



TAIWAN

# Next-Generation Vehicle

Key Innovative Industries in Taiwan

Information Security

**Next-Generation Vehicle**

Communications Industry

Circular Economy

Green Energy

Biopharmacy Industry

Smart Machinery

Semiconductor Industry

Internet of Things

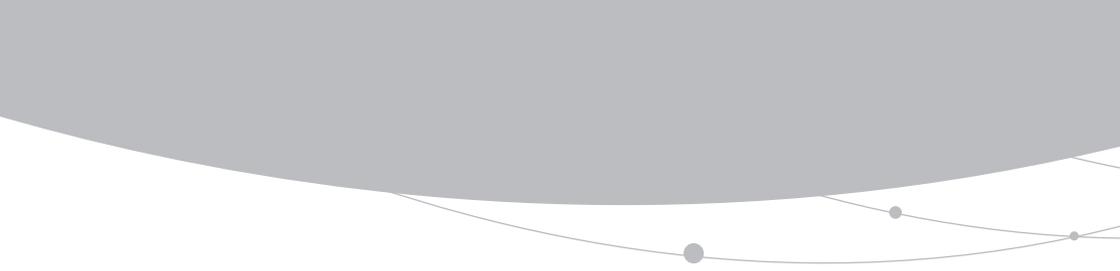
International Logistics and E-commerce





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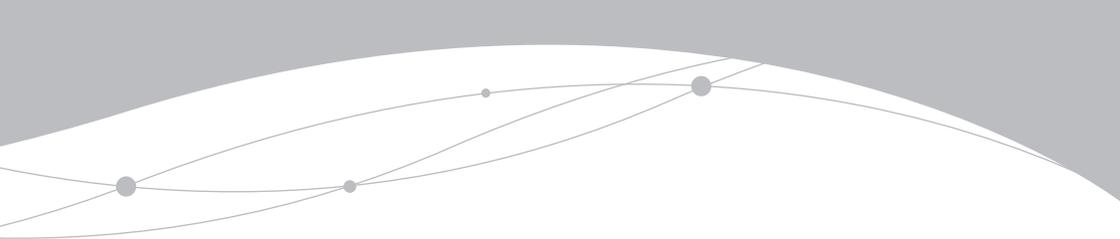
# Policy Initiatives

Mercedes-Benz launched its C.A.S.E. initiative in 2016. C.A.S.E. is an acronym that stands for the four key concepts of "Connected" (i.e. online connectivity), "Autonomous" (i.e. autonomous driving), "Shared & Services" (i.e. the principle of shared ownership of Mercedes-Benz vehicles, and the apps and partnerships that are shared with Mercedes-Benz), and "Electric." These concepts guide the company's development strategy. Moving forward, many auto makers will treat C.A.S.E. as the direction in which the development of new generation automobiles will be moving.

C.A.S.E. is also the developmental direction that Taiwan government policy is pursuing. Take "electric," for example. When our government in 2015 set the direction of a project to promote the development of smart electric vehicles, we adopted the following five key strategies: inter-agency promotion of electric buses; provision of bigger incentives to buy vehicles; adoption of innovative business models; and establishment of industrial value chains. The objectives are to get more electric vehicles on the roads, and to spur upgrading of the electric vehicle industry.

Next, with an eye to protecting the health of the public, Taiwan has taken aggressive action to improve air quality and adopted specific targets in this regard. In 2017 we adopted an "Action Plan for the Prevention of Air Pollution," which set a target of a 50% reduction of suspended particulate matter by 2019. The Action Plan also introduces a plan for phased introduction of electric vehicles, including complete conversion to electric vehicles and buses in government fleets by 2030.

As for the "autonomous" concept, our government is using advanced driver assistance systems (ADAS) as the basis for legislative amendments designed to improve traffic safety. And with respect to the development of self-driving vehicles, in order to keep pace with progress taking place on this front throughout the world, Taiwan's national legislature in 2018 passed the "Unmanned Vehicles



Technology Innovative Experimentation Act." Drawing upon the "regulatory sandbox" spirit, this act provides a statutory basis for loosely regulated experimental efforts to develop new types of unmanned vehicle technologies. The regulatory sandbox approach seeks to facilitate the development of a new generation automobile industry by allowing for industrial, academic, and research entities in Taiwan to cooperate in experiments on new self-driving vehicle technologies, services, and business models within specifically prescribed areas where regulatory restrictions have been eased to a minimum. The Changhua Coastal Industrial Park, for example, provides self-driving shuttle buses that operate between tourism factories, and is operating a 5G intelligent transportation area in Danhai New Town. Both of these projects are being undertaken on an experimental basis.

Taiwan currently has the following two closed-course testing facilities for autonomous vehicles: (1) Taiwan CAR Lab in Shalun, Tainan occupies a site of 1.8 hectares and tests vehicles having the dimensions of a mid-sized bus or smaller. Its road test items simulate driving conditions on Taiwan's roads, with vehicles moving at a speed of roughly 30 kph or slower. (2) A phase-one testing ground at the Hutoushan Innovation Hub in Taoyuan City covers a site of 1.8 hectares, and relies on the Internet of Vehicles (IoV) & Smart Driving Center and Information Security IoT Center to test autonomous vehicles under a wide variety of simulated environments.

Taiwan has begun to pour resources into innovative autonomous vehicle R&D work. Legislation governing autonomous vehicles has been passed. At both the central and local levels, our government is actively working to establish autonomous vehicle testing grounds. The aggressive attitude demonstrated by these actions has gotten Taiwan listed for the first time on the KMPG 2020 Autonomous Vehicles Readiness Index, where it ranks 13, ahead of Germany, France, and Australia.

