



**Taiwan's Renewable Energy Landscape:
Prospects for Deepening U.S.-Taiwan Relations**

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Introduction

The United States and Taiwan have long benefited from strong economic ties. Taiwan is a crucial partner for the U.S., particularly given its central role in the global technology supply chain. Meanwhile, the U.S. continues to be a major trading partner even as Taiwan re-calibrates its China exposure and expresses a renewed interest in partnering with its South and Southeast Asian neighbors.

In November 2020, the U.S. and Taiwan concluded the inaugural Economic Prosperity Partnership Dialogue (EPPD), intended to further strengthen the bilateral economic relationship. The EPPD culminated in a new economic understanding expressed in the form of a five-year agreement where the two sides pledged to explore future cooperation on numerous strategic sectors. Issues marked for discussion included global health security, science and technology, supply chains, 5G and telecommunications security, women's economic empowerment, infrastructure cooperation, and investment screening.¹ Subsequent corresponding working groups will be established to conduct further discussions on these issues.

While the five-year agreement is a non-binding Memorandum of Understanding (MOU), it still delivers a high-level message on potential future ambitions for collaboration between the U.S. and Taiwan. The agreement has seen broad support from within both governments and from the private sector, and effectively foreshadows possible future working relationships on trade, industrial policy, and innovation. It is also indicative of areas where both can potentially see significant gains from collaboration – including cooperation on medical, energy, and other critical technology supply chains, as well as exploring joint business opportunities in infrastructure, renewable energy sources like wind and solar, and related areas.

In the aftermath of the signed MOU, and under the banner of the ongoing discussions around a possible U.S.-Taiwan Bilateral Trade Agreement (BTA), this report will analyze the energy sector – one of the sectors identified for future collaboration – with a particular focus on renewable energy. While it may initially be difficult to conceptualize the role of energy in future U.S.-Taiwan trade dialogue and economic cooperation, the connection between energy and the collaborative framework within the EPPD is non-trivial. Energy is inherently tied to many of the areas proposed for cooperation, including science and technology, 5G, supply chains, and infrastructure. As the energy sector in Taiwan is currently undergoing an important transformation, Taiwan also holds unique advantages in the pursuit of digital, decentralized, and democratized energy networks.

As Taiwan presses ahead with its domestic energy and climate ambitions, it also stands to benefit from positioning itself as a trusted economic, technological, and security partner on energy issues. Taiwan already possesses one of the world's most innovative and sophisticated industrial bases given its outsized role in the technology sector. Since the island is already trying to make its mark on renewable energy through ambitious deployment, Taiwan could play a key role as a partner for cutting-edge green technologies and services. This is true particularly as the global climate mandates from the Paris Agreement, along with individual national policies, attempt to underscore the urgency of supporting a global energy transition away from fossil fuels.

Discussions on Taiwan's energy ambitions are still predominantly framed through a domestic policy and industrial development lens. Taiwan policymakers and domestic industry players have also focused on incentive mechanisms and

¹ Fact Sheet, *American Institute in Taiwan*, November 21, 2020, <https://www.ait.org.tw/fact-sheet-by-ait-tecro-us-taiwan-eppd/>

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clear renewable targets to attract inward investments and to promote socioeconomic benefits such as attracting talent, engendering job growth, and stimulating localized supply chains. But as the sector matures and a green energy ecosystem is catalyzed, Taiwan can reformulate its approach to promote national techno-economic competitiveness and to differentiate itself as a cut above the rest. This would mean positioning Taiwan not only as a renewable energy hub but as a reputable and trusted global green energy leader.

Taiwan could reap significant benefits if it focuses not only on exporting its goods and services, but also on offering its technological, financial, commercial, and regulatory know-how and practices to its global partners. As sustainability becomes intimately embedded in all corners of the global economy, an increasing number of governments will embrace “green growth,” and green energy will be a crucial engine for such growth.

This report will examine critical developments in Taiwan's energy sector and energy policies. We will discuss potential opportunities for additional bilateral cooperation in new, value-added energy industries, and on finding productive areas of collaboration in support of both U.S. and Taiwan energy and climate evolution and ambitions.

