4 Sustainability Risks and Opportunities

The SDGs CHT contributes to in this chapter

Our "Risk Management Committee" adopts Enterprise Risk Management (ERM) software and the "Risk Analysis Matrix" as our assessment tools, governing every business decision made by our employees.

The development of the Artificial Intelligence of Things (AIoT) will popularize edge computing, IoT phone numbers, drones, AR, VR, and smart homes. These emerging industries will propel the development of hardware and operating systems.

CHT is the first telecom company in Taiwan to sign the support statement issued by the Task Force on Climate-Related Financial Disclosures (TCFD).

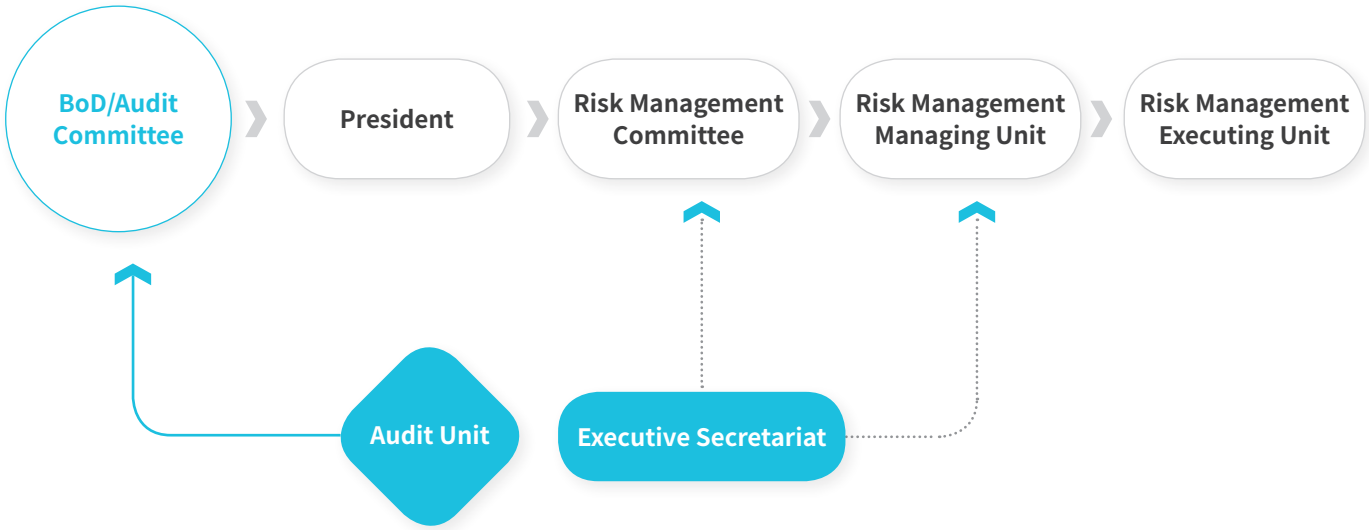
CHT promises that it will submit its Science Based Targets (SBT) on carbon reduction for review within the next 2 years.

CHT is actively looking into the development of renewable energy. We have the largest capacity, self-built or otherwise, for solar energy among all telecom companies in Taiwan.

Adopting a risk-based approach, CHT established the"Chunghwa Telecom Cybersecurity and Privacy Protection Framework." Based on NIST's Cybersecurity Framework (CSF) and domestic and international standards and regulations, the framework includes five steps: identify, protect, detect, respond, and improve.

CHT places emphasis on the control of the corporate operation and sustainability risk. In 2016, the Company established a Risk Management Committee with the President as convener and high rank managers as members. The committee supervises risk management throughout the organization and is responsible for prioritizing identified risks, formulating response strategies to key risk issues, and reporting to the board of directors when deemed necessary. Through control of the mechanism at each level, potential risks and loss to the Company can be minimized.