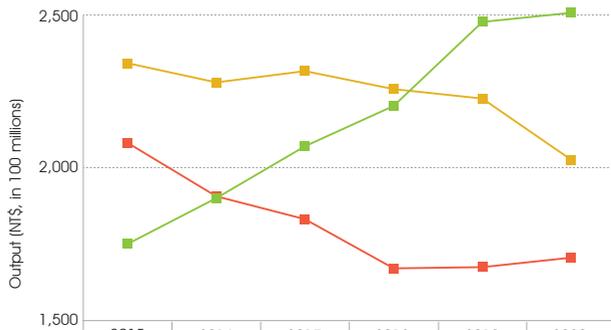
# Overview of Industrial Development

## 1 | Output Value |

For Taiwan's auto manufacturing sector in 2020, total output came to NT\$170.5 billion. Meanwhile, the total output of the auto components sector was NT\$202.6 billion, and for the automotive electronics sector it was NT\$250.7 billion. For the three sectors combined, total output value came to NT\$623.8 billion (see Fig. 1). For the past two years, the automotive electronics sector has posted the biggest growth in our auto industry, and this one sector accounted for about 40% of total auto industry output value in 2020.

In terms of product categories, Taiwan mainly produces small family cars (having an engine of 2,000 cc or smaller), and Taiwan's component makers mainly produce auto lights, body and stamping parts, tires, and wheel rims. In addition to high domestic sales, Taiwan-made auto components are also exported in large quantity to markets in North America and Europe. Taiwan is also a significant player in the aftermarket and OEM markets, and some Taiwanese manufacturers have worked their way into the supply chains of international auto makers (such as Tesla and Ford). This background -- plus the fact that firms in Taiwan's ICT and related sectors are making an active effort to break into the fields of automotive electronics, autonomous vehicle technology, and new energy -- means that Taiwan is in a very strong position to develop new generation automobiles.





	2015	2016	2017	2018	2019	2020
Automotive Electronics Industry	1,750	1,900	2,070	2,202	2,477	2,507
Automotive Parts and Body Manufacturing Industry	2,342	2,279	2,316	2,257	2,226	2,026
Automobile Manufacturing Industry	2,081	1,906	1,831	1,670	1,674	1,705

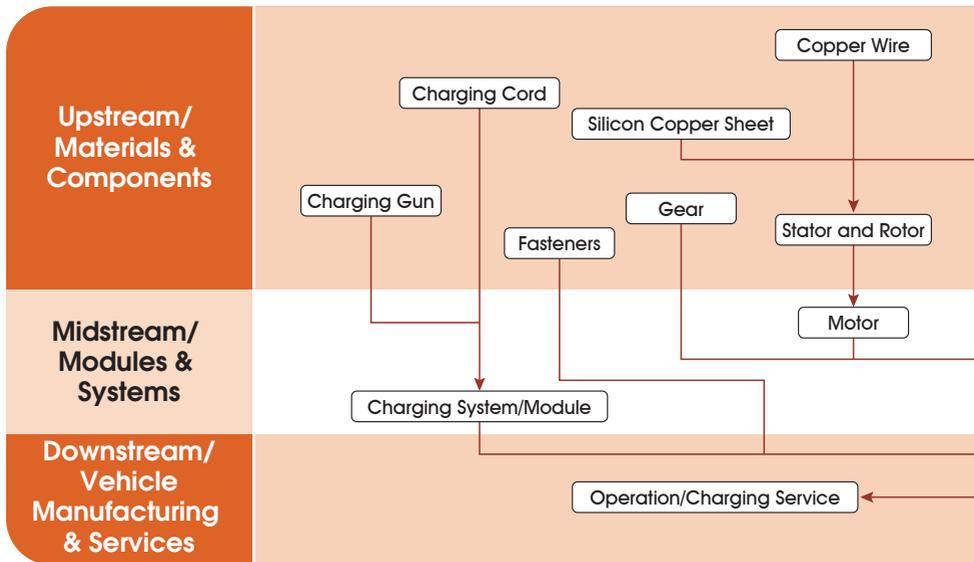
Source: Statistics for the automobile manufacturing industry and automotive parts and body manufacturing industry are from the Taiwan Transportation Vehicle Manufacturers Association (TTVMA). The statistics on automotive electronics are from the Industry, Science and Technology International Strategy Center (IEK), ITRI.

**Figure 1 Production Value of Taiwan's Automobile Industry in 2015-2020**

## 2 | Industry Value Chains |

After several decades of development, Taiwan's auto industry has built up strong capability for the manufacturing of conventional vehicles, and our firms have long-standing cooperative ties with the big-name manufacturers as well as contractors. As a result, a very comprehensive auto industry supply chain has formed in Taiwan. In recent years, due to the trend toward development of intelligence and autonomy in vehicles, Taiwanese makers of auto components have been taking aggressive steps to position themselves in the field of new generation automobiles, and automotive electronics makers are also capitalizing on their competitive advantages to become members of the supply chains of big-name international auto makers. Fig. 2 shows that the supply chain in Taiwan's electric vehicle sector has attracted the participation of firms specializing in: materials; components and modules; systems and subsystems; systems

integration; and finished vehicle assembly. Firms that supply components and modules are especially numerous. As for batteries, Taiwanese firms are able to provide cathode and anode materials, ion membranes, separators, electrolytes, and other such materials and battery cell parts. There are also firms that provide battery modules and battery systems. As for powertrains, Taiwanese firms can provide motors and motor controllers, upstream gears, stators, and power elements/modules. Taiwanese firms also provide automotive chips. In the field of fully assembled electric vehicles, the Yulon Group has several different electric vehicle models and has entered into a joint venture with Foxconn to establish Foxtron Vehicle Technologies, which is heavily involved in the development of electric vehicles. Kuozui Motors began producing hybrid vehicles in 2019, and RAC Electric Vehicles has the ability to independently design and manufacture electric buses.



