In this process, we are making joint efforts with several partners who use NAVER platforms to expand the eco-friendly ecosystem.

Carbon Off Implementation Strategy

① Operational Excellence – Reducing our Environmental Impact

NAVER was very active in external cooperation to expand the adoption of renewable energy in 2021. We are currently analyzing the validity and effectiveness of various measures for renewable energy procurement, while striving to secure renewable energy contracts starting in 2022. We are having many discussions so that these efforts are effective for 100% transition to renewable energy over mid- to long-term, in addition to short-term renewable energy procurement.

In addition, in order to reduce operational environmental impact more actively, we established GHG inventory at all business sites, calculated the reduction amount at each business site, and then received third party verification. Furthermore, we expanded the overall carbon emissions management scope to cover the entire value chain in 2021. Starting in 2022, we will be more active in reviewing methods to measure our Scope 3 carbon emissions and set the ways to manage and reduce the Scope 3 emissions.

② Future Green Product – Developing Green Products and Service Solutions

NAVER strives to create eco-friendly business opportunities from the fundamental business perspective as well. As part of these efforts, we provided eco-friendly bags made of 100% biodegradable resin to stores at NAVER's Neighborhood Market Shopping, in partnership with the Small Enterprise and Market Service, starting in 2020. In 2021, we provided 340 thousand eco-friendly bags to more than 146 traditional markets across the nation and also distributed 60 thousand oxo-degradable eco-friendly ice packs. We are also offering eco-label certification information for stores in NAVER Smart Store. Starting in 2022, we will run special and exclusive sections with ESG themes in order to increase user convenience.

③ Offset Partnership – Expanding External Partnerships

NAVER seeks to expand the eco-friendly ecosystem through collaboration with internal and external stakeholders of NAVER. We are accordingly focusing on discovering eco-friendly initiatives aligned with our business characteristics. To this end, we will first participate in eco-friendly initiatives, taking our characteristics into account, such as EV100 and K-EV100 as well as CDP Climate Change, thereby raising environmental awareness in the industry. To implement the initiatives, we have already begun to change our fleets to electric vehicles (EVs), and will replace at least ten fleets with EVs in 2022.

NAVER is increasing environmental investments by issuing sustainability bonds. We will also expand investment in eco-friendly technologies to reduce energy consumption at our second IDC "Sejong Gak" and second office building "1784", in our efforts to make our workspace to be more sustainable.

Governance

A. The Board's oversight of climate-related risks and opportunities

In October 2020, NAVER created the ESG Committee under the BOD. Tasked with the management of ESG risks and new business opportunities, the Committee consists of three independent outside directors and one inside director.

In 2021, the ESG Committee reviewed the implementation status of 2040 Carbon Negative and the acquisition of ISO 14001 certification. Also, by reviewing the progress of ESG management of global peer companies, it strived to objectively diagnosed NAVER's level in comparison to the global industry. In 2022, Chae Sun-joo, the External/ESG Policy Representative of NAVER joined the ESG Committee, and she will be in charge of active communication with NAVER's diverse internal and external stakeholders. Going forward, the ESG Committee will review NAVER's mid-to long-term strategic directions for climate response, approve key tasks, and manage and supervise implementation status.

Composition of ESG Committee

Committee name	Composition	Name of members	Purpose of establishment and authorities
ESG Committee	3 Independent outside directors[1] 1 Inside director	Lee In-moo (Chair) Byun Dae-gyu Rho Hyeok-joon Chae Seon-ju	**Purpose of establishment** - Internalize sustainability in corporate management decision-making - Manage major ESG risks and opportunities
			Authorities - Engage in top decision-making on corporate-wide ESG execution matters - Discover environmental/social business items centered around sustainability and make decisions on relevant investments - Establish strategies and direction on climate response, and manage ESG information disclosure and external communication - Execute social contributions, etc.

[1] 3 Independent outside directors are 2 outside directors and 1 other non-executive director.

Reporting Agenda of the ESG Committee

Classification	Major reported items in 2021	Date of reporting			
		Apr.	Jun.	Aug.	Oct.
Report on the status and outcome of ESG execution strategies	Implementation status of NAVER's corporate-wide tasks for ESG improvement in 2021	●	●	●	●
	ESG best practices achieved by global peer companies	●	●	●	●
	Implementation status and plan of the 2040 Carbon Negative	●		●	
	Green e-commerce strategies	●			●
Response to ESG ratings and information disclosure	Status of NAVER's external ESG ratings and improvement directions		●	●	●
Monitoring of stakeholder requirements and internal and external communication	Ways to internalize ESG management and fully establish the ESG culture			●	●
	Ways to strengthen stakeholder communication		●	●	●
Director attendance rate (%)		100	100	100	100

B. Management's role in assessing and managing climate-related risks and

With the appointment of new top management, NAVER seeks to take a more systematic, professional approach to climate response in 2022. Roles and responsibilities for establishing climate response strategies, executing relevant investments, and handling various matters related to raising capital were assigned to the Chief Financial Officer (CFO) until 2021, and they were transferred to the External/ESG Policy Representative in 2022. Accordingly, the Representative will oversee NAVER's climate change response strategies and more actively implement and communicate our response direction and execution tasks to internal and external stakeholders. The Chief Executive Officer (CEO) takes the lead in identifying business items that are related to environmental sustainability within the area of commerce to call for the transition to a low carbon economy and to expand green business opportunities.

What NAVER's management has been mainly interested in since the announcement of the 2040 Carbon Negative is to promote understanding among all employees of the direction that we should move towards in order to counter climate change and to induce company-wide cooperation. Accordingly, training was provided in 2021 to staff in charge of the environment on climate change response strategies and climate risk management processes.
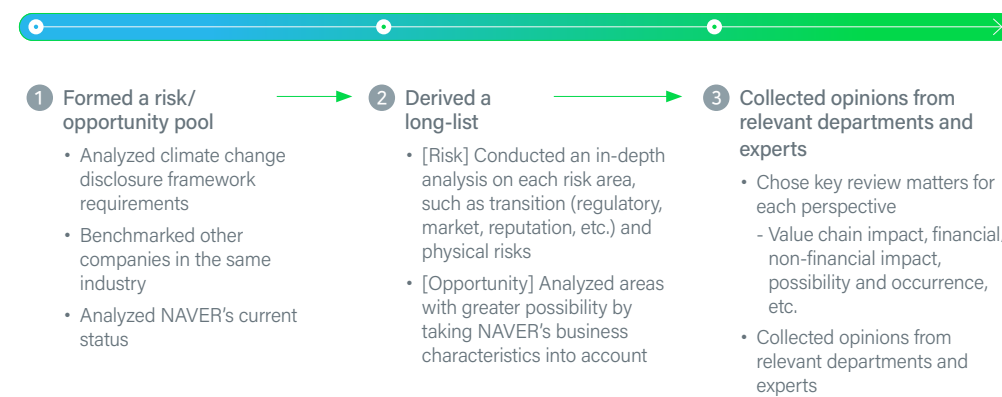
Job Training for Staff in Charge

Job training for staff in charge of the environment at business sites	No. of trainings	10
	No. of participants	50

Strategy

A/B/C. Climate-related risks and opportunities the company has identified, and the impact on the company's businesses, strategy and financial planning

1. Approach to climate-related risk and opportunity analysis

Against the backdrop of major stakeholders' increasing demand for disclosure of the 2040 Carbon Negative implementation status, NAVER strived to analyze climate-related risks and opportunities in detail and systematically establish a response plan in 2021. We used the process below for an overall diagnosis and review of our climate-related risks and opportunities.