CHT Risk Management Organization Structure



Identifying and Analyzing Climate Change Related Risks

Identifying and analyzing climate related risks are important responsibilities of CHT's "Risk Management Committee." Led by CHT's President in conjunction with committee members, the committee takes charge of risk management. Issues are prioritized based on the types of risks and urgency involved. Apart from formulating an action plan, climate-related issues are reported to the Board of Directors.

Managing and Assessing Climate Change Related Risks

CHT's Environmental Sustainability Task Force systematically reviews climate change-related issues that could potentially impact day-to-day business operations and comes up with countermeasures based on its "Five Year Plan of Sustainable Development Strategies and Goals."

The review process includes a scenario analysis of physical and transitional risks and how they could affect major business operations. It also evaluates the effectiveness of energy-saving practices and the adaptability of equipment, ensuring normal operation even in extreme weather conditions. The potentiality of natural disasters is considered in the construction of telecom equipment. In other words, we assess the risks of earthquakes, tsunamis, geological instability, and other weather-related risks to ensure our equipment operates correctly and to ensure the safety of our employees in the event of a natural disaster.

Including Weather Related Risks in the Internal Risk Management Framework

CHT's CSR Environmental Sustainability Task Force keeps track of climate change on a regular basis and submits a yearly assessment report to the Risk Management Committee, which, if necessary, takes measures to mitigate the level of risks.

Based on the task force's feedback, the Risk Management Committee will seek ways to improve the existing risk management model to ensure that the process is consistent with our business goals. Finally, the Chief Audit Executive, who performs the final review, reports the assessment results to the Board of Directors. Our goal is to incorporate climate change-related risks into our existing internal risk management framework.

Aspects	Description
Organizational Aspect	• The "Risk Management Committee" was established
Strategic Aspect	• The BoD established the risk management strategy and structure • The "Risk Management Regulations" were established as a foundation and are followed by all employees engaged in business operations
Management System	• The Enterprise Risk Management (ERM) system was established for the regular control of the risks from each division and business
Assessment Tool	• We use the "Risk Analysis Matrix" as our assessment tool to assess legal, network maintenance, market and financial operation risks , etc. • For the major operational items and relative CSR issues, we enhance the performance of sensitivity analysis and the pressure test
Audit Aspect	• The executive Secretariat helps promote the risk management activities in all company • The Auditor reviews the risks and reports to the BoD
Feedback and Improvement	• Risk status is followed up monthly and reported to the Risk Management Committee generally • The Committee improves the current risk management mechanism based on feedback from individual units to ensure the process is up to date and satisfies the operational need
Implementation outcomes in 2018	• **2** meetings were convened. • Seminars on "the difference in law application between EU's GDPR and Taiwan's Personal Information Protection Act (PIPA)" and "the effectiveness of assessment of the accountability scheme"

Emerging Risks

CHT continues with advanced technological research and development to take advantage of the many business opportunities in this digital convergence era and reduce operational risk. We absorb, cultivate and make good use of excellent available talent to integrate Internet and marketing resources. We cooperate closely with our strategic partners in the launch of new services and products that satisfy our customers. We have become "The Digital Economy Motivator and The Creative Industry Pilot," and we create values for clients, shareholders, employees and society.

Risk Factor	Potential Influences (Obstacles)
The decrease in the voice revenue	• Market competition and VoIP have caused a slight decrease in voice revenue • We continue to maintain our competitive edge in broadband Internet, even in the face of low-price competition from cable television.
The 5G business model is unclear	• The cost of our 4G investment has not been fully recovered and 5G belongs to the high-frequency spectrum. We predict that serious investment will need to made to satisfy the requirements for new construction in the near future.
Energy supply stability	• A stable and sufficient electricity supply • The establishment of renewable energy