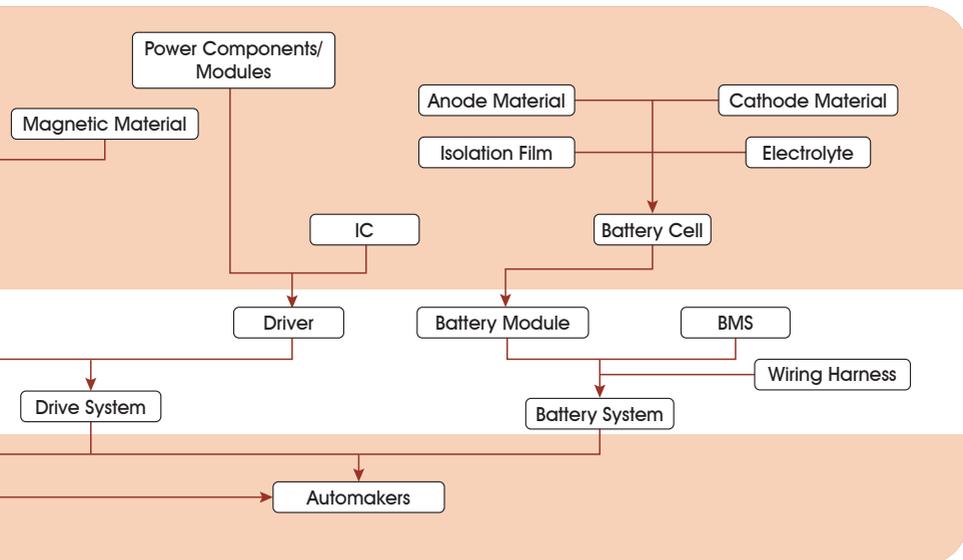
Source: Industry, Science and Technology International Strategy Center, ITRI.

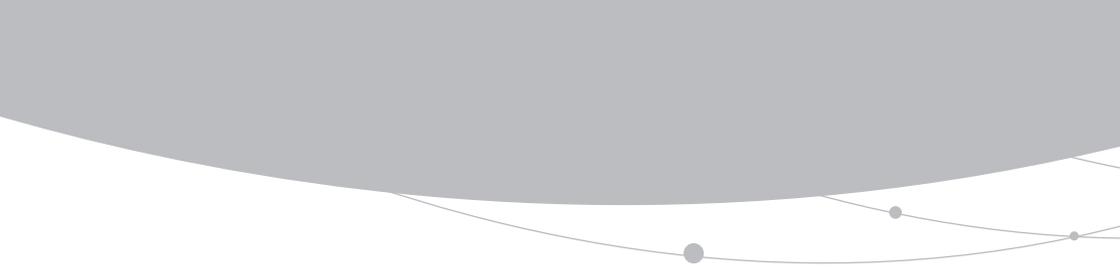
Figure 2 Taiwan Electric Vehicle Industry Chain

### 3 | Industrial Clusters |

#### 1. Clusters in Northern Taiwan

Taiwan's main auto industry stronghold is in the north, where there is a comprehensive industrial supply chain. Assemblers of complete vehicles include Gogoro, Sanyang Industry, Yulon Motor, China Motor, RAC Electric Vehicles, Ford Lio Ho Motor, and Kuozui Motors. There are specialists in the manufacture of auto bodies, such as Hsin Sheng Autos. Makers of drive motors, control modules, electric vehicle auxiliary systems, electric vehicle power storage systems, power management systems, other key technologies and systems for electric vehicles, and niche electric vehicles include E-One Moli Energy, Delta Electronics, Foxtron Vehicle Technologies, and TungThih Electronic Co. Suppliers of cathode materials for lithium batteries include Formosa Lithium Iron Oxide Corp., Chang Chun Petroleum, CoreMax, and Mechemma Chemicals International (see Fig. 2).





## 2. Clusters in Central Taiwan

Central Taiwan has always been home to an important industrial cluster in the precision machinery sector. This cluster includes makers of drive motors, control modules, electric vehicle auxiliary systems, electric vehicle power storage systems, power management systems, other key technologies and systems for electric vehicles, and niche electric vehicles. Among these firms, Mobiletron is one of the best known.

## 3. Clusters in Southern Taiwan

Well known firms in the industrial clusters of southern Taiwan are active in many different sectors. Companies that assemble finished vehicles include Master Transportation (electric bus manufacturing) and KYMCO (motorcycle manufacturing). Makers of electric vehicle components manufacture drive motors, control modules, electric vehicle power storage systems, power management systems, other key technologies and systems for electric vehicles, and niche electric vehicles. Makers of electric vehicle structural components include Honley Auto Parts (specializes in hot stamping of auto body components), while companies that supply anode materials for electric vehicle lithium batteries include China Steel Chemical Corporation and Yonyu Applied Technology Material.