1 Formed a risk/opportunity pool
- Analyzed climate change disclosure framework requirements
- Benchmarked other companies in the same industry
- Analyzed NAVER's current status

2 Derived a long-list
- [Risk] Conducted an in-depth analysis on each risk area, such as transition (regulatory, market, reputation, etc.) and physical risks
- [Opportunity] Analyzed areas with greater possibility by taking NAVER's business characteristics into account

3 Collected opinions from relevant departments and experts
- Chose key review matters for each perspective
  - Value chain impact, financial/non-financial impact, possibility and occurrence, etc.
- Collected opinions from relevant departments and experts

First, in forming a risk/opportunity pool, we conducted multilateral analyses of the climate change disclosure framework and the status of other companies in the same industry and NAVER to identify diverse risks that can impact NAVER.

This was followed by in-depth analyses of each risk and opportunity by type, leading to general identification of each risk's background and potential impact on NAVER. For the climate-related risks/opportunities that were derived through this process, we chose key review items and prioritized each risk and opportunity by collecting opinions from relevant departments and experts. By including various perspectives in the key review items, such as value chain impact level, financial/non-financial impact level, and possibility and time of occurrence, we strived for a more overall risk diagnosis.

2. Analysis results of climate-related risk and opportunity

(1) Climate-related risks

Transition Risk | Physical Risk | Circle size=Importance (possibility of occurrence X impact)

Classification	No	Detailed risks
Regulatory (current)	T1	Increased burden of purchasing carbon credit
	T2	Increase of renewable energy procurement costs
Regulatory (new)	T3	Increased burden of responding to domestic and overseas carbon regulations
Technology	T4	Increased R&D expenses related to technologies for reducing environmental impact of IDCs while maintaining performance
Reputation	T5	Drop in brand value as a result of insufficient responses to climate change
Physical	P1	Facility damage due to typhoons or floods
	P2	Rise in IDC operation costs due to abnormal high temperatures
	P3	Reduction of commerce revenue due to a blow to the logistics chain caused by abnormal climate

[T1] Regulatory (current)   Increased burden of purchasing carbon credit

NAVER is subject to the national GHG emissions trading scheme, and is obligated to purchase carbon credit in the Korea Exchange ETS (K-ETS) market for the amount of carbon emissions that is in excess of the emission permit or to reduce emissions. The paid allocation ratio[1] increases according to the emissions trading scheme plan period, and we expect expenses from the rise in the paid allocation ratio. In addition, if NAVER purchases additional carbon credit because it was not able to preemptively respond to a rise in electric power consumption with the completion of the second Internet data center (IDC), our expenses from purchasing carbon credit will rise in tandem with a continued increase in carbon credit price, in addition to increased GHG emission liabilities, which may impact our financial soundness.

Last year, we derived and reported that our financial burden can reach an accumulative KRW 1.3 trillion[2] by 2030 if we fail to secure emissions rights with the completion of our second IDC based on forecasts on the increase of future emissions. To immediately respond to this risk, we completed the construction of a GHG inventory at all our business sites in 2021, and also completed the corresponding year's GHG emissions details report, third party assurance, and application for additional emissions level allocation for new business sites. Thanks to these efforts, we reduced the potential financial burden of purchasing carbon credit to an accumulative KRW 25.9 billion by 2030[3].

In addition, we have been recognizing and managing GHG emission liabilities in our financial statements since 2019, and the amount stood at around KRW 710 million as of the end of December 2021. This is around 0.001% of the annual operating revenue, but we are aware that relevant financial impact may intensify. To respond to this financial risk, we established the 2040 Carbon Negative Roadmap. 99% of our GHG emissions is generated from electric power consumption. We have therefore set a goal to increase the use of renewable energy to 60% by 2030 and 100% by 2040 to achieve our target. We will accelerate the pace of transition to renewable energy in 2022, and thus expect to reduce indirect emissions (Scope 2), thereby receiving recognition for our GHG reduction performance in the emissions trading scheme and saving costs that are incurred from purchasing additional credit. In addition, we are exploring various reduction measures, such as business site GHG reduction projects and participation in external offset programs. For example, we plan to consecutively replace our internal combustion engine-based fleets with electric vehicles by 2030, thereby reducing emissions from mobile combustion, including gasoline and diesel. If the roadmap we established is implemented successfully, we expect a continued reduction in the potential financial burden from purchasing GHG credit.

[T2] Regulatory (current)   Increase of renewable energy procurement costs

Korean government is enforcing various policies and regulations to implement its net-zero goal and to change the nation's economic structure to a low-carbon society. In particular, the government plans to actively change the main source of energy supply from fossil fuels to new and renewable energy, and abolish coal power generation in a phased manner by 2050. A sharp rise in renewable energy demand in industry and an increase of renewable energy unit prices are expected in accordance with the national energy mix transition plan. NAVER's renewable energy procurement costs are also expected to rise. In the long term, renewable energy procurement costs are forecast to stabilize as a result of expansion of new and renewable power generation facilities for the transition to carbon-free power supply, leading to a drop in levelized cost of electricity (LCOE) and achievement of grid parity[4].

[1] Free of charge during the 1st plan period (2015-2017) → 3% charged during the 2nd period (2018-2020) → 10% charged during the 3rd period (2021-2025)

[2] Estimated monetary penalty for non-compliance with emissions trading scheme (accumulative figure by 2030)

[3] Based on the assumption that the ratio of paid allocation of GHG credit can rise to 30% by 2030

[4] Time when the unit price of new and renewable energy power generation sources, such as photovoltaic and wind power, becomes the same as the unit price of thermal fuel-based electric power

To stay ahead of others in mid- to long-term climate responses, NAVER announced its 2040 Carbon Negative and renewable energy procurement goal and established an implementation roadmap. 99% of NAVER's GHG emissions is generated from electric energy consumption. As a major means of reduction, we are actively considering reducing carbon emissions by increasing the use of renewable energy. Hence, renewable energy purchase price is expected to be a variable that can impact our operation costs and financial soundness. We estimate an additional accumulative 20% from 2021 to 2040 in electric power costs if renewable energy usage contracts are signed. In detail, energy costs are less than 0.3% of NAVER's sales at present, and the additional cost impact from the shift to renewable energy is less than 0.1% of sales.

