



Lead the Development of a Smart City

Strategy

Continue the investment in R&D, the introduction of advanced technologies and the joint ventures with the government and academic circle.

Management

Establish the quality improvement task force, quality assurance center, and business process task force for introducing ISO R&D quality system for integration with the development of competence, project management and system operation.

Action

Continue to present innovative products and create a smart city, including ITS smart transportation and smart home.

Response

Please refer to page 52-53 "Review and Prospects"

Target

Short-term Continue to pool momentum for research and development and launch new products for the creation of a smart city.

Long-term 2015~2018 earn **600,000** paid accounts for 4G smart city service, assist governments to create smart city.

Indicator

CHT 3.6 billion in R&D investment

CHT 1,488 talent in R&D

CHT 1,417 patents



Sustainable Products and Services

Changes in the global environment and climate have given rise to the idea of low-carbon economy and green consumption. Sustainable products and services will gradually become the mainstream in consumers' purchases, which we believe will be made possible once smart city and related applications become available.

Business opportunity*

- 1 million paying users in 4G smart city; potential to contribute NT\$70 billion of GDP
- NT\$40 billion of business value to be created from 4G access
- Smart city has the potential to create NT\$30 billion in business opportunities, and increase the value of 4G services to NT\$1.56 trillion by 2017

Advantages of Chunghwa Telecom

- Complete network infrastructure and the ability to integrate hardware, software, and technologies such as 4G and cloud computing
- Nationwide operations that enable the Company to develop "distinctive and innovative" smart city services

Featured projects in 2015

- We collaborated with the Industrial Development Bureau and local government bodies in the launch of 4G smart city project
- We spent NT\$312 million to develop three custom-tailored smart city applications for Taipei City: "accessibility service," "culture/creativity/tourism service," and "smart shopping service." The ultimate goal is to build Taipei into a friendly, cultured smart city favored by tourists

Note: Estimated based on statistics of the smart city project published by the MOEA.

4G Leads Smart City

4G Smart City has been supported by 15 counties and cities spreading across Keelung City, Taipei City, New Taipei City, Taoyuan City, Hsinchu County and City, Miaoli County, Taichung City, Chiayi County and City, Kaohsiung City, Taitung County, Yilan County, Penghu County, and Kinmen County, and also 2 specific areas, including Taiwan Taoyuan International Airport and Taoyuan Metro.

Intelligent Video Surveillance (IVS)