### North District Vendors

Drive motor and control module : Delta, Teco, Seec, Taigene, Evt, Tatung

Electric vehicle accessory system : Teco, Taigene, Delta, DENSO

Electric vehicle energy storage system & Power management system : Amita, Simplo, Molichel, PHOENIX, WELLTECH, Delta, PIHSIANG, TAIWAN YUASA, Kneron, LIFETECH ENERGY

Key technologies and systems integration of other electric vehicles : Delta, Haitec, Chroma, LIOHO

Niche electric vehicle : Elebike, PIHSIANG, Yulon, Advanced

### Central District Vendors

Drive motor and control module : RhymeBus, FUKUTA, Adlee

Electric vehicle accessory system : RhymeBus

Electric vehicle energy storage system & Power management system : EXA, CAEC, MOBILETRON

Key technologies and systems integration of other electric vehicles : TPG, Chiau Cheng

Niche electric vehicle : MERIDA, TAIWAN HELIO

### South District Vendors

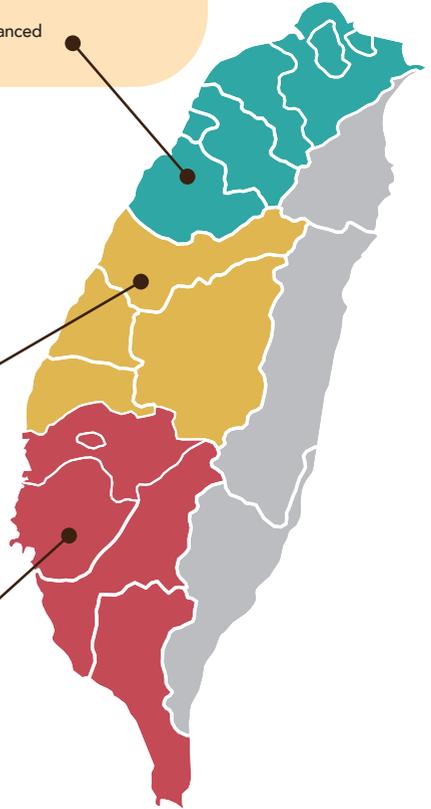
Drive motor and control module : Hwameei, RICH ELECTRIC, SAC

Electric vehicle accessory system : N/A

Electric vehicle energy storage system & Power management system : CSCC, Renetronics

Key technologies and systems integration of other electric vehicles : JUJLI

Niche electric vehicle : e-ton, KYMCO, Pillar Spoke



Source: Industry, Science and Technology International Strategy Center, ITRI.

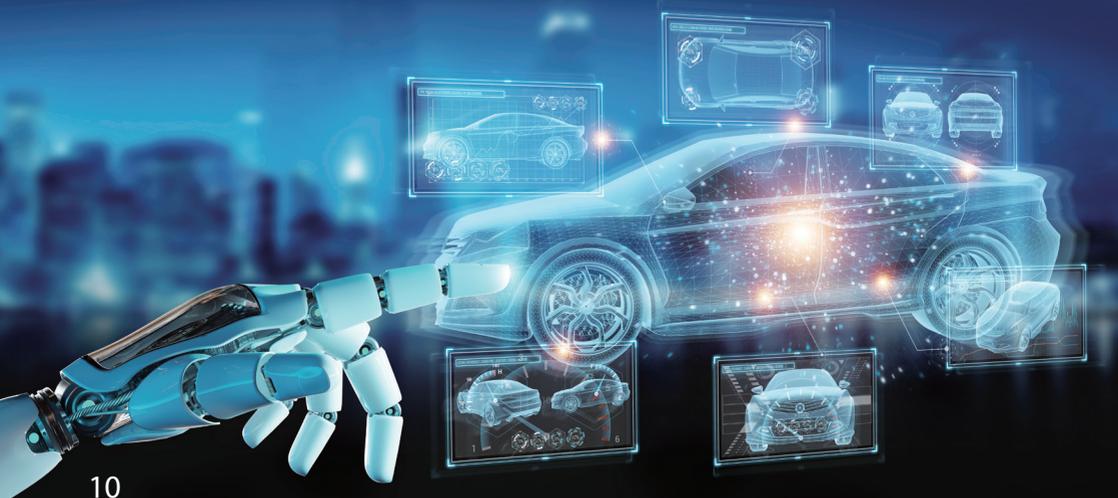
Figure 3 Taiwan's EV Industry Cluster

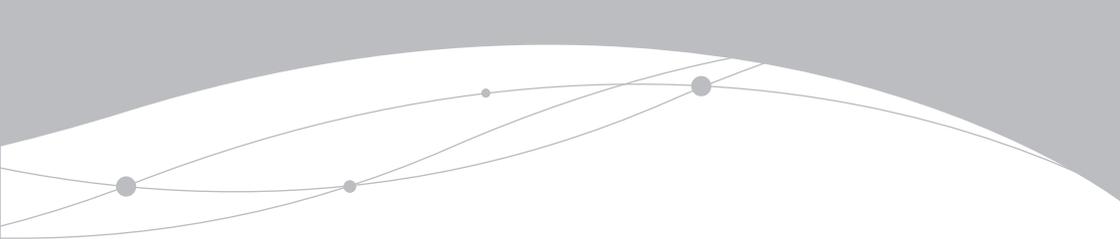
# Potential Investment and Collaboration Opportunities in Taiwan

1

## Best R&D and Testing Facilities for New Generation Automobiles

Taiwan is a small and densely populated island. Traffic conditions are highly complex. Pedestrians, motorcycles, and autos pack the streets and roads in close proximity. Also, the people of Taiwan make heavy use of communications devices. Within the context of the C.A.S.E. principles for the development of new generation automobiles, all the above factors show that Taiwan could use international cooperation to upgrade its industrial technological capabilities and make up for its shortcomings. Those factors also show that Taiwan is in a very good position to launch demonstration sites for the development of new generation automobiles. Examples include new business models for interdisciplinary cooperation and pilot operation of new