In response, we are analyzing applicability of several options that are presented by domestic and global RE100 implementation support systems from economic and environmental perspectives. Also, we seek to establish an investment plan and other relevant plans from a mid- to long-term perspectives of at least a decade in an effort to fully secure renewable energy contracts starting in 2022.

To identify a method of securing renewable energy with the highest level of economic feasibility, we are analyzing feasibility and effectiveness based on the weight of each renewable energy procurement measure, including a third party power purchase agreement (PPA) and power generation equity investment. The establishment of an optimal portfolio is expected to enable us to minimize our financial burden of the shift to renewable energy and thus procure electric power at an affordable cost in the mid- to long-term future. Also, if we sign a long-term fixed-price PPA contract, we will be able to purchase electric power for a certain price over a long period and this is expected to reduce the risk of additional costs from future increases in the unit price of renewable energy. We are holding discussions so that these efforts will be effective for a mid- to long-term 100% transition to renewable energy, in addition to short-term renewable energy procurement. Ultimately, continued investments for a transition to renewable energy will serve as the foundation for a change in company-wide IT services (cloud, AI, search, commerce, etc.) to eco-friendly services, based on which we expect improvements in customer satisfaction, marketability, and sustainability.

[T3] Regulatory (new)   Increased burden of responding to domestic and overseas carbon regulations

There is a possibility that NAVER will be subject to new regulations, such as the adoption of the Carbon Border Adjustment Mechanism (CBAM) in Korea and abroad and increases in the GHG management scope and climate risk/opportunity disclosure obligations.

An example includes the EU's CBAM (Carbon Border Adjustment Mechanism) applied to such items as steel, aluminum, cement, fertilizer, and electricity. As of current, it does not apply to NAVER products and services. However, there is a need to continually monitor GHG emissions to establish measures for expected strengthening of regulations and to strengthen internal management capabilities.

In addition, the US Securities and Exchange Commission (SEC) announced a draft mandatory climate disclosure regulation in March 2022, requiring disclosure of climate risk-related information as well as GHG emissions that include Scope 1 and 2 and, in some cases, Scope 3. There are also other such movements of strengthening and expanding disclosure requirements.

In the mid- to long-term future, we expect greater burden from responding to regulations and increased operation costs for establishing measures according to whether the new regulations apply to NAVER. We constantly monitor GHG and environmental regulation trends that can apply to NAVER in the future, and are building a Scope 3 inventory to monitor GHG emissions from the value chain and to strengthen our emissions responsibilities.

[T4] Technology **Increased R&D expenses related to technologies for reducing environmental impact of IDCs while maintaining performance**

The volume of data processing has been in sharp rise in line with increased demand for digital platform services. To respond to this trend, it is essential to develop technologies that maintain data center performance while reducing environmental impact. Accordingly, we expect a rise in R&D costs for technologies that can improve both energy efficiency and performance of our IDCs. Data Center "GAK Chuncheon" has developed the Air Misting Unit (AMU) and the NAVER Air Membrane Unit (NAMU) – eco-friendly technologies that can reduce server room temperatures using cold air and underground water – and expanded the scope of their application to maximize energy savings.

For example, the North Wing, which is the oldest wing at Data Center GAK Chuncheon, changed its heating, ventilating, and air-conditioning (HVAC) system from AMU, which uses a mist method, to NAMU, which adopted a membrane method technology, to reduce energy consumption while maintaining the amount of adopted outside air for data center performance and cooling. Data Center GAK Chuncheon, which has applied eco-friendly technologies, maintains a power usage effectiveness (PUE) level that is on par with that of global data centers and that is closest to 1, the best performance among data centers in South Korea.

"GAK Sejong", which is slated for completion of construction in 2023, has been built with the goal of maintaining a better PUE than that of the Chuncheon IDC since the design phase. Based on the operation experience and know-how we gained from GAK Chuncheo, we are continuing with our R&D efforts to improve energy efficiency. GAK Sejong is being built with the goal of achieving a better PUE compared to GAK Chuncheon by applying a hybrid cooling system. The hybrid cooling system was developed to use natural outside air as much as possible to improve cooling energy efficiency by as much as 20% in comparison to GAK Chuncheon' In addition, we plan to save data center cooling energy by improving mechanical infrastructure facilities, including late-night electric power, freezer, and cooling tower, and by applying new technologies. We will continuously make investments in facilities to minimize electric power consumption of IDCs, and on the back of these preemptive responses, we will improve facility energy efficiency, leading to the reduction of operation costs in the long term.

[T5] Reputation **Drop in brand value as a result of insufficient responses to climate change**

Demand for companies to fulfill environmental responsibilities is rising in tandem with worsening climate change. As the nation's largest platform company, NAVER is especially a subject of considerable interest from various stakeholders, including the government, investors, users, and partners. For this reason, continuous negative feedback may lead to a decline in corporate reputation and brand value.

In 2020, NAVER declared its mid- to long-term GHG reduction goal (2040 Carbon Negative) and renewable energy transition (RE100) goal to maximize eco-friendly effects through business activities while minimizing negative environmental impact, and established an implementation roadmap. We expect increased demand among stakeholders, including consumers, for us to achieve the 2040 Carbon Negative goal or RE100 goal that we announced. There will be strengthened monitoring of the comprehensive mid- to long-term climate change response direction, such as whether measures to achieve the goals are being established in detail and whether risks are managed while implementing the measures, in addition to whether the final goals are accomplished. In particular, amid rising disputes over green washing, corporate reputation risks are expected to grow in the mid- to long-term future in case of absence of target implementation measures. A negative reputation will result in decreased preference toward NAVER products/services and will likely lead to lower brand value.

In response, we are making preparations to take part in global and domestic initiatives, including RE100 and EV100, to strengthen monitoring and execution capabilities for the achievement of 2040 Carbon Negative, which is a promise we made to our stakeholders, including shareholders and customers. We will actively and transparently disclose the status of our response to climate change, including participation in initiatives, in our efforts to expand stakeholder communication. By doing so, we seek to alleviate the risk of the possibility of corporate reputation damage, while enhancing the corporate image in the long term.