Emerging Opportunities

The 5G technology will drive intelligent technological applications. AI will be everywhere around us in the future. Completely new types of services such as AIoT (AI and IoT) will become the core of fast convergence. The rise of new industries, edge computing, the volume of the IoT, drones, AR, VR and the intelligent family, will push corporations in Taiwan to move their business emphasis. We predict that the global output value of AI hardware will exceed NT$ 5 trillion. This will inevitably become an important force in pushing global economic growth. With the advent of Industry 4.0 and the rapid emergence of new online applications, cybersecurity specialists are issuing warnings regarding the looming threat of multimodal, multifaceted attacks. However, this also creates an opportunity for companies that offer an integrated cybersecurity service package. The government has classified information security as a "matter of national security," including it as part of the "national defense industry" in the "5+2 New and Innovative Industries Policy."

Opportunity Factor	Potential Business Opportunity
Development of 5G	• Forecasts show that 5G technology will result in an output of US$ **134** billion to the companies in Taiwan in 2035.
IoT/Big Data	• International research institute Gartner predicts that the IoT product and service providers will create a marginal benefit of US$ 300 billion. • The global IoT output value in 2025 will be US$ **6** trillion.
Information Security Management	• Business opportunities in cyber security are plentiful thanks to the rapid development of IoT technology, the popularization of complex hybrid networks, and the reliance on industrial control systems (ICS). • The Executive Yuan announced the Cybersecurity Industry Development Action Plan in 2018. The gross output of the industry is expected to exceed NT$ **78** billion dollars by 2025. • Gartner predicts the investing amount the companies put into information security will rise to US$ **114.8** billion in 2020 with a compound annual growth rate of **7.9**% around the globe.
Climate change (low carbon products and services)	• For 3 consecutive years, the WEF's annual risk report has cited "extreme weather events" as the **top** risk factor in terms of occurrence possibility. • Businesses around the globe are investing in low carbon emission infrastructure, including green energy, electric automobiles, and smart cities to reduce reliance on electricity. • According to an estimate by The United Nations Environment Programme (UNEP), the volume of outstanding "green bonds" reached a magnitude of US$ **155** billion in 2017.

Enhancement and Response Mechanism

- In addition to enhancing current core business, we continue with new product research and development, as well as service and value-added applications. These include video service, information security, IoT, the cloud, mobile payment and other new business.
- We are concentrating on applications related to big data, information security, the cloud, IoT, 5G and the intelligent city. CHT is being transformed into the leading brand for information, communications and digital convergence.
- We have developed an IoT intelligent internet platform by combining five main services, which are information security, big data, blockchains, AI and AR.
- We expect IoT applications to develop rapidly with the advent of 5G and we already have **3** million phone numbers authorized by the NCC. We intend to provide IoT for both industrial and domestic applications.
- We are increasing the percentage of self-built renewable energy devices and have set up emergency power generating equipment to avoid interruption to our services in times of crisis.

CHT IoT Smart Platform: http://iot.cht.com.tw/iot/

CHT spares no effort in the refinement of cybersecurity technology. In response to the government's cybersecurity automatization and industry innovation policies, CHT founded Chunghwa Cybersecurity International, a subsidiary dedicated to the development of integrated cybersecurity solutions especially for emerging technologies. We hope that our endeavors will encourage other companies to follow suit, paving the way for the domestic cybersecurity industry to enter the international market.

According to the "Global Risks Report 2019" published by the World Economic Forum (WEF), the "probability" and "magnitude of impact" arising from weather-related risks are now classified as two of the major global economic development factors. CHT possesses the core technologies and capabilities are necessary to bring about a greener telecom industry. In a brand new era of IoT, AI, and cloud computing, CHT's commitment to reducing carbon emission and transforming into a green enterprise gives us a competitive edge.