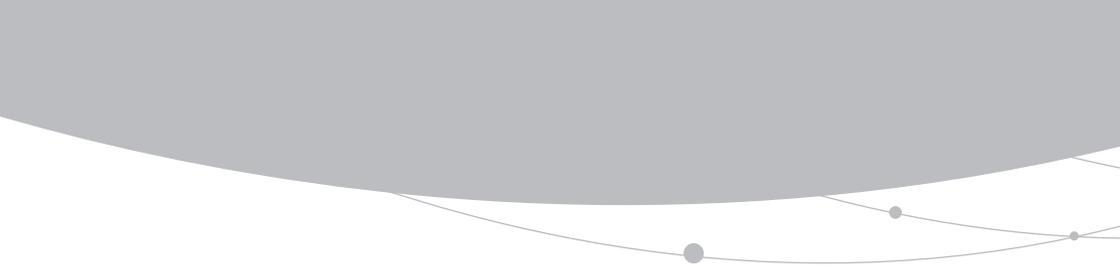




energy vehicles. With respect to autonomy, for example, compared to other countries currently developing self-driving vehicles, Taiwan has testing environments that are more complex and more suited to the development of self-driving vehicles. In addition, the promulgation of the "Unmanned Vehicles Technology Innovative Experimentation Act" has created conditions that are even more conducive to the creation of autonomous vehicle test environments. This will make it easier for foreign firms to come to Taiwan to engage in product development and testing.

The development of electric vehicles and self-driving vehicles has brought huge changes to automotive electronics technology. Demand for an Internet of Vehicles (IoV) is set to grow to enormous proportions, and the associated need for cybersecurity has become a very important issue. In the field of new generation automobiles, it is true that the mainland China market offers huge business opportunities and plentiful development resources, but the US-China trade war is still heating up, and the US government is extremely sensitive about cybersecurity issues. Taiwan, which is strong in cybersecurity technologies and very experienced in defending against cyber attacks, is very suitable as a partner in the development of new generation automobiles and testing sites.

In addition, the Electromagnetic Compatibility (EMC) Testing Laboratory at Taiwan's Automotive Research & Testing Center (ARTC) is the most comprehensive laboratory of its kind in all of Asia. This lab is able to test electric buses, passenger cars, and motorcycles, and also carries out key system/parts tests that focus on such things as electromagnetic interference and electromagnetic susceptibility. The EMC Testing Laboratory is certified by A2LA, GM, Ford, FCA, Fisker, Jaguar, and Land Rover, and can directly help manufacturers to obtain internationally recognized EMC test reports. In the future, as vehicles go electric and the Internet of Vehicles (IoV) takes shape, more and more vehicles will undergo EMC testing. A firm that chooses to carry out product development in Taiwan will be able to efficiently carry out testing and product improvement.

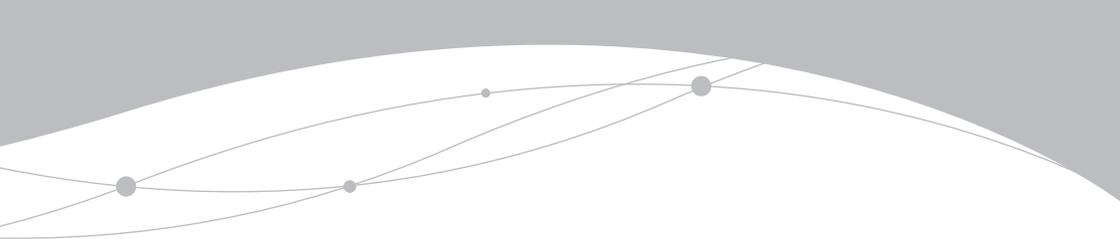


## 2

### Link up with ICT Industry, Seize upon Business Opportunities

A very wide swath of industry is involved in new generation automobiles. For both electric vehicles and autonomous vehicles, there are new types of technology where breakthroughs are still needed, and the barriers to entry in this type of R&D are high. Makers of conventional vehicles cannot develop new generation automobiles on their own, nor can high-tech firms manage it independently. Any firm wanting to make new generation automobiles must search for partners to engage in cross-sector and inter-disciplinary cooperation if they are ever going to make breakthroughs in emerging technologies. Sometime, moreover, technological cooperation will have to involve cross-border partnerships. Taiwan's ICT industry has world-class R&D and manufacturing capabilities, and has put years of work into electric vehicles, developing applications in such areas as vehicle safety, mobility assistance, multimedia communications, and automotive chips. Major international auto makers have deep trust in our ICT industry's manufacturing capabilities. Taiwan is already forming supply chains that will someday be capable of providing the key components needed for the new generation automobiles of the future. Such components include various sensing and positioning products, such as cameras, radar, and IoV communication modules. Taiwanese firms already have a long and successful track record of providing products to international manufacturers, and more firms are getting involved in such fields as LiDAR, HD maps, and automotive Ethernet chipset design. In the process, they are creating even stronger business opportunities in systems integration. Development of new generation automobile technologies, growing consumer consciousness regarding green energy and environmental protection, and increased demand for active vehicle safety have triggered a sharp rise in demand for vehicle sensing technologies. Taiwan's ICT manufacturers are in position to partner with big-name international auto makers to develop new generation automobiles.