[P1] Acute **Facility damage due to typhoons or floods**

Data center electric power supply may become unstable due to abnormal climate events that are caused by climate change, such as typhoons, floods, and rise in sea levels. If abnormal climate events continue, there is a high possibility of major facility and data center asset damage risk, including servers. We expect costs to be incurred from building facilities embedded with emergency power generation systems as well as disaster prevention capabilities in an effort to establish abnormal climate event countermeasures. In addition, even if our major facilities are not directly impacted, lower quality of electric power from KEPCO is expected to result in a rise in operation costs from the installation of an in-house compensation system.

To prevent damage to data center facilities that may arise if an abnormal climate event occurs, we included disaster prevention capabilities and emergency power generation systems to respond to unusual weather when we designed Data Center GAK Chuncheon. In case of Data Center GAK Sejong, which is under construction, we chose a site that is only slightly impacted by unusual weather, such as a rise in sea levels, and established countermeasures for physical risks. The site we chose also has a small network load, enabling stable IDC operation amid expectations of concentrated energy and electric power consumption due to the construction of a hyperscale IDC.

[P2] Chronic   Rise in IDC operation costs due to abnormal high temperatures

NAVER's data center uses a natural cooling system that is based on cold outside air to reduce server room temperature. Hot and humid air that results from abnormal high temperatures caused by climate change cannot be used for server cooling. In this case, use of outside air should be restricted and internal circulation (internal air-conditioning) must be operated. Data Center GAK Chuncheon uses natural (direct) outside air for heating, ventilating, and air-conditioning (HVAC), and begins outside air operation mostly after early to mid-September in consideration of temperature and humidity levels that are appropriate for cooling. In October 2021, we operated internal circulation due to abnormally high temperatures compared to the same month in the average year, leading to a year-on-year increase in electric power consumption. A reduction in the number of days of outside air use results in greater electric power consumption for data center cooling and higher cooling costs. Also, the electric power load factor consumed by IT equipment goes up and may result in a temporary PUE increase.

Data Center GAK Sejong, which is slated for completion of construction in 2023, adopted the NAMU 3rd generation, which is a hybrid HVAC system that uses direct outside air as well as indirect outside air, based on Data Center GAK Chuncheon's operation know-how. The NAMU 3rd generation applied NAVER Cloud's unique technology (completed patent application in April 2020) that uses indirect outside air for energy efficiency improvement through heat exchange in case outside air temperatures are low.

In addition, we took direction configuration into consideration since the design phase of Data Center GAK Sejong as a way to use natural outside air as much as possible, aimed at minimizing environmental impact of data center operations from physical risks. We plan to continue investments to advance data center facilities and anticipate to curtail operation costs in the long term by making facility energy efficiency improvements through preemptive responses.

[P3] Acute   Reduction of commerce revenue due to a blow to the logistics chain caused by abnormal climate

NAVER's commerce revenues are indicating firm growth as a result of a continued rise in online shopping demand and merchants with the advent of the contactless era. However, worsened unusual weather, including earthquake and flood, from climate change can cause a blow to the logistics chain and supply chain, which ships products that consumers purchased through NAVER commerce. The resulting shipping service delay and suspension acts as a severe risk to the level of satisfaction of customers who use the NAVER commerce platform as well as customer attraction and retention, and can ultimately lead to a reduction in commerce operating revenue.

As a marketplace model (3P) business operator, NAVER does not directly operate a logistics chain. Since individual sellers choose a logistics chain, compensation for shipping delays and product damages that are caused by a blow to the logistics chain is first handled by the respective individual seller or logistics business operator. As such, unless the nationwide logistics distribution network is paralyzed, the direct impact that a blow to the supply chain that is caused by climate change will have on NAVER commerce will not be high.

(2) Climate-related opportunitie

Opportunity   Circle size=Importance (possibility of occurrence X impact)
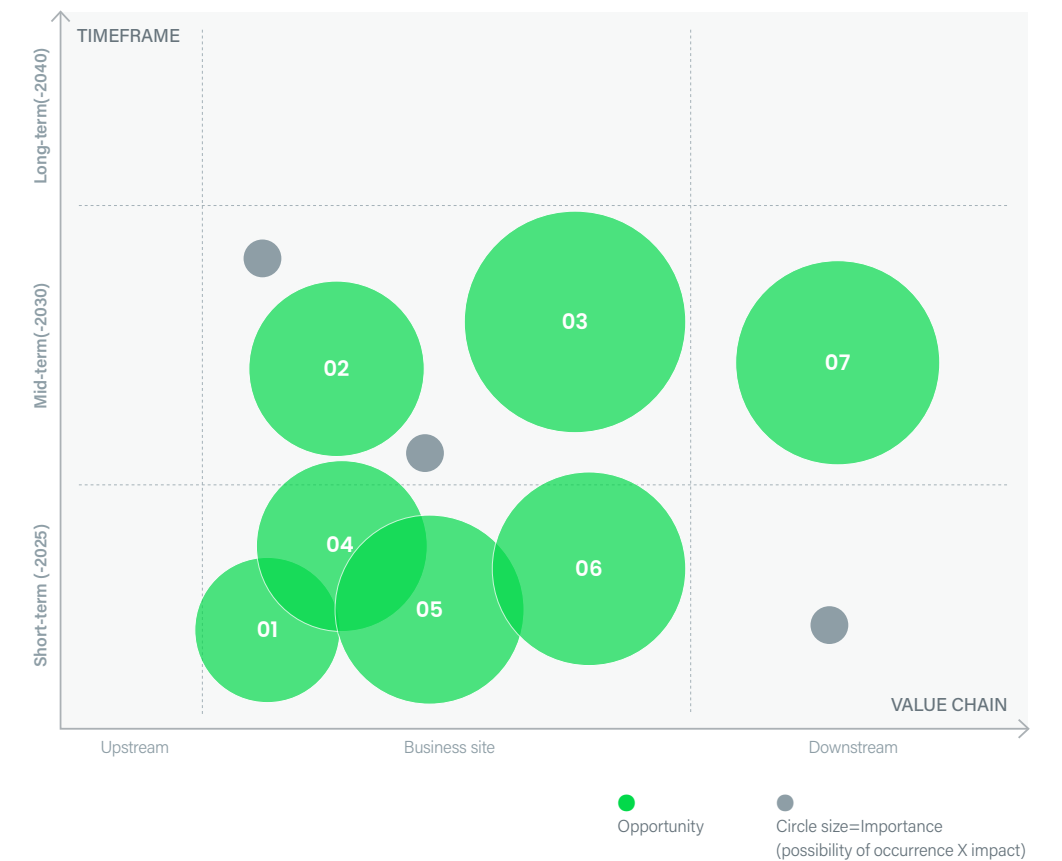
Classification	No	Detailed risks
Resource efficiency	01	Energy efficiency improvements through IDC performance improvements burden of purchasing carbon credit
	02	Reduction of operation costs through the change of fleets to electric vehicles
	03	**Reduction of regulation compliance costs through stable renewable energy procurement**
Energy source	04	Reduction of operation costs through preemptive low-carbon facility expansion
	05	Enhancement of corporate image through the use of renewable energy
	06	**Increase of capital availability due to increasing number of investors who prefer low-carbon industries**
Products and services	**07**	**Increase of commerce revenue on the back of expansion of green products**