Enhancement and Response Mechanism

- We cooperate with the 5G office in DoIT, Industrial Technology Research Institute, and Institute for Information Industry to launch the "Taiwan 5G Industry Development Alliance - CHT leading team" project.
- We are forming a national IoT team. Through allying with the international and Taiwanese companies, we create international competitiveness for the IoT industry in Taiwan. There are now **40** first-tier companies in the alliance.
- We developed the IoT intelligent internet platform on our own, combining 5 main services, including information security, big data, the blockchain, AI, and AR.
- Through emerging technologies such as machine learning, big data analytics, and AI, we plan to establish the newer version of Security Operation Center (SOC), providing companies with real time cyberattack information and enabling them to counteract in a timely manner.
- Our in-house developed multi-factor identity authentication technology can be incorporated into and with smart energy, smart cities, smart healthcare, and smart homes, providing a safe and reliable biometric identification system for IoT networks.
- With our current IT solutions as the basis, we plan to offer even more complex solutions for clients using ICS/OT infrastructure connected to a hybrid network.
- We position ourselves as a managed security service provider (MSSP) dedicated to the provision of a wide range of cybersecurity solutions. In addition to extending our market reach within the border, we are actively seeking business opportunities overseas.
- We strive to maintain our leading position in the industry by consolidating our advantages in internet services, distributions channels, and R&D capabilities with domestic and overseas high-quality products to provide integrated solutions to our large enterprise clients.
- "Green Product and Service Program"—In addition to developing renewable energy, we plan to provide businesses with energy-saving technology and services.
- By combining innovative green services, such as video conferencing, e-bills, and other cloud services, with our existing technology, we plan to build smart cities with lower carbon emission.
- We are building a cloud service platform that enables clients to access real time data regarding their energy usage and equipment status so that failures can be predicted and prevented.
- We began investing in the photovoltaics and Green ICT industries in 2017, establishing the Smart Energy Lab and the Smart Architecture Lab. As of 2018, we have the largest capacity, self-built or otherwise, for solar energy among all telecom companies in Taiwan.

Climate Change Risks and Opportunities

With the current trends associated with global climate change, the mitigation of greenhouse gas emission has become a critical issue in global economic development since the Paris Agreement entering into force and the UN proposal of the Sustainable Development Goals (SDGs).

In 2018, to facilitate the transparent disclosure of climate risks and opportunities, Chunghwa Telecom became the **first** telecom company in Taiwan to sign on as one of the 513 supporters of the Task Force on Climate-related Financial Disclosures (TCFD) initiative. Our 2018 Corporate Social Responsibility Report also discloses climate change-related information in accordance with the suggested frameworks of TCFD.

Commitment to Science Based Targets and their Development

1. To establish clear medium- and long-term goals, in 2019 we shall commit to the submission of our targets to the Science Based Targets (SBT) for evaluation within two years.
2. It is expected that the substantive benefits of energy-saving and carbon reduction shall be reflected in the revenues from green products. In addition to such benefits, we shall also implement the public disclosure of information related to our carbon management achievements in our annual corporate responsibility reports.

Risk Factors

Transition Risks

① **Policy & Regulation:** Emission disclosure responsibility
② **Policy & Regulation:** Increased cost of GHG emissions
③ **Technology:** Replacement of existing products and services with low-carbon alternatives
④ **Technology:** Lack of investment in innovative low-carbon technologies
⑤ **Technology:** Transitional costs of low-carbon technologies
⑥ **Technology:** Abrupt changes in energy (electricity) costs
⑦ **Reputation:** Appraisals by domestic/foreign investors and sustainability awards
⑧ **Reputation:** Changes in consumer preferences
⑨ **Reputation:** Stigmatization of industry

Physical (Natural) Risks

① **Acute:** Increased severity in extreme weather events (heavy rainfall, regional flooding)
② **Chronic:** Changes in regional rainfall patterns
③ **Chronic:** Increased average temperature