The Evolution of Taiwan's Energy Policies

Historically, Taiwan has seen significant success in many conventional policy areas relevant to environmentalism and sustainability, and many domestic politicians and civic activists are passionate about these issues. From the 1960s to the 1980s, the Taiwan government and its affiliated industrial organs – e.g. the Industrial Technology Research Institute (ITRI) – oversaw the adoption of critical environmental management methods and technologies.² As Taiwan was a developing economy, this was seen as a key to increasing economic competitiveness through innovation, and to cultivate independence through resource savings. Since the 1980s, the Taiwan anti-nuclear movement has also been closely affiliated with the political dissident movement, thus embedding itself into widespread civic narratives.³

Developments in Taiwan's energy landscape have been driven by a complex array of domestic and international considerations. Like for many other nations globally, energy security has increasingly emerged as a primary political and public concern in Taiwan. The 1973 energy crisis prompted governments around the world to begin seeing energy as a key issue for both national security and economic growth. Given that the island lacks natural resources and relies heavily on imported energy sources – with over 90% of its energy imported from overseas – Taiwan was no different.

Household electricity prices in Taiwan remain relatively low due to government subsidies, with Taipower primarily shouldering the burden of that subsidization, and the sustainability of this model is questionable. High costs of imported energy can impact economic growth and industrial competitiveness, and increased energy prices can erode margins by increasing production costs for high energy-consumption industries such as semiconductors and computer hardware. Meanwhile, price and availability volatility represent separate but significant concerns.

Today, Taiwan's energy policies manifest through a strong institutional and policy focus on implementation and deployment of low-carbon, renewable technologies in the power sector, and a corresponding reduction in energy dependence. For decades, Taiwan has been trying to develop its manufacturing base in clean technologies, with companies jostling to grow into industrial leaders in solar photovoltaics (PV), energy storage systems (including batteries), electric vehicles (EVs), and other notable grid-edge technologies. However, the domestic utilization of these technologies has been sub-optimal due to the lack of a conducive policy environment. There were also insufficient commercial pressures to move forward with a widespread domestic adoption of these technologies, given the lack of demand-side incentives.

Energizing Taiwan in the 21st Century

Earlier administrations had already implemented renewable energy targets, but Taiwan's focus on renewable energy accelerated after 2016 when Tsai Ing-wen was elected President. The Tsai Administration has a broad green agenda, and seeks to scale the use of renewables while simultaneously tapering the economy's dependence on fossil fuels and nuclear energy. Its vision is to harness the island's vast renewable resources, particular land-based solar and offshore wind, while simultaneously stimulating domestic industrial supply chains. The implementation will coordinate state measures and capabilities – such as setting targets, implementing mandates, and providing support mechanisms like feed-in tariffs (FiTs) – with localization policies (chiefly for offshore wind).

² Ho, Peter, editor, "Greening Industries in Newly Industrializing Economies: Asian-Style Leapfrogging", *Routledge Taylor and Francis Group*, April 2006

³ Kim, Sunhyuk, "Democratization and Environmentalism: South Korea and Taiwan in Comparative Perspective," *Journal of Asian and African Studies* 35(3), p.287–302, January 1, 2000, https://brill.com/view/journals/jaas/35/3/article-p287_1.xml (Subscription Only)

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These changes in focus towards renewables could actually protect and expand Taiwan's position in global trade, as suppliers intimately connected with the global technology supply chain are now facing pressures to use green power. Acer, Google, and Apple, for example, have all announced their commitment to matching their annual global electricity consumption to 100% renewable energy. These companies are simultaneously putting pressure on their own supply chains, including on numerous Taiwan companies, to meet the same requirements.

The urgency felt by the Taiwan government on green energy issues is underscored by its setting ambitious targets of a nuclear-free homeland by 2025, and recent efforts to consider getting to zero net emissions by 2050. Taiwan is also targeting an energy mix of 20% renewables, 50% natural gas, and 30% coal by 2025 – a substantial reduction for the role of coal in Taiwan power generation, and with Liquid Natural Gas (LNG) the most significant and growing source in Taiwan's energy mix. It is worth noting that Taiwan theoretically has sufficient resources to reach this renewables goal. Taiwan is located in a subtropical area with high solar radiation, and enjoys some of the best wind resources in the world in the Taiwan Strait.

To pursue its green energy ambitions while simultaneously fortifying its climate goals, the Tsai Administration has combined reinforcing energy policy with legislative initiatives that support renewables and low-carbon technologies. That includes relatively generous FiTs, strong targets across the power and other energy sectors, Research & Development (R&D) support for lower Technology Readiness Level (TRL) technologies, demonstration incentives, and green finance action plans.⁴ ⁵ Research into renewable energy was also promoted by including it as one of the 5+2 Innovative Industries, the Tsai Administration's flagship economic development initiative.