O1 Energy efficiency improvements through IDC performance improvements burden of purchasing carbon credit

There have been increasing demands for minimizing environmental impact of business sites and facility operations in addition to stricter regulations and relevant certifications for low-carbon and low-power infrastructure. We anticipate to reduce operation costs by adopting high-efficiency facilities which will enable us to reduce energy costs, including cost of electricity. Investment costs may be incurred for performance improvements, but we expect curtailed costs in the long term as a result of a decrease of energy consumption. We therefore continue to strive for saving energy and developing new technology while also expanding our investment aimed at reducing environmental load and maintaining performance of IDCs.

We replaced the AC fan (alternating current) in the West Wing of Data Center "GAK Chuncheon" with a BLDC supply fan (direct current) with small power loss in 2021 as a way to improve energy efficiency of server room operations. We are verifying energy-saving effects from replacing the fan through a pilot operation in the West 3, and plan to expand application to the entire West Wing. Furthermore, to reduce energy consumption while maintaining IDC performance and the amount of outside air adopted for the North Wing, the oldest wing of GAK Chuncheon, we changed the HVAC system from AMU, which uses a mist method, to NAMU equipped with a membrane technology. When the membrane method is adopted, outside air that is around 2°C higher in temperature can be used, meaning that it is effective in increasing the number of days of outside air circulation and reducing energy consumption. We will continue to seek for ways to improve IDC performance and energy efficiency, such as cooling systems that adopt outside air and high energy-efficiency facilities. In response to climate change, we will expand our investment in upgrading facility which is expected to serve as opportunities for reducing operation costs in the long term.

O2 Reduction of operation costs through the change of fleets to electric vehicles

Replacing internal combustion engine (ICE) fleets with eco-friendly vehicles, including electric vehicles (EVs), is anticipated to result in reducing operation costs, such as fuel expenses, while also reducing credit purchase costs. According to research conducted in January 2021 by the KEPCO Economy & Management Research Institute (KEMRI), fuel and maintenance/repair costs of battery electric vehicles (BEVs) are around half of those of ICE vehicles. In addition, it estimates that total ownership costs of BEVs enables around 5-7% savings compared to those of ICE vehicles when calculating total costs that consider depreciation, financing, and fuel costs, among other factors. In terms of emissions reduction, emissions of EVs while driving are zero, when considering "Tank-to-wheel"1), enabling a reduction in mobile combustion emissions compared to internal combustion engine vehicles, including gasoline and diesel. Therefore, costs incurred from purchasing additional credit can be saved by driving EVs.

To reduce environmental impact in the process of running its business, in addition to reducing operation costs, NAVER plans to replace its ICE fleets with EVs by 2030 by joining EV100/K-EV100. We plan to replace at least 10 fleets with EVs in 2022, and will make a greater number of meaningful decisions that raise eco-friendliness of our business operations while contributing to financial aspects as well.

O3 Reduction of regulation compliance costs through stable renewable energy procurement

In response to climate change responses over the mid- to long term, NAVER declared 2040 Carbon Negative and set renewable energy transition goals and an implementation roadmap. 99% of NAVER's GHG emissions is generated from electric energy consumption at its data centers and office buildings. We are therefore seeking for reducing GHG emissions by increasing the use of renewable energy as a major means of reduction. According to Article 18 of the "Guidelines on Emissions Reporting and Certification of the GHG Emissions Trading Scheme", amended in January 2021, issuance of a document confirming renewable energy use or purchase of a Renewable Energy Certificate (REC) can be certified as GHG reduction performance, and at the same time be acknowledged as RE100 execution performance.

NAVER strives to increase the use of renewable energy use. To this end, we are analyzing feasibility and effectiveness of renewable energy procurement measures presented by the RE100 execution support system of South Korea, and will make concentrated efforts in 2022 to secure renewable energy. By actively procuring renewable energy, we expect to reduce GHG emissions and use this to respond to emissions trading scheme regulations and thus reduce cost impact of regulatory changes.

O4 Reduction of operation costs through preemptive low-carbon facility expansion

There have been increasing demands for minimizing environmental impact of business sites and facility operations in addition to stricter regulations and relevant certifications for low-carbon and low-power infrastructure. NAVER is already operating a data center with the world's lowest-level power usage effectiveness (PUE), as well as an eco-friendly office building with an LEED platinum grade. NAVER's Green Factory office building was designed to constantly save energy, and does so at a rate of more than 5% every year through investments in energy-efficient devices such as heat-insulated partitions, LED lights, and others, as well as continued energy-saving efforts. Data Center "GAK Chuncheon" uses renewable energy through photovoltaic power generation and also makes continuous investment in relevant businesses. In 2021, it reduced 213 MWh of power consumption through photovoltaic power generation, leading to the reduction of some 98 tons of GHG emissions. Also, by using natural cooling systems, 33,989 MWh of power was saved. It uses energy efficiently, including through installation of LED lighting and use of EVs.

In addition to existing business sites, we adopted energy-saving elements, starting from the design phase, for our second office building that was completed its construction in 2021 and our second IDC, whose construction is planned to be completed in 2023, and explored ways to curtail costs in comparison to existing business sites in consideration of eco-friendliness. For our second office building,"1784", we set up a photovoltaic power generation facility on the rooftop and used underground space as much as possible to build a geothermal system. Furthermore, the 1784 project applied various energy-saving element technologies, including a radiant cooling system, chilled water thermal energy storage system, and high-efficiency lighting system, to result in a 38.1% reduction in expected annual energy costs compared to the ASHRAE standard building model[1].

"GAK Sejong" can procure 300 MWh of renewable energy through a rooftop photovoltaic power generation system, and has built a system that actively uses geothermal heat and waste heat. It was designed to achieve higher energy efficiency based on the know-how we accumulated from GAK Chuncheon, such as use of heat exchange for warm water in bathrooms and the application of the Snow Melting system to an internal beltway. By continually making preemptive investments in facilities/infrastructure with low-carbon, high-efficiency levels compared to existing facilities/infrastructure, we expect to curtail energy costs from reduced energy consumption.