Financial Impacts on Chunghwa Telecom

Transition Risks

① **Policy & Regulation:** Increased operational costs (e.g. increased regulatory or insurance costs)
② **Policy & Regulation:** Increased insurance liability caused by climate-related impacts
③ **Technology:** Development of new and alternative technologies and their development expenditure
④ **Technology:** Capital invested in technological development
⑤ **Market:** Increased insurance liability caused by climate-related impacts
⑥ **Market:** Abrupt changes in energy (electricity) costs

Physical (Natural) Risks

① Decreased revenue caused by lowered manufacturing capacity (transportation difficulties, supply chain disruption)
② Decreased revenue and increased costs caused by negative effects on employees (cost of workplace absence and care due to health, safety, or medical issues)

Chunghwa Telecom Disclosures to TCFD

Framework	Disclosures	Page
Governance	• The board's oversight of climate-related risks and opportunities	p.19
	• Management's role in assessing and managing climate-related risks and opportunities	p.19
Strategy	• The climate-related risks and opportunities the company has identified over the short, medium, and long term	p.45
	• The impact of climate-related risks and opportunities on the Company's businesses, strategy, and financial planning	p.45-46
	• The potential impact of the company's businesses, strategy, and financial planning in different scenarios	p.45-46
Risk Management	• The company's processes for identifying and assessing climate-related risks	p.40
	• The company's processes for managing climate-related risks	p.40
	• Processes for identifying, assessing, and managing climate-related risks and how they are integrated into the company's overall risk management	p.40
Metrics and Targets	• The metrics used by the company to assess climate-related risks and opportunities	p.19
	• Scope 1, Scope 2, and Scope 3 greenhouse gas emissions	p.49
	• The targets used by the organization to manage climate-related risks and their implementation	p.45-47

Climate-related Risks, Opportunities, and Financial Impacts on CHT

As the industry leader in telecom, Chunghwa Telecom has upheld the company tagline "Always Ahead" through our contribution to society and the industry by our utilization of the industry's core value and influence. We believe that the opportunities brought about by climate change shall be reflected in our future products and services. Chunghwa Telecom shall continue to pay close attention to and seek out green technologies and targets suitable for development. We hope to gain momentum developing more innovative products, services, and businesses as well as getting ahead in the low-carbon smart economy.

Chunghwa Telecom has evaluated and analyzed climate-related risks and opportunities by looking at distinct periods of time, including short-term (present-2020), medium-term (2020-2030), and long-term (post 2030).

Short-term present-2020	Medium-term 2020-2030	Long-term post 2030
Risk Factor: 1 5 7 1	Risk Factor: 1 2 4 6 1 2	Risk Factor: 1 2 3 8 9 1 2 3
Financial Impact: 1 5 2	Financial Impact: 1 2 4 6 2	Financial Impact: 1 3 5 6 1 2

Impacts of Climate-related Risks on Chunghwa Telecom

Chunghwa Telecom deeply understands the importance of climate change issues and knows that the inability to comply with environmental regulations may incur regulatory fines, a loss of competitive advantages within the industry, stakeholder concerns, and impact the Company's image and reputation.

Potential Climate-related Risks on CHT's Operations

1. The rising global temperature and intensifying extreme weather due to enhanced greenhouse effect have led to the threat of severe typhoons and flooding; the industrial and residential water usage in certain regions have also been affected by water shortage crises. Therefore, more resources need to be invested in natural disaster prevention, post-disaster facility maintenance, and operational energy access.
2. The government's implementation of the Greenhouse Gas Reduction and Management Act shall result in the enforcement of greenhouse gas emission control and the liberalization of carbon rights & carbon emission trading. The corresponding increases to our operational costs, due to Chunghwa Telecom's significant reliance on energy in the maintenance of networks and computer facilities, will undoubtedly impact our finances.

Opportunities and Strategies

Chunghwa Telecom adopts a two-pronged strategy which is dedicated to the pursuit of a low-carbon transition and taking advantage of future business opportunities both internally and externally.

Internally

Establishment of the Company's "Environmental Sustainable Development Strategies and Targets" via organized, systematic methods. Effectively improving the effective management of carbon emissions and other environmental information through the use of our internally developed environmental information management system.