Intelligent Energy Service



Electronic Invoices service



Enterprise Cloud



Virtualization Platform



Mobile Payment Service



Intelligent Transportation System



Data Security Service



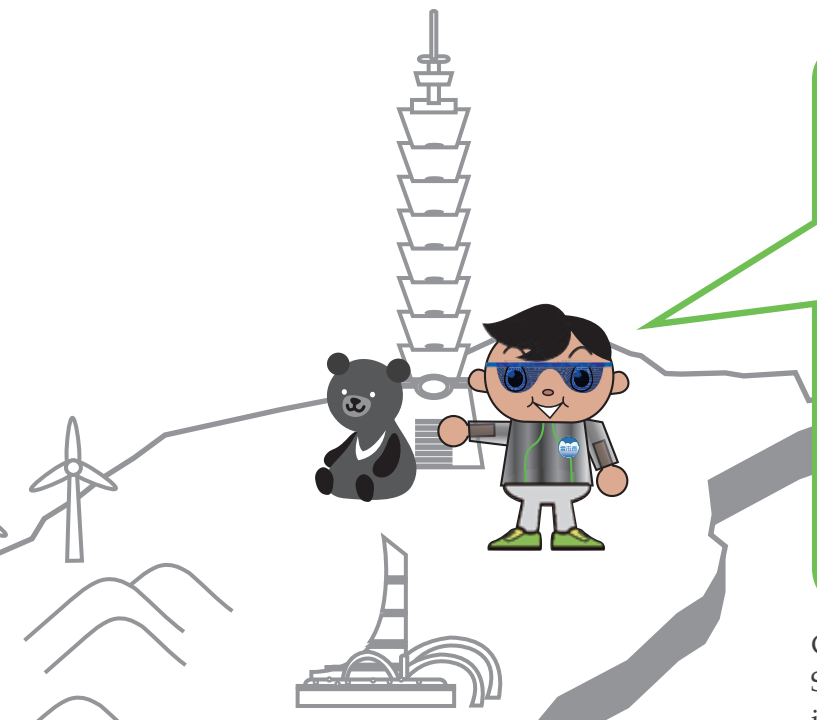
eHome



CHT utilizes 4G technology to link the mobile life and to create a LOHAS city with a thorough network of Cultural and Creative, touring and shopping, and entertainment AV.



CHT creates a 4G smart city of convenience, LOHAS and friendliness to lead a new era of smart life.



CHT builds a bridge of friendliness, making a Smart City convenient and happiness both to individuals and family.



4G technology has been used to monitor the traffic, shaping a safer, smoother and more convenient and Environmentally-friendly city.

Chunghwa Telecom remains devoted in green innovation, and strives to accomplish our goals through green consumption, green service, and green activities. We hope to apply our advantages in environmental protection and energy conservation onto existing products and services, as we view business and environmental sustainability our competitive focus and opportunity. In 2015, there was NT\$5,350.2 million revenues from green products, which accounted for 2% of total revenues.

Intelligent Energy Network Service (iEN)

The iEN service features three energy focuses: clean energy, energy management, and professional service, and six water focuses: "segment planning," "water management," "water quality monitoring," "effluent recycling," "desalination of seawater," and "agricultural return flow." A smart energy office and a water resource management office have been created to serve as an open platform for product solutions across industries. The smart energy office features a professional team of consultants to offer total energy conservation services from construction, marketing, to lifestyle applications. Its mission is to optimize energy management in ways that improve system efficiency and reduce operating costs.

We hope to increase the capacity of our renewable energy supply and improve the efficiency of which energy is used, so that we can become less dependent of conventional energy sources. Since the initial launch, the service has been widely adopted by hospitals, schools, government institutions, fish farms and mass retailers. This service has won multiple awards for Chunghwa Telecom, including two consecutive Best Energy Technology Service Provider from the Bureau of Energy, MOEA.

In Hsinchu City, for example, the iEN service was incorporated into Hsinchu City Government's "LED Street Lamp Replacement Project", where an IoT structure was developed and combined with map system to facilitate remote management and service call for street lamps. The combination of IoT infrastructure and energy-saving technology also has the potential for other smart applications including control of campus air conditioning, hot water supply, lighting, and street lamp upgrade.

<http://ien.com.tw/Info/> 

Fleet Management Express

This service incorporates the use of several advance technologies including smart in-car units, GIS, and smart transport system. It is well-integrated with customer service platforms used by taxi fleets to deliver functionalities such as fleet management, dispatch, customer service, safety monitoring, statistical report, emergency aid etc. The system captures GPS data transmitted from in-car units installed in taxis to give the taxi company a comprehensive view on the whereabouts, speed and direction of current vehicles. In addition to assuring passengers a safe journey to their destination, the system is also effective in reducing the vacancy rate, which makes it a multi-win solution for the Company, the taxi fleet, the driver and passenger.

The "Smart Taxi Dispatch Solution" offers the following advantages to a taxi fleet:

- More efficient dispatch: The time taken to process taxi bookings has been reduced from an average of 46 seconds to 20 seconds.
- Increased passenger load and shortened waiting time: With a 28% increase in daily taxi bookings, the percentage of vacant taxis on the street was effectively reduced, allowing drivers to work 20% lesser time.
- Lower fuel consumption and carbon emission: By using GPS to pinpoint and dispatch vehicles, taxi drivers are no longer required to drive around looking for customers, which saves fuel consumption by approximately 17%.
- SMS service through the "TAXI App": The "TAXI App" not only allows consumers to call taxis using their smartphones or tablets, it can also be configured to send text messages to relatives as soon as picked up.