Foxconn, for example, has partnered with Fisker, a US maker of electric vehicles and mobility solutions, using Foxconn's MIH Open Platform as the foundation for joint development of a lightweight EV platform. Plans are in the



works to establish a first EV factory in the US to produce Fisker electric vehicles. Foxconn is also partnering with Stellantis (formed through a merger between FCA and PSA) to establish a joint venture called Mobile Drive. The two partners will collaborate in two core fields -- smart cockpit solutions and the Internet of Vehicles (IoV) business.

3

### **Comprehensive Production Services for Finished Vehicles and Components**

Taiwanese auto makers, in order to comply with exhaust emissions legislation, have expended a lot of resources to develop and adjust production equipment, and have continually improved their overall manufacturing capabilities. In addition, many firms are making aggressive moves to develop electric vehicle production technologies, and are already capable of independent manufacturing of finished electric vehicles. And beyond that, Taiwan's auto makers have relatively flexible production lines and can provide comprehensive manufacturing services for special auto models that are produced in small batches. As such, they could be good partners for big-name international auto makers during the pilot production phase.

Next, Taiwanese auto makers are high-level producers of auto components, and have strong technologies for the production of EV lithium batteries, drive motors, reduction gears, power storage systems, power control modules, power control systems, and telematics. Many Taiwanese manufacturers provide EV components for cars like Tesla and the BMW Mini-E. It is thus clear that Taiwanese suppliers of auto components have an excellent international reputation. In addition, Taiwan can also produce cathode and anode materials for lithium batteries. The cathode materials they produce include lithium iron phosphorous oxide, lithium manganese iron phosphate, cobalt(II) sulfate, and nickel(II) sulfate. In the future, as the technologies needed for new generation

automobiles continue to be developed, Taiwanese makers of components will be able to rely on their superior R&D capabilities to continue providing products to big-name international auto makers to meet needs of new technologies and new fields.

Recently, due to the impact of the COVID-19 pandemic, many auto plants in mainland China, Europe, and North America have suspended production of both components and finished vehicles. This has highlighted the global auto industry's need to establish secure supply chains, and made it clear that having widely distributed production bases will become an even more predominant trend moving forward. In the future, Taiwan could serve as one of various regional supply centers for big-name international auto makers. Foreign firms can, on the one hand, make good use of the existing foundation that's been laid by Taiwanese ICT firms and makers of auto components. At the same time, they can also diversify their supply chain risks by setting up a Taiwan-centered regional production network that serves as a backup production base or supply source for important components.



# Investment Incentive Measures

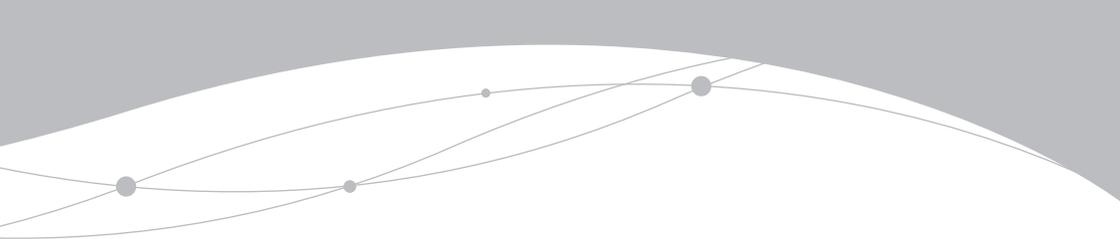
## 1 | Tax Incentives |

Taiwan's profit-seeking enterprise income tax rate is 20%. To encourage foreign companies to invest in Taiwan, support industrial innovation, and promote industry-academia collaboration, foreign companies are eligible for the following preferential taxes (Table 1):

**Table 1 Preferential Taxes**

Item	Preferential Tax(es)
R&D and introduction of technology or mechanical equipment	<ul style="list-style-type: none"><li>• Up to 15% of the company's R&amp;D expenditures may be deducted from its profit-seeking enterprise income tax for current year; or up to 10% of such expenditures may be credited over three years against the profit-seeking enterprise income tax payable by the company.</li><li>• Royalty payments to foreign companies for imported new production technologies or products that use patents, copyrights, or other special rights owned by foreign companies is, with the approval of the Industrial Development Bureau, MOEA, exempt from the corporate income tax.</li><li>• Imported machinery which local manufacturers cannot produce are eligible for duty-free treatment.</li></ul>

Item	Preferential Tax(es)
Investment in smart machinery / 5G	<ul style="list-style-type: none"> <li>• Smart machinery: Automatically scheduled, flexible, or mixed-model production lines that utilize big data, AI, and IoT.</li> <li>• 5G: Related investment projects include 5G communication systems, and new hardware, software, technology, or technical services.</li> <li>• For investments of no less than NT\$1 million and no more than NT\$1 billion, either "5% of investment spending deducted from profit-seeking enterprise income tax (current FY)" or "3% of investment spending deducted from profit-seeking enterprise income tax, if total spending spread over three years" may be selected, but the total amount deducted may not exceed 30% of corporate income tax that year.</li> <li>• The applicable periods are January 1, 2019 through December 31, 2021 (smart machinery) and January 1, 2019 through December 31, 2022 (5G).</li> </ul>
Employee stock compensation	<ul style="list-style-type: none"> <li>• A company employee who has obtained stock compensation worth a combined total of less than NT\$5 million and continuously held the stock while remaining in the company's employ for at least two years may choose to be taxed on the market price of the stock at either the time the stock was obtained or the time the stock is sold, whichever is lower.</li> </ul>
Foreign special professionals	<ul style="list-style-type: none"> <li>• Foreign special professionals who meet criteria are eligible for a 50% deduction of total income tax for amounts exceeding NT\$3 million.</li> </ul>
Setting up operations in industry parks	<ul style="list-style-type: none"> <li>• Companies that set up operations in export processing zones, science industrial parks, or free trade ports are eligible for exemptions on import duties, commodity tax, and business tax for the import of machinery and equipment, ingredients, fuel, materials, and semi-finished products for their own use.</li> </ul>
Others	<ul style="list-style-type: none"> <li>• Companies that use undistributed earnings to engage in substantive investments may exclude the amount when calculating their profit-seeking enterprise income tax.</li> </ul>