Externally

Development of green products and services to develop renewable energy and provide businesses with energy-saving technologies and services.

Chunghwa Telecom has utilized its long-established experience in the development of information & communication systems and environmental monitoring systems for electrical environments to integrate and monitor our clients' energy-consuming equipment inside their buildings. We've also adopted a cloud platform to provide clients with services such as energy-saving performance calculations, equipment operational status monitoring, and real-time notifications. These services help businesses lower carbon reduction threshold and reach their energy-saving and carbon reduction targets.

As for our development of renewable energy, Chunghwa Telecom has invested thousands of manpower to build the Changhua Coastal Solar Power Plant. This plant is the country's **largest** solar power plant, with a total capacity of 100 MW and an annual output of **130 million** kWh. The power plant reduces annual CO_2 emissions by **70,000** metric tons, creating revenues for the Company and thus is a mutually beneficial endeavor benefitting both the environment and our operations.

Carbon Reduction Practices and Measures

In order to adapt to the potential changes in the environmental and climate change regulations & international accords, we have developed the following strategy:

Close Observation of Regulatory Changes both Domestically and Abroad

Establishment of the "Five-year Plan of Strategy and Goal for Environmental Sustainability Development" through active engagement with the competent authorities, related organizations, and other stakeholders to expand environmental protection efforts through the pursuit of "green corporation," "green sustainability," and "green innovation" goals. We've also implemented hazard mitigation measures for computer facilities and climate adaptation plans to strengthen emergency response measures and reduce climate risks.

Development of Renewable Energy

In 2017, we crossed into the solar photovoltaic field with the establishment of smart energy offices and office buildings, along with the development of Green ICT. By the end of 2018, Chunghwa Telecom had **topped the industry** in the energy capacity of solar photovoltaic facilities, including those installed in our own facilities and those commissioned by other businesses. We have also installed solar panels on cell towers in remote mountainous areas to reduce energy consumption and carbon emission; these panels can also provide power to the cell towers in the case of a power outage to support emergency communications.

Establishment of a Sustainable, Low-Carbon Supply Chain

In 2017, Chunghwa Telecom joined the CDP Supply Chain Program and became the **first** telecom company in Taiwan to participate in CDP's international platform. The official implementation of our carbon management measures with our **100** suppliers prompted them to disclose complete greenhouse gas information in a positive and proactive manner and commence planning of carbon management measures and strategies.

We incorporated the ISO 20400 Sustainable Procurement Standard in 2018 to implement our sustainable development beliefs in procurement practices, allowing us to evaluate our suppliers and establish graded management of a green supply chain. These measures helped us achieve our sustainable development goals in environmental protection, corporate management, labor rights, and health & safety.

Development of Low-Carbon Products and Services

In addition to mitigating the environmental impact caused by our operations, products, and services, we have reduced our carbon footprint via green innovative services and revolutionary technologies such as video conference, digital receipt services, and cloud products. We've also utilized the technological advantage in our primary businesses to help build smart cities; an example of such low-carbon solutions is a smart taxi dispatch system that lowers the number of empty cabs on the road and reduces fuel consumption.

Management of Service Centers' Carbon Footprints

In 2017, we have a wide range of service centers across Taiwan, linking environmental protection and online services to a green store. Chunghwa Telecom is the **first** company in Taiwan to incorporate green stores in its employee convenience stores. To further plan for the promotion of environmental sustainability, in 2019 we plan to implement the management of the service centers' carbon footprints. The program shall be assessed for its conformance to ISO 14067 and submitted for review to attain the Environmental Protection Administration Carbon Footprint Label, making Chunghwa Telecom the **first** telecom company in Taiwan to acquire the label. This shall be beneficial for "green communication" between the customers and ourselves.