<http://210.61.251.143> 



Participation in “Taiwan Intelligent Aerotropolis Association”

To assist in the government’s “Taoyuan Aerotropolis Project,” Chunghwa Telecom has taken the initiative to call local and foreign industry leaders of the same ecosystem into meeting, and was able to develop a consensus in just 2 month’s time while recruit nearly 70 businesses to form Taiwan Intelligent Aerotropolis Association (TIAA). Having envisioned “Forge a city of smart logistics and of industrial advance technologies” the TIAA exists to offer insightful advices to the development of Taoyuan Aerotropolis.

TIAA was officially founded on December 10, 2013 with Chunghwa Telecom Chairman taking the first chair. This association is a good demonstration of Chunghwa Telecom’s influence in building an “aerotropolis” and a “smart city”. Its involvement has contributed favorably to the Company’s image of a visionary and innovator.

On December 18, 2015, TIAA joined Taoyuan City Government in the organization of “Exhibition and Conference for Aerotropolis/Smart City Applications.”

The exhibition featured three main themes, namely: smart government, smart industry, and smart living; it demonstrated 13 successful innovations and applications that were made possible through a combination of 4G broadband, Internet of Things (IoT), and cloud computing. Participants were invited to experience personally the new smart applications and how they contribute towards a smart city.



Taiwan Intelligent Aerotropolis Association (TIAA): <http://www.tiaa.com.tw/>

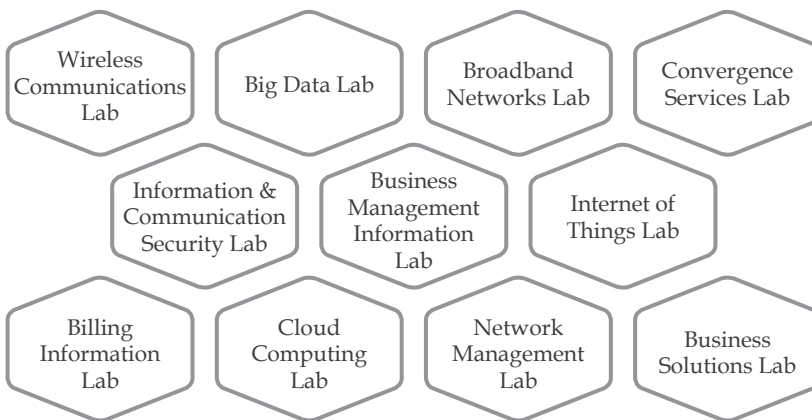
Sustainability in Innovative R&D

As the leader in telecommunication, we understand that research, development and innovation are what drive the growth of a business. To maintain our current advantage, we have adopted a visionary and creative culture that focuses on interacting, sharing, and creating mutual benefits with industry participants.

A dedicated research institution Chunghwa Telecom Laboratories commits substantial resources into research and development works. In addition to developing technologies needed by Chunghwa Telecom, the laboratory also plays an important role in the nurturing of new businesses.

The laboratory focuses its research efforts on innovative services, core technologies, and visionary applications. It strives to explore convenient and useful services from consumers' perspective, and formulate solutions through intricate coordination. Its ultimate purpose is to find ways to "simplify tasks for consumers and let Chunghwa Telecom deal with complexities."

CHT-TL Talent Summary



Quick View of Chunghwa Telecom Laboratories

- More than 1,488 employees (nearly 6.4% of total employees in CHT), 92% are R&D personnel. The laboratory plans to hire 30 additional permanent staff in 2016.
- R&D expenses totaling NT\$3.6 billion were spent in 2015, which accounted for 1.6% of consolidated operating revenues.
- In 2015, the laboratory added 162 new product/service patents to a total of 1,417 (1,294 were registered locally and 123 were registered abroad). 769 of these patents are currently in force (706 registered locally and 63 registered abroad).

Revenues from Innovative Businesses

In 2005, We spun off a division from the laboratory to create "Chunghwa Precision Test Tech Co., Ltd." By 2015, the entity has delivered excellent performance with full year revenues reaching NT\$1.725 billion and after-tax profit doubled to an EPS of NT\$14.77. It is currently the most profitable new business under Chunghwa Telecom, and will be listed on Taipei Exchange (TPEX) towards the end of March 2016.