## 2 | Subsidies |

### 1. Global R&D Innovation Partner Program

Some foreign companies have a high degree of complementarity with Taiwan's industries, so we encourage them to come to Taiwan to plan and develop forward-looking technologies more advanced than those that Taiwanese firms currently possess, as well as key technologies or integrated technologies. By engaging in R&D work on such technologies in cooperation with Taiwanese firms, they could exert a key influence on Taiwanese industry by: (a) spurring R&D work on industrial technologies as well as the establishment and development of supply chains; (b) improving R&D efficiency; (c) accelerating the timetable from R&D to production; and (d) contributing actively to expansion of international markets. Foreign companies that achieve such things, after gaining approval from the MOEA, will be eligible for subsidies of up to 50% of total R&D expenditures.

### 2. Program for the Development of Pioneering Companies

The purpose of this program is to build Taiwan into a high-tech R&D center and encourage leading international manufacturers to establish cutting-edge R&D bases in Taiwan so that they can work here on forward-looking technologies and link up with the Taiwan supply chain, thereby creating a division of labor in the areas of research, co-creation, and development, with an eye to strengthening the technological competitiveness of Taiwan's leading industries and accelerating the formation of clusters in emerging industries. Program funding of up to 50% of total expenditures may be granted for any project that has been approved by the Ministry of Economic Affairs.

### 3. Taiwan Industry Innovation Platform Program

The MOEA Industrial Development Bureau and the Ministry of Science and Technology are jointly implementing the "Taiwan Industry Innovation Platform Program" to guide industries to develop toward greater value, and to encourage companies to enter high-end product application markets to increase industry's overall added value. For companies owning R&D teams in Taiwan, the program provides up to 50% of funding for R&D projects proposed by the companies themselves.

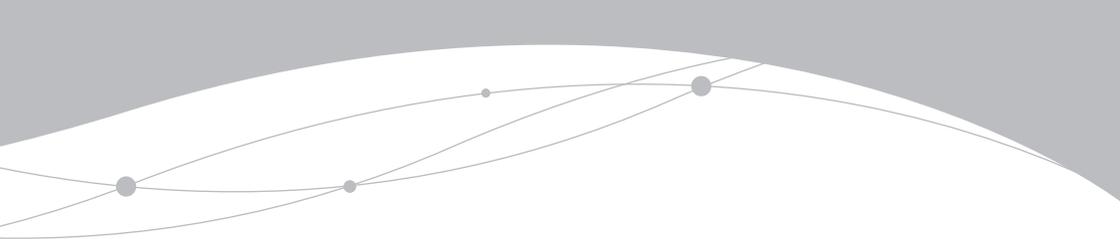
# Leading Taiwanese Companies

## 1 | Materials and Components |

Chang Chun Petroleum (CCP), established in 1964, mainly provides electro-deposited copper foil, which is one type of material used in automotive lithium batteries. This company's copper foil measures as thin as 5 microns and greatly improves battery performance. The world's five biggest suppliers of lithium batteries are all customers of Chang Chun Petroleum, and fully 60% of all Tesla electric vehicles manufactured in the US have batteries that make use of CCP's copper foil. Today, CCP commands a 25% share of the global market for the copper foil used in EV batteries.

Honley Auto Parts, established in 2014, mainly manufactures and assembles hot-stamped auto body components and structural components (e.g. A pillars, B pillars, doorbeams, bumpers, roof rails, and rocker panels). Hot-stamped components have the advantages of being thin, lightweight, and safe, and can meet the need to make electric vehicles lighter and safer.

TungThih Electronic Co., established in 1979, mainly develops advanced driver assistance systems. It is the world's third-largest supplier of backup radar, and also develops ultrasonic radar and automotive mirror solutions. TungThih's customers include Tesla, Ford, GM, SAIC Volkswagen, and PSA.



## 2 | Modules and Systems |

Pegatron Corporation, established in 2008, is a well-known Taiwanese electronics maker that has long supplied German auto makers with automotive electronics products, such as car entertainment systems, remote recording devices, and advanced driver assistance systems. In recent years the company has branched out into the EV field, and provides electronic control units and partition solutions or sub-system solutions. Pegatron's customers include Tesla, Audi, and Toyota, and for some of them Pegatron has risen to the status of a Tier 1 supplier.

Foxtron Vehicle Technologies was established in 2020 as a joint venture between the Yulon Group and Foxconn. Foxtron Vehicle Technologies combines the Yulon Group's complete vehicle autonomous R&D platform with Foxconn's supply chain systems, components manufacturing, mechanical design expertise, and systems integration capabilities. Foxtron Vehicle Technologies develops new energy vehicles and key sub-systems (e.g. digital cockpits, autonomous driving, new energy power, auto bodies, and 5G), and is promoting a model for an open and shared MIH EV platform.