O5 Enhancement of corporate image through the use of renewable energy

A company's goals for low-carbon energy transition and implementation performance have a direct impact on short-to mid-term operation costs. They are also monitored by ESG evaluation organizations, NGOs, and investors and can therefore influence the company's external reputation, such as level of confidence in the execution of the goal that was declared to stakeholders and the company's competitiveness in comparison to peers. Since NAVER is the nation's largest platform company, various stakeholders, including the government, investors, users and partners, are paying keen attention to the status of NAVER's fulfillment of environmental responsibilities and response to climate change. We will increase stakeholder communication through timely disclosure of the implementation roadmap and outcomes for 2040 Carbon Negative and RE100, which is a promise we made to stakeholders, including shareholders and customers, based on which we anticipate to be recognized by consumers as a company that actively responds to climate change. Active communication of our mid- to long-term direction for making climate change responses can lead to stakeholder recognition of NAVER as an outstanding ESG management company and can have a positive influence on operating revenue and intangible assets, such as brand value and business rights.

O6 Increase of capital availability due to increasing number of investors who prefer low-carbon industries

We forecast that there will be a continued increase in investment demand for sustainability bonds and green bonds owing to a rise in investors who prefer low-carbon industries and place importance on investments' social responsibility. In March 2021, NAVER issued a USD 800 million worth of sustainability bond, a first of its kind among South Korea's tech and Internet companies. This bond is a special-purpose bond that is combined of green and social bonds, and funds can be used for comprehensive purposes in eco-friendly business areas and to resolve social issues. In addition, sustainability bonds, special-purpose bonds, are generally issued at lower interest rates than general bonds and serve as a means for stable procurement of funds that are needed for mid- to long-term eco-friendly projects, and therefore are recognized as a climate change opportunity. For example, the interest rate of the sustainability bond that NAVER issued is around 0.5-6%p lower than the average interest rate of corporate bonds, leading to interest cost reduction effects through low interest rates.

We will use the funds raised through the sustainability bond for securing renewable energy and building a green SME ecosystem and eco-friendly IT infrastructure. As part of strengthening environmental investments in 2021, we made green technology investments to save energy at our second data center "GAK Sejong" and second office building "1784". We will continue to use funds that are raised by issuing bonds to actively increase investments in eco-friendly technologies to save energy at the company-wide level, and strive to fully establish NAVER as a company that fulfills social responsibilities.
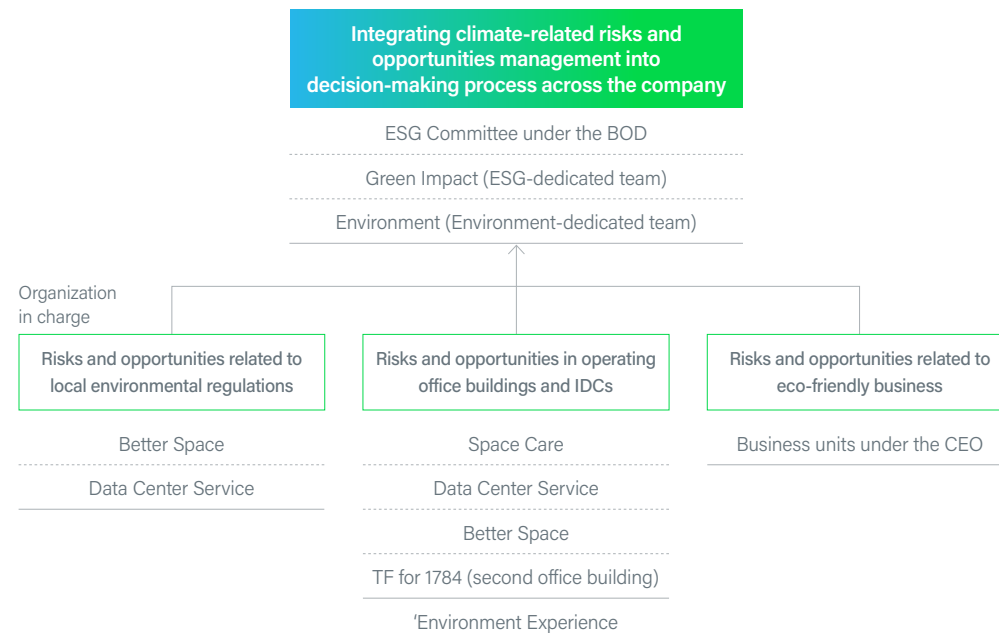
O7 Increase of commerce revenue on the back of expansion of green products

Consumers prefer products that minimize environmental load and create social value throughout production, distribution, and consumption steps, and pay more for these products, adopting them as a criterion for brand selection. To be in line with consumer preferences, we plan to expand green product group-providing services by actively engaging Smart Store, a major part of our Commerce Business, which accounts for around 22% of total operating revenue as of 2021. We are aware of the potential environmental impact on the overall e-commerce ecosystem, and thus established a mid- to long-term strategic direction and have been implementing it since 2021 to fully create green impact in the e-commerce ecosystem.

In 2021, we began providing "eco-label certification information", offering a product's environmental certification information on the product details page at Smart Store. There are currently around 1,350 products registered in NAVER Smart Store for which environmental certification can be confirmed. We are also making service improvements so that consumers can search for and purchase eco-friendly products, such as low carbon-certified products. In addition, our Commerce Business is cooperating with CJ Logistics to build a sustainable fulfillment system. We also recognize the environmental impact of packing materials as a major environmental risk of the e-commerce industry, and are making active preparations for reduction of packing materials and replacement by sustainable materials. By securing eco-friendly commerce business leadership, we expect to make short-term operating revenue improvements by raising our market share, while also increasing brand value and business rights based on improved reputation in the mid- to long-term future.

Risk Management

Integrating climate-related risks and opportunities management into decision-making process across the company

ESG Committee under the BOD

Green Impact (ESG-dedicated team)

Environment (Environment-dedicated team)

Organization in charge

Risks and opportunities related to local environmental regulations	Risks and opportunities in operating office buildings and IDCs	Risks and opportunities related to eco-friendly business
Better Space	Space Care	Business units under the CEO
Data Center Service	Data Center Service	
	Better Space	
	TF for 1784 (second office building)	
	'Environment Experience	

Management organizations are in charge of managing environmental risks in operating NAVER's office buildings, IDCs, and other infrastructure of the company as its tangible assets. They are also in charge of green purchasing for green facility construction and operation. Company-wide ESG management team under the External/ESG Policy Representative reviews and identifies the company's overall climate change risks based on outside expert advice, and establishes short-term and mid- to long-term response directions. The Representative examines mid- to long-term investment expenditures or acquisition of financial resources that are needed to respond to the risks. Finally, the ESG Committee under the BOD makes decisions on the direction for managing major non-financial risks and on investments. In the event of a severe calamity/disaster caused by climate change, the Risk Management Committee under the BOD and supporting organization under the CEO, exclusively in charge of risk management, manage business continuity.