Internal Carbon Pricing

Chunghwa Telecom first introduced the concept of carbon pricing management in 2018 to enable stress testing from a risk management perspective. In 2019, we established the stress testing scenario evaluating voluntary carbon reduction targets. Although the current greenhouse gas emission reduction and management methodology has yet to establish the telecom industry's total greenhouse gas emissions, we at Chunghwa Telecom continue to follow our voluntary medium- and long-term carbon reduction targets, which serve as the basis for the calculation of internal carbon pricing and the evaluation of internal energy-saving and carbon reduction projects.

Chunghwa Telecom Internal Carbon Pricing Analysis

Carbon Management Scenario	Carbon Pricing Adopted (Shadow price)	Scope of GHG Emissions	Number of Operating Locations Involved
Voluntary Carbon Reduction Target	NT $ 1,500 /t-CO_2e	Scope 1 + Scope 2	Headquarters, business groups, and branches

Carbon management scenarios are based on voluntary medium- and long-term carbon emission reduction targets. With 2017 as the base year, the carbon emission reduction of the Company's buildings should accumulate to a total of 10% by 2023. In other words, Chunghwa Telecom should reach an accumulated greenhouse gas emission reduction of 83,298.75 t-CO_2e in its buildings by 2023.

Business Group/ Branch	Emission Changes in 2018	Carbon Price Allocated (NT$ 10,000)	Business Group/ Branch	Emissions in 2018	Carbon Price Allocated (NT$ 10,000)
Headquarters	22.02	3.3	Corporate Business Group	112.02	16.8
Northern Taiwan Business Group	2,196.31	329.4	Mobile Business Group	864.37	129.7
Taipei Branch	2,909.80	436.5	Mobile Business Group—Taipei Branch	5,328.79	799.3
New Taipei Branch	(37,064.59)	-	Mobile Business Group—Taichung Branch	7,958.98	1,193.8
Yilan Branch	510.13	76.5	Mobile Business Group—Kaohsiung Branch	17,274.78	2,591.2
Hualien Branch	66.00	9.9	International Business Group	1,786.21	267.9
Miaoli Branch	171.63	25.7	Chunghwa Telecom Laboratories	64.61	9.7
Taoyuan Branch	1,584.32	237.6	Institute Headquarters	153.84	23.1
Keelung Branch	(373.11)	-	Institute Taichung Branch	53.52	8.0
Hsinchu Branch	285.73	42.9	Institute Kaohsiung Branch	(35.45)	-
Southern Taiwan Business Group	251.11	37.7	Pingtung Branch	208.93	31.3
Taichung Branch	2,925.29	438.8	Kaohsiung Branch	2,210.54	331.6
Taitung Branch	1,008.72	151.3	Yunlin Branch	526.67	79.0
Tainan Branch	1,547.26	232.1	Chiayi Branch	(52.51)	-
Nantou Branch	1,469.04	220.4	Changhua Branch	773.17	116
Company Data Communication Business Group	3,464.63	519.7	Total		8,359.3

The numbers in the parentheses signify a decrease in carbon emissions compared to 2017; therefore, no carbon price is allocated.

Greenhouse Gas Emissions Management

The total greenhouse gas emissions in 2018 were **834,513.3** t-CO_2e, consisting of six types of greenhouse gases, namely, CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6.

As the operations of Chunghwa Telecom primarily use electrical power, the greenhouse gas is mainly scope 2 emissions (purchased electricity), accounting for a percentage of **96.35**%. Scope 1 emissions, which account for **3.65**%, are mostly generated by workplace emission sources. Closer investigation of the 2018 statistics reveals that although electricity consumption decreased, there was a slight increase in total carbon emissions due to the increase in national carbon emission factor.

To facilitate the decrease of greenhouse gas emissions, Chunghwa Telecom has actively built solar photovoltaic systems in recent years, reducing carbon emissions by **53,738** kg-CO_2e; we also acquired **97** Taiwan Renewable Energy Certificates (T-REC) in 2018.