In addition, we also expect to spin off another division from the laboratory to create a new optoelectronics company in 2016. This company will be producing military night vision goggles and industrial cameras, as near infrared-based products for various applications such as testing of agricultural produce, and facial recognition. The extensive applications of near infrared have already won purchase orders around the world for the new entity.



Credentials of the CHT Laboratories

👍 Ministry of Economic Affairs

Won 3 gold, 2 silver and 4 bronze from Taipei International Invention Show & Technomart

👍 IT Month Committee

Received "Gold Award" in 2015 Innovative Products for EyeQuila APT solution

👍 Industrial Development Bureau, MOEA

Ranked third and received Award for Excellence in the 2015 Industry Information Application Challenge

👍 Intelligent Transportation Society of Taiwan

Won the 2015 Smart Transportation Thesis Award from Intelligent Transportation Society of Taiwan

👍 The Chinese Institute of Electrical Engineering

Dr. Huang-Tien Lin of Wireless Communication Lab and Dr. Meng-Chun Weng of Internet of Things Lab were presented with "Outstanding Electrical Engineer Award" and "Outstanding Young Electrical Engineer Award," respectively, by The Chinese Institute of Electrical Engineering

👍 Chinese Society for Management Of Technology

The Wireless Communication Lab won the "17th Technology Management Award" organized by Chinese Society for Management Of Technology

👍 Cloud Computing Association in Taiwan

The EyeQuila APT solution won third place in the 2015 Cloud Innovation Competition

CHT Laboratories' Talent Overview



PH.D.

95 people
6.39%

8 people
0.54%

Master

963 people
64.72%

310 people
20.83%

Bachelor

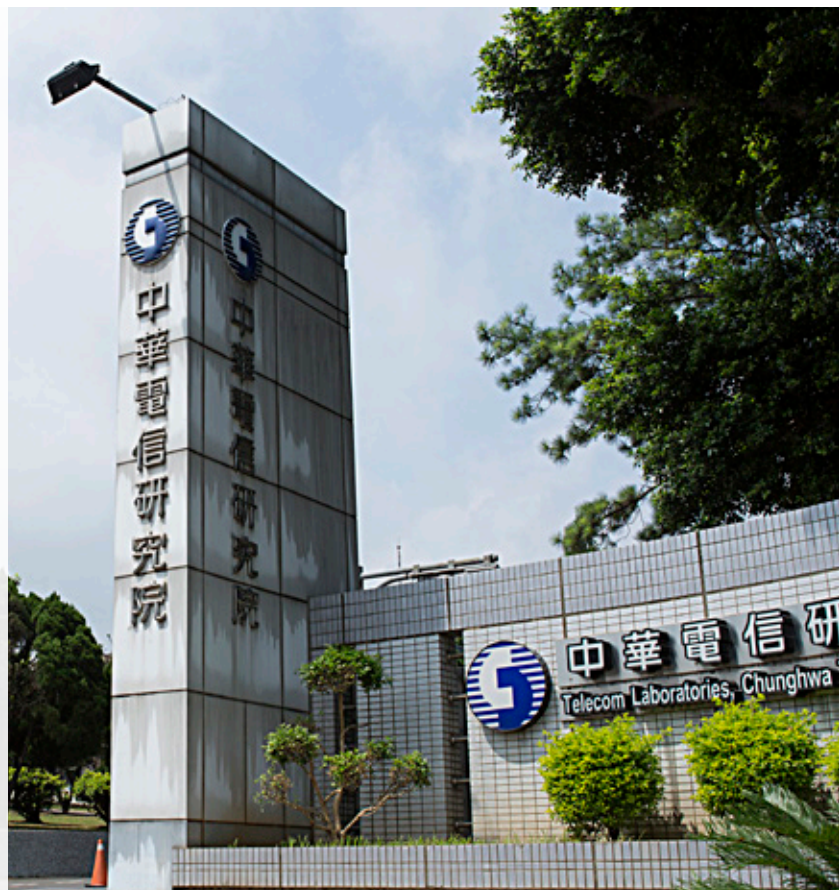
28 people
1.88%

20 people
1.34%

Others

32 people
2.15%

32 people
2.15%



Encourage Internal Innovation

For nurturing the corporate culture of innovation, we have established the “Chunghwa Telecom Creative Network” as a means to inspire employees’ creativity. If a proposal passes validation and is successfully launched into the market, the proposer may even be entitled to receive rewards up to NT\$30 million depending on how the product performs.