In 2021, we acquired the ISO 14001 certification for our environmental management system and established environmental risk management guidelines, with the Environment Team playing the leading role. We also established new environmental management policies and an environmental performance evaluation system, in our efforts to reduce environmental impact of internal operations. In addition, by establishing environmental risk management guidelines by business site that reflect TCFD guidelines, we enabled more systematic environmental risk management. Starting in 2022, more focus will be placed on full establishment of environmental management system operation by building a system that sets, in detail, environment-related KPIs (GHG, water resource, waste, etc.) by business site.

Metrics and Targets

NAVER manages the amount of GHG emissions, amount of energy consumption and renewable energy consumption, and PUE of its IDCs to manage climate-related risks and opportunities. In 2021, we further increased the scope of climate-related risk and opportunity management to include our second office building 1784, Connect One, NAVER Square, and leased business sites, for which we are measuring environmental impact.

Greenhouse Gas (GHG) Emissions (Unit: tCO₂e)

	Classification	2018	2019	2020	2021
	Total	**72,416**	**78,712**	**79,907**	**78,872**
Total GHG emissions	Green Factory	7,510	7,178	6,731	5,888
	1784	-	-	-	1,636
	Connect One	-	-	-	923
	NAVER Square	-	-	-	693
	Leased business sites	-	-	-	403
	Data Center GAK Chuncheon	64,909	71,534	73,176	69,329
GHG emissions	Scope 1				
	Green Factory	295	244	197	204
	1784	-	-	-	0
	Connect One	-	-	-	265
	NAVER Square	-	-	-	8
	Leased business sites	-	-	-	4
	Data Center GAK Chuncheon	49	52	33	44
	Scope 2				
	Green Factory	7,215	6,934	6,534	5,684
	1784	-	-	-	1,636
	Connect One	-	-	-	658
	NAVER Square	-	-	-	685
	Leased business sites	-	-	-	399
	Data Center GAK Chuncheon	64,858	71,483	73,143	69,286

* Began to estimate GHG emissions of 1784, Connect One, NAVER Square, and leased business sites in 2021

Energy Consumption

Energy Consumption (Unit: TJ)

Classification		2018	2019	2020	2021
Total energy consumption	Total	1,495	1,624	1,649	1,646
	Green Factory	159	152	143	124
	1784	-	-	-	34
	Connect One	-	-	-	18
	NAVER Square	-	-	-	14
	Leased business sites	-	-	-	8
	Data Center GAK Chuncheon	1,336	1,472	1,506	1,448
Direct Energy Consumption	Total	6.7	5.7	4.5	9.7
LNG	Green Factory	5.8	4.8	3.9	1.9
	1784	-	-	-	0.0
	Connect One	-	-	-	5.2
	NAVER Square	-	-	-	0.1
	Leased business sites	-	-	-	0.1
	Data Center GAK Chuncheon	0.3	0.4	0.4	0.5
Mobile combustion	Green Factory	-	-	-	1.6
	Data Center GAK Chuncheon	0.1	0.1	0.1	0.0
Diesel	Green Factory	0.0	0.0	0.0	0.0
	1784	-	-	-	0.0
	Connect One	-	-	-	0.0
	NAVER Square	-	-	-	0.0
	Data Center GAK Chuncheon	0.4	0.4	0.1	0.3
Indirect Energy Consumption	Total	1,488	1,618	1,645	1,640
Electricity	Green Factory	143	138	130	113
	1784	-	-	-	32
	Connect One	-	-	-	14
	NAVER Square	-	-	-	14
	Leased business sites	-	-	-	8
	Data Center GAK Chuncheon	1,335	1,471	1,506	1,448
Steam	Green Factory	10.0	8.8	8.5	8.2
	1784	-	-	-	2.9

* Began to estimate energy consumption of 1784, Connect One, NAVER Square, and leased business sites in 2021

Renewable Energy Consumptio (Unit: MWh)

Classification		2018	2019	2020	2021
Renewable energy consumption	Total	283	318	314	1,082
Geothermal power	Green Factory	101	101	101	101
	1784	-	-	-	684
Solar power	1784	-	-	-	22
	Connect One	-	-	-	62
	Data Center GAK Chuncheon	182	217	213	213

*Began to estimate renewable energy consumption of 1784 and Connect One in 2021

Power Usage Effectiveness (PUE)

Classification		2018	2019	2020	2021
Power Usage Effectiveness	Data Center GAK Chuncheon	1.11	1.09	1.09	1.10

* PUE: Power Usage Effectiveness. The ratio of total amount of energy consumption of a data center facility to the energy consumed by IT equipment, it is generally used as a measure of the efficiency of data centers. An ideal PUE is 1.0.

According to the draft sustainability disclosure criteria of the International Sustainability Standards Board (ISSB) under the International Financial Reporting Standards (IFRS) and draft mandatory climate disclosure regulations of the US Securities and Exchange Commission (SEC), there has been increasing demand for companies to measure and manage Scope 3 emissions and to include the emissions in their respective emissions responsibility. In response, NAVER will review the way of measuring Scope 3 carbon emissions as w way to monitor GHG emissions across entire value chain of NAVER. We will also establish an inventory, thereby improving GHG emissions disclosure.

NAVER is subject to the national carbon emissions trading scheme, and has to purchase carbon credit in the Korea Exchange ETS (K-ETS) market for the amount of carbon emissions that is in excess of the emission permit. In particular, if we fail to meet the emissions target, we have to pay for purchasing carbon credit which may lead to increased GHG emission liabilities. The construction of our second data center "GAK Sejong" and the second office building "1784" is expected to bring about a sharp increase of GHG emissions. In response, we strive to reduce financial risks due to carbon emissions by expanding the procurement of renewable energy, improving energy efficiency, and making other efforts to achieve our mid- to long-term carbon reduction goal.

C. Targets used by the company to manage climate-related risks and opportunities and performance against targets

NAVER set the goal of Carbon Negative, aimed at having GHG reduction levels to be higher than GHG emissions by 2040. Increased use of renewable energy is a prerequisite to reducing the environmental impact of consumption of electric power, which accounts for the highest proportion among our GHG emission sources. As such, we plan to engage in decision-making that is based on efficiency in the aspect of the renewable energy purchase price and return on investment (ROI) on infrastructure investments. After establishing our mid- to long-term climate change goal in 2020, we detailed measures for renewable energy procurement and made active efforts to save energy in building operations in 2021.