Unit: t-CO_2e

	2016	2017	2018
Direct emissions (Scope 1)	27,345.62	30,873.98	30,469.89
Indirect emissions (Scope 2)	811,826.45	802,113.48	804,043.42
Total emissions (Scope 1 + Scope 2)	839,172.07	832,987.46	834,513.30
Emission intensity (t-CO_2e/NTD in million)	3.7	3.7	3.9
Percentage of scope in revenue	100%	100%	100%

Greenhouse gas inventory and verification are carried out in accordance with the ISO 14064-1 standard. The source of the global warming potential (GWP) is the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report. All data has been verified by SGS-Taiwan.

Scope 3 Emissions Inventory and Verification

Chunghwa Telecom conducts regular annual inventories of the organization's greenhouse gas emissions and conforms with the internationally mainstream scope 3 inventory guidance, investigating the greenhouse gas emissions of upstream and downstream activities to calculate scope 3 carbon emissions. Among these emissions, our inventory data on business travel emissions was awarded the verification certificate by SGS-Taiwan. The modes of transport used by Chunghwa Telecom's employees for business travel principally consist of the following: (1) land transport (high speed rail), (2) air transport (airplanes). The total greenhouse gas emissions of business travel in 2018 was **278,531.52** kg-CO_2e.

The total scope 3 emissions were

5,581,082.62

kg-CO_2e

Chunghwa Telecom Scope 3 Emissions

Unit: kg-CO_2e

Upstream	
Product & Service Procurement	1,310,033.13
Waste Treatment	46.97
Employee Commuting	101,000
Business Travel	278,531.52
Downstream	
Product Transportation	1,330,506
Leased Assets	2,560,965

Cybersecurity Risks

In response to emerging technology issues such as 5G AIoT and Big Data, and hacker attacks continue to be refurbished, CHT is working with the government and the International Information Security Organization to promote cybersecurity awareness and provide customers with a safer and more trustworthy digital environment.

CHT has performed the risk assessment in correspondent with the law compliance after the "Cyber Security Management Act" of the Executive Yuan and EU's "General Data Protection Regulation" (GDPR) become effective. We report the risk events and corresponding measures, and will continue to follow-up in the future.

Corresponding Strategies

To ensure the security of our "critical infrastructure" and "critical information infrastructure," we established the "Chunghwa Telecom Cybersecurity and Privacy Protection Framework." Based on the guidelines found in NIST's Cybersecurity Framework (CSF) and domestic and international standards and regulations, the framework helps us evaluate our performance in cybersecurity management.

We have established a department dedicated to cybersecurity. It is responsible for coordinating cybersecurity strategies, formulating and revising regulations, and the centralized monitoring of information infrastructure security. Furthermore, we update our annual action plans and performance indicators based on external environment and internal risk assessments to reduce cybersecurity risks. These performance indicators are applicable in every employee's performance review.

The Risk Management Committee keeps track of the risk monitoring process of cybersecurity and personal information protection. Any material risks identified will be reported to the audit committee of the Board of Directors, or in severe cases, directly to the Board of Directors. In 2018, there were **no incidents of material risks arising from cybersecurity or personal information protection.**

- Regulation Compliance
- Cybersecurity Policy and Procedures
- Cybersecurity Roles and Responsibility
- Asset Management
- Risk Management Strategy and Assessment
- Supply Chain Management

Opportunities and Actions

CHT reviews its cybersecurity and personal information protection measures on a yearly basis. Through internal and external audits, government inspection, and third-party verification (ISO 27001, ISO 27011, BS 10012, CSA STAR Certification, etc.), our clients can rest assured that their personal information will be securely safeguarded. The key mechanisms of our risk management framework are shown in the table below:

For more information of "Chunghwa Telecom Cybersecurity and Privacy Protection," please refer to page 126-129 in the 2018 Annual Report.