Delta Electronics, established in 1971, mainly supplies EV drivetrains and charging equipment. Delta Electronics and GKN Automotive, a British drivetrain supplier, are cooperating on joint development of next-generation eDrive technology that will combine GKN Automotive's eMotor and gearbox systems with motor drives supplied by Delta Electronics. This new technology will reduce systems weight and packaging volume while simplifying assembly processes, and is projected to capture a 10% share of the global market for EV power systems. Delta Electronics has obtained safety and standards certifications in the EU, the US, mainland China, and Taiwan for the charging equipment (including bi-directional chargers, including rapid DC chargers, AC chargers, and charging stations) that it provides.

### 3 | Braking Systems |

RAC Electric Vehicles, established in 2005, is a Taiwanese maker of electric commercial vehicles. It sells an EV bus (the RAC bus), has the ability to independently design and manufacture electric buses, and has technologies for three electric systems (batteries, electric motor, electric control). The following are just some of the technologies for which it has obtained a patent: an EV bus power control system; an EV bus battery abnormality detection system; a battery configuration structure for low-floor chassis electric buses; a motor drive mechanism for electric buses; and a condensing device for electric bus air conditioning.

XING Mobility, established in 2015, holds a patent for its immersion-cooled modular battery technology, which uses a high power density modular design to achieve rapid cooling while sharply reducing weight and volume. This type of battery makes it easier to flexibly accommodate all kinds of space and power requirements, and the modular design means the batteries can more easily fit into vehicles of widely varying shapes and sizes. This technology greatly reduces the time and expense required to develop any particular vehicle, and is already being applied to convert extreme performance cars, trucks, and conventionally powered antique cars into electric vehicles.

The Automotive Research & Testing Center (ARTC), working hand-in-hand with 18 companies, has developed the WinBus, Taiwan's first home-grown self-driving electric minibus. In October 2019, ARTC received the first license to operate an unmanned vehicle subject to the provisions of the "Unmanned Vehicles Technology Innovative Experimentation Act." The WinBus meets the standard for SAE Level 4 autonomous driving, can travel up to 50 km/h, and has a range of up to 70 kilometers per charge. In March 2020, a company commenced a project designed to result in eventual use of the WinBus to provide shuttle services connecting four tourism factories in the Changhua Coastal Industrial Park. Phase 1 of the project (in which the bus was driven along its future route without carrying passengers) and Phase 2 (in which the bus passengers on a fixed schedule) have both been completed. In Phase 3, which has yet to begin, the bus will be dispatched flexibly and operated on a pilot commercial basis. The eventual goal is to use the bus in regular commercial operations, and to ramp up to mass production.

# Examples of Successes Achieved by Foreign Companies

## 1 | Production and Technology |

Toyota Tsusho has acquired a stake in Fukuta Electric & Machinery, and the two entities plan to cooperate in developing motors for electric vehicles and plug-in hybrid vehicles (PHV). Kuozy Motors, which builds Toyotas under license for the domestic market, recently invested NT\$6 billion to upgrade its production lines to begin turning out hybrid vehicles. Denso, a big Japanese automotive components manufacturer, took an equity stake some time ago in Cryomax Cooling System, which mainly produced auto radiators under the Cryomax brand and exported them as aftermarket products to Europe and North America. More recently, Cryomax has begun to sell OES components via Denso, and has gained technical assistance from Denso to develop condensers. In the future, it will develop condensers for electric vehicles.





## 2 | Inter-Disciplinary Industrial Cooperation |

Gogoro formed a partnership with Sumitomo Corporation in 2017 and launched GoShare, a new Smartscooter sharing service, on the Japanese island of Ishigaki, then in 2019 Gogoro partnered with TIC Corporation, a South Korean motorcycle company, to establish battery swapping stations in Seoul's Gangnam District. These stations will support the use of Gogoro smartscooters created for logistics and delivery fleets. As of June 2020, 14 battery swapping stations had been set up, and more were planned. Also, in November 2019 Sumitomo Corporation invested in RAC Electric Vehicles, spending NT\$126 million to obtain a 7% equity stake. Sumitomo will rely on RAC to perform electric bus manufacturing and related services, while RAC will rely on Sumitomo's global marketing and services network to expand its international markets.



### 3 | R&D and Testing Facilities |

NVIDIA, a US maker of graphics chips, has signed a letter of intent to engage in cooperation with the National Applied Research Laboratories (NARLabs), which is subordinate to Taiwan's Ministry of Science and Technology. NVIDIA will take part in efforts to develop Taiwan's autonomous vehicle industry, and will cooperate with Taiwan CAR Lab on technology applications. In addition, Canadian auto parts maker Magna, has already had an R&D center in Taiwan for several years where the company has been working to develop ultrasonic sensors, parking/reverse assist systems, automotive imaging, and forward camera modules and systems. And now Magna is drawing up plans for an additional investment to engage in further R&D work on new technologies.

### 4 | Training of Talent |

The Volkswagen Group Taiwan Training Academy that was established in 2015 in the Xizhi District of New Taipei City is Volkswagen's biggest training institution anywhere in Asia outside of mainland China. Recently, in order to embark upon Taiwan's electric vehicle market, Volkswagen established the "e-Mobility Center" to train professionals with special expertise in maintenance of Taiwan-made electric vehicles, and to engage in cooperation with Delta Electronics on the development of EV charging infrastructure. In addition, Honda Taiwan is cooperating with technical and vocational schools in Pingtung County to train technicians and provide young graduates with employment opportunities.



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