The power sector market structure and regulatory framework also require further changes to transition towards a more decentralized and liberalized network. Such changes would place a greater focus on the needs of independent renewables producers, as well as offer more benefits and choices to consumers. Taiwan has started on this path already. For example, it has amended the Electricity Act to liberalize the power sector and modified the Renewable Energy Development (RED) Act to allow for Corporate Purchasing Power Agreements (Corporate PPAs).⁶ PPAs are agreements between renewable energy suppliers and their discerning consumers, and play a significant role in enabling the uptake of renewables. The changes included the simplification of application procedures for smaller renewables facilities. On the demand side, mandatory renewables portfolio standards for large end users – with a requirement to source a part of their electricity supply from renewables – is set to drive deployment.

IHS Markit reports that from 2021, large electricity consumers with over 5-megawatt (MW) capacity would have to achieve 10% renewables consumption within 5 years.⁷ The overall impact of the new regulations is an increase in private participation by renewables producers and developers.

⁴ Feigenbaum, Evan A. and Hou, Jen-yi, "Overcoming Taiwan's Energy Trilemma," *Carnegie Endowment for International Peace*, April 27, 2020, <https://carnegieendowment.org/2020/04/27/overcoming-taiwan-s-energy-trilemma-pub-81645>

⁵ "FSC Launches the 'Green Finance Action Plan 2.0' for Joint Creation of a Sustainable Finance Ecosystem by Public and Private Sectors," *Financial Supervisory Commission, Republic of China (Taiwan)*, November 2, 2020, https://www.fsc.gov.tw/en/home.jsp?id=54&parentpath=0,2&mcustomize=multimessage_view.jsp&dataserno=202011020001&dtable=News

⁶ Ministry of Economic Affairs (MOEA), "The Electricity Act," *Law and Regulations Database of the Republic of China*, May 22, 2019, <https://law.moj.gov.tw/ENG/LawClass/LawAll.aspx?pcode=J0030011>

⁷ Xue, Shan, "The Surging Demand of Green Energy in Taiwan will Drive the T-REC Price Up in the Near Term," *IHS Markit*, March 9, 2021, <https://ihsmarkit.com/research-analysis/the-surging-demand-of-green-energy-in-taiwan-will-drive.html>

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These changes to the regulatory framework made it possible for non-utility buyers to procure Taiwan-Renewable Energy Credits (T-RECs) directly from projects or from dedicated renewable energy retailers. T-RECs are well designed and are recognized by major international organizations such as RE-100, Electronic Product Environmental Assessment Tool (EPEAT), and the Carbon Disclosure Project (CDP).

More than 700 million kWh of green energy had been sold through the T-REC program as of November 2020, surpassing government expectations according to the Bureau of Standards, Metrology, and Inspection at the Ministry of Economic Affairs (MOEA). The latest batch of T-RECs also brought onshore wind into the fold. These power market changes are a significant step forward, particularly as Taiwan had previously been listed by RE100 members as one of the 10 most difficult locations in the world for sourcing renewables.

As a sign of the changing times, and the evolution of the company's central role in the power-generation market, state-owned enterprise the Taiwan Power Company (Taipower) announced in May 2020 that it has obtained a license to operate as a retailer of renewable electricity. Taipower's participation could potentially increase the supply of green power in Taiwan by an estimated 840 million kWh.⁸ Taipower should also continue to play a major role in the Taiwan energy market as a key supplier, particularly as it develops its pipeline of solar and wind projects as a way to leverage its legacy position to drive significant cost savings and promote innovation.