Green Factory

NAVER's Green Factory office building was designed to constantly save energy, and does so at a rate of more than 5% every year through investments in energy-efficient devices such as heat-insulated partitions, LED lights, and others as well as continued energy-saving efforts. We encourage employees to take stairs instead of elevators by setting up the staircases with number of calories burned by walking upstairs, have designed a parking lot with bike racks for those who commute to work using bicycles, and expanded the electric vehicle-charging facilities to 22. We also participate in "Earth Hour", an environmental campaign hosted by the World Wide Fund for Nature, every year. To reduce energy consumption in the building operation, we simulated and applied optimal nighttime lights-out conditions, thereby reducing an annual 162 MWh of power. In particular, energy consumption additionally dropped in 2021 as a result of increased remote work due to COVID-19. Energy consumption and GHG emissions therefore decreased by approximately 13% and 12%, respectively over the previous year.

1784 Project

The 1784 project applied various energy-saving element technologies, including a radiant cooling system that uses geothermal heat, chilled water thermal energy storage system, and high-efficiency lighting system, to result in a 38.1% reduction in expected annual energy costs compared to the ASHRAE standard building model[1]. In particular, the radiant cooling system uses the most effective radiation method, from among heat transfer methods, and can reduce energy consumption and improve indoor thermal comfort through cooling. The system's annual energy consumption reduction effects reach 12.67% compared to the ASHRAE standard building model. Moreover, through water-saving plumbing fixtures and heavy water processing system, we achieved a 37.96% reduction in expected annual water use volume. The building uses a Building Energy Management System (BEMS) to save energy and improve functionality. As a result of these efforts, primary energy consumption is estimated to be 160.7 kWh/m^2 a year, one of the top levels of business facility buildings with total floor space of 10,000 m2 or more, based on statistics provided by the Korea Energy Agency, and around 26% lower than the average figure – 217.9 kWh/m^2 a year.

[1] ASHRAE standard building model (Baseline#model) refers to a virtual model that applies general energy-related system and equipment specs presented by ASHRAE 90.1, meaning that a virtual version of the 1784 project designed without considering energy consumption reduction.

Data Center GAK Chuncheon

Opened in June 2013, Data Center "GAK Chuncheon" was built by making many efforts and applying many technologies to reduce server heat in an eco-friendly way. As a result, it became the world's first data center to receive 'Platinum' certification, which is the highest grade, at LEED[2] New Construction (NC) 2009, an international environmentally-friendly building certification system. GAK Chuncheon has developed the Air Misting Unit (AMU) and the NAVER Air Membrane Unit (NAMU) – eco-friendly technologies that can reduce server room temperatures using cold air and underground water – and expanded the scope of their application to maximize energy savings. In addition, Data Center GAK Chuncheon uses photovoltaic energy and also invests in relevant businesses. It reduced an annual 213 MWh of power consumption through photovoltaic power generation in 2021, leading to the reduction of some 98 tons of GHG emissions. Moreover, by using such technology as natural cooling systems, 33,989 MWh of power was saved. It manages energy as efficiently as possible, including through LED lighting and EVs, and uses the air heated in the process of cooling computer servers to operate greenhouses. All plumbing fixtures are water-saving, and uncontaminated water is purified and reused in bathroom fixtures where possible. Rainwater is collected to be used as cooling water or for firefighting.

[2] LEED: Leadership in Energy and Environmental Design, Environmentally-friendly building certification developed by the US Green Building

Data Center GAK Sejong

"GAK Sejong" is NAVER's second IDC, representing our promise to deliver technological stability and efficiency as well as nature conservation. GAK Sejong is being built with the goal of achieving a better PUE than that of GAK Chuncheon by applying a hybrid cooling system. The hybrid cooling system that will be applied to 'GAK Sejong' was developed to use natural outdoor air as much as possible and therefore can improve cooling energy efficiency by as much as 20% in comparison to GAK Chuncheon. In addition, we plan to save data center cooling energy by improving mechanical infrastructure facilities, including late-night electric power, freezer, and cooling tower, and by applying new technologies. By optimizing cooling system arrangement, we will enhance electric power efficiency and also strengthen stability of heating, ventilating, and air conditioning equipment. GAK Sejong currently produces an annual 300 MWh renewable energy through a rooftop photovoltaic generation system, and uses a geothermal system for its cooling and heating. Waste heat retrieved from the server room is used to supply warm water in the building and for floor heating of the wide indoor space of the operation building. Also, we applied the Snow Melting system to an internal beltway, and used other such accumulated know-how from GAK Chuncheon to design GAK Sejong in a way that leads to higher energy efficiency.

Connect One

Connect One, a training institute exclusively for NAVER employees, is created into ONE 1, 2, and 3 according to geographical features and was designed to separate work space and rest space. It optimized energy consumption by adopting the Building Energy Management System (BEMS), leading to energy saving of 34% below the baseline. In addition, it uses recycled water, including rain water and heavy water, instead of service water. Rain water is collected on the rooftop of Connect One and reused for plant irrigation, while heavy water is used in bathrooms. Some of the heavy water is rainwater processed and used for plant irrigation, resulting in a heavy water recycling rate of 50%. Thanks to these efforts, Connect One earned the LEED v2009 NC Platinum grade in 2014, and its GHG reduction reached 13,494.630 tCO$_2$eq according to an environmental impact assessment conducted in 2017[3].

[3] Based on the operations in 2017

Climate Risk & Opportunity Management –
Environmental Impact of Hardware Infrastructure   (Unit: MWh)

Classification		2018	2019	2020	2021
Total energy saving	**Total**	37,303	41,689	41,199	**37,402**
Saving through office management	Green Factory	138	517	837	1,819
	Data Center GAK Chuncheon	511	511	514	512
Saving of electricity for air-conditioning and heating by adopting geothermal energy	Green Factory	101	101	101	101
	1784	-	-	-	684
Saving through natural cooling system	Data Center GAK Chuncheon	36,371	40,343	39,534	33,989
	1784	-	-	-	22
Saving by producing renewable energy	Data Center GAK Chuncheon	182	217	213	213
	Connect One	-	-	-	62
Renewable energy consumption	**Total**	283	318	314	**1,082**
Geothermal power	Green Factory	101	101	101	101
	1784	-	-	-	684
Solar power	1784	-	-	-	22
	Connect One	-	-	-	62
	Data Center GAK Chuncheon	182	217	213	213

* Began to estimate energy saving of 1784 and Connect One in 2021

NAVER