Cross-industry Collaboration and Incentives for Innovation

- Solution for paperless medical history: worked closely with Shuang Ho Hospital, Wanfang Hospital, and Taipei Medical University Hospital to produce 8 categories and 34 types of new medical charts.
- Hami+ and Springhouse Entertainment Tech: Hami+’s digital book store is being run by Springhouse Entertainment Tech, and Chunghwa Telecom offers its assistance in the development of value-adding features for Hami+. The App provides personalized article recommendations based on reading preferences of each Hami+ member, and offers text-to-speech feature to satisfy members’ reading needs under different scenarios.
- The Company collaborated with NTT West on a number of topics including: FutureNetwork, Wi-Fi network maintenance, Cloud computing, data security, IoT and Server-based infrastructure Management. This engagement helped Chunghwa Telecom learn more about the Hikari Collaboration Model that is currently being adopted by Japanese peer NTT for new businesses, which enables the Company to prepare ahead for potential business opportunities.
- The Company joined National Chiao Tung University to participate in the Industry-Academia Collaboration of SDN Technology organized by Ministry of Science and Technology. This collaboration reduces the time and cost taken to develop SDN technology, the results produced also have the potential to enhance network planning and construction, and create new value-adding services to the benefit of both the local telecommunication industry and the academia.

SDN Technology and Applications

- SDN (Software Defined Network) technology has been adopted as the supporting foundation to provide Wi-Fi QoE (Quality of Experience) and CDN (Content Delivery Network) QoE parameter measurement with scalability and elasticity, which could greatly reduce monitoring complexities and operating costs.
- Accompanied National Center for High-Performance Computing to exhibit SDX Topology Exchange in Super Computing 2015 held at Austin, Texas, USA; bringing global visibility to both the Company and the nation.



- Begin Wi-Fi Gateway virtualization, which enables greater flexibility without the need to purchase hardware in advance, and hence shortens the time of installation.
- Benefit in terms of economic aspect: reduce hardware equipment.
- Benefits in terms of social aspect: improve user experience, satisfies consumers’ needs and society’s expectations.
- Benefits in terms of environmental aspect: increase resource efficiency and reduce greenhouse gas emission.

Defense Solution Against APT

- Developed technologies such as ICAO document, ECC algorithm, virtual smart card, multi-card functionality, and citizen card for use with government administration, banking, and commercial applications.
- The Company’s EyeQuila APT big data solution won the Gold Award in 2015 Innovative Products and third place in the 2015 Cloud Innovation Competition.
- Received government subsidy for 4G Smart City Application, where a TSM system is used to transmit citizen card, electronic card, and credit card information over-the-air (OTA) to user’s smartphone.



- Continue enhancement of EyeQuila system features in particular regards to APT defense and information security forensics. Build APT defenses based on the intelligence system that extends all the way from Log, gateway to terminal.
- Invest into the development and application of NFC technology. Research the next-generation Easy Hami Wallet to give non-NFC cellphone users the chance to enjoy the convenience of digital wallets as do NFC cellphone users.

2015
in
Review

2016
in
Prospects



Smart Environment Solutions

- In support of the government's initiative to conserve energy, reduce carbon and eliminate mercury lamps, the Company developed a LED lamp management system that combines GIS to enable useful features such as lamp monitoring, malfunction reporting, power usage monitoring, and App for service calls.
- Developed a water resource management system that provides quantitative analysis, quality detection, and leakage assessment. Developed energy management system for the electronic industry.
- Devised monitoring solution for an array of air compressors that adjusts the number of units in operation depending on the factory's air intake requirements. Helped reduce units that operated at low load or inefficient speed, and saved energy for customers.



- Continually invest into water resource management. Complete functional modules such as effluent monitoring, DMA segment measurement etc. Provide customers with solutions that help them comply with effluents regulations.
- Support the government's initiative towards cloud-based healthcare by developing paperless medical history. Continually standardize personal health records (PHR) to enable better filing, security, management, sharing and exchange.
- Assist healthcare institutions in sharing, exchanging and consolidating personal records for better quality healthcare.

B4G/5G Technology

- Chunghwa Telecom was the telecommunication company that standardized technical specifications for tri-band carrier aggregation (B3+B3+B8 and B3+B7+B8) at 3GPP during the time when 4G bands were licensed in Taiwan.



- Chunghwa Telecom is currently a member of 3GPP and NGMN, both of which are vital to the development of 5G technology. The Company continues to devote resources into the research of mobile communication technologies, including technologies before 5G such as 4G/B4G. Meanwhile, small cells are being constructed in areas of high signal demand and locations that are not easily covered by conventional infrastructures. The Company will be introducing 5G services at the proper timing to realize the government's vision of "A smart nation inspired by mobile broadband, a life without borders, and information without delay."

Innovative Application Challenge - Nurturing Creative minds

Chunghwa Telecom's innovative application challenge has been run for nearly 10 years. We provide an open platform and invite passionate students and working adults to turn creative ideas into useful Apps, micro films and children's e-books. Through this competition, we have established communication between creators and business users, and gave them the opportunity to observe, learn and inspire one another and take creativity to a whole new level.

Hami Apps Development Challenge

- 1 More than 10,000 students have participated and more than 1,000 mobile applications have been completed since the challenge first began. The competition received 200 entries in 2015; 135 of which were considered valid (shelved) and received 100,000 download during the year. Hami software store current has a customer base of 1.45 million.

MOD Micro Film Competition

- 2 Amongst all micro film competitions in Taiwan, MOD receives the highest number of entries and offers the largest regards. The 2015 campus division had attracted the attention of Taipei Film Commission and Micro Movie Association; both of which had proposed to share resources and collaborate in the event.

FunPark - Creative Storytelling

- 3 "FunPark" is the nation's first digital creative platform for children's publications. It is where students are inspired to create stories, and the winning pieces are published into personalized interactive digital illustration Apps with the help of a professional editing team.
A total of 1,183 schools had participated in the program in 2015, and nearly 60 campus tours were organized to reach more than 100,000 students, teachers and parents. The winning pieces were viewed more than 80,000 times, and the addition of "FunPark" had contributed to a 10% revenue increase.





Build Corporate Cloud

Chunghwa Telecom's cloud computing infrastructure is created based on the framework of "4 centers, 1 platform and 1 marketplace." The 4 centers refer to the R&D Center, the Testing Center, the Operating Center and the Experience Center, whereas the rest comprises of a cloud creativity platform and a cloud marketplace. We hope to utilize our advantage in software and hardware integration to help transform and grow the local industry.

In 2015, Chunghwa Telecom participated in New Taipei City Government's "3rd Generation Corporate Cloud" project to help local businesses embrace the enormous opportunities presented in the cloud computing era. By the end of 2015, the Company had completed 5,496 counseling sessions on the use of enterprise cloud service. We currently offer three cloud services: data security, cloud database, and cloud server to deliver data protection, storage, backup, and server hosting at the enterprise level. Through this effort, we hope to make New Taipei City the most advanced cloud city in Taiwan.

The "Cloud Valley" Project

Chunghwa Telecom has been working closely with Cloud Computing Association in Taiwan for a project named "Cloud Valley" since 2013. With the support of technology, guidance and funding from the association's prominent members, Cloud Valley has been vested the hope of discovering future talents/entrepreneurs in Taiwan's cloud computing industry, and becoming the model industry cluster.

In 2015, Division Chief Jao of Chunghwa Telecom's Data Communications business Group was assigned to counsel two new businesses (NOC Internet Technologies and Magen king) for the finalist competition in Cloud Valley, which they both delivered extraordinary performance.