Renewable energy targets are often seen as the bellwether for government climate and energy ambitions. In this regard, Taiwan has committed to sourcing 20% of its generated power from renewables by 2025, which equates to approximately 27 gigawatt (GW) of installed capacity. To reach this goal, the Taiwan government is targeting deployment of 20 GW of solar PV, up from a meager 668 MW of installed capacity in 2015, as well as an additional 5.7 GW produced by offshore wind. The government's technology deployment scenarios for both onshore and offshore wind power, as well as solar PV deployment, are underlined by the *Four-year Wind Power Promotion Plan* and *Two-year Solar PV Promotion Plan*.^{9 10}

The offshore wind play by the Taiwan government was driven by a strong policy impetus to make Taiwan a key early mover in the Indo-Pacific wind market. MOEA held two offshore wind auctions in 2018, selecting projects with a combined capacity of 5.5 GW. Taiwan sought to take advantage of the strong appetite for expansion of global offshore wind developers, the increasing interest in new entrants that feed the interest in offshore wind more broadly (e.g. oil and gas majors along with institutional investors), as well as the comparatively poor state of China's highly regulated energy sector that makes it prohibitively difficult for foreign players to participate.

Notably, a coordinated and strong government support for offshore wind, along with clear targets, has translated into robust investor interests and an established pipeline of projects in various stages of development. Significant offshore wind capacity is ready to come online in Taiwan by 2025.

⁸ "Taipower Takes on a New Role as a Renewable Electricity Retailer and Will Be Expanding Green Energy Supply via Government's Platform," *Energy Trend*, May 12, 2020, <https://www.energytrend.com/news/20200512-17563.html>

⁹ "Four-year Wind Power Promotion Plan," *Department of Information Services, Executive Yuan*, June 14, 2019, <https://english.ey.gov.tw/News3/9E5540D592A5FECD/d603a1bf-9963-4e53-a92b-e6520a3d93ff>

¹⁰ "Promotion of Solar Energy," *Department of Information Services, Executive Yuan*, October 29, 2019, <https://english.ey.gov.tw/News3/9E5540D592A5FECD/777fcee7-90db-4b72-9927-573eef9ea9e>

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Overall, by 2030 more than 20 GW of non-hydro renewables capacity is expected to be operational in Taiwan.¹¹ This build-out of renewables capacity is imperative, given that nuclear as a low-carbon alternative remains highly disfavored by the Tsai Administration.

Transition Challenges

Like in other markets and sectors, Taiwan's energy sector has been negatively impacted by the COVID-19 pandemic. In solar, developers were disrupted by supply chain difficulties across the industry, and therefore narrowly missed the target of 6.5 GW of solar capacity by 2020. Offshore wind plans were also disrupted due to the pandemic, with new installations lagging behind original projections.¹² Despite the deceleration seen last year, however, Taiwan's transition overall appears on track, with a political framework being put in place to cultivate public support for increased usage of renewables.

Nevertheless, Taiwan's renewables push and the transition away from fossil fuels does not come without its political difficulties. The Tsai Administration's 2025 energy goals present notable challenges for Taiwan as power generation capacity weakens through the transition – with decreased energy operating margins due to decommissioning of coal and oil-fired power plants and mothballing of nuclear power plants (NPPs). As capacity is reduced, concerns have been raised over potential power shortages. The Taiwan public and domestic businesses are naturally concerned about another iteration of August 15, 2017, when millions of households and businesses were severely affected by a power outage that lasted approximately five hours.

As Taiwan's economy grows, energy demand has also risen across residential, commercial, and industrial sectors. Record heat in the summer of 2020 saw peak consumption reach 37.79 GW in July, and all top-10 peak consumption records in Taiwan have occurred over the past three years.¹³ While solar has the potential to mitigate peak demand in summer – with an attractive generation profile that could ameliorate peak electricity usage (e.g. for cooling) – wind generation is strongest in the winter and could not help address these summer peaks.

Politicking around energy also still lingers in Taiwan. This is true for nuclear in particular. The Chinshan (Jinshan) NPP 1 ceased operating officially in December 2018 and entered decommissioning, while the Kuosheng NPP2 unit 1 will be shut down ahead of the expiration of its operating license in December 2021. But the Taiwan public voted to abolish the 2025 denuclearization target in a 2018 referendum, and another referendum is planned for August 2021 on restarting the dormant Lungmen Nuclear Power Plant project.¹⁴ Yet wrangling over the Lungmen project means it is unlikely to be commissioned before 2030, even if construction is restarted soon after the referendum. Other industry observers and analysts, such as Fitch, have published reports expecting all Taiwan nuclear power plants to be shut down by 2024.¹⁵

¹¹ Hancock, Edith, "Fitch: Taiwan to Install 20.4 GW of Solar and Wind by 2030, Offsetting Coal Shutdowns," *PV Tech*, January 29, 2021, <https://www.pv-tech.org/taiwan-to-install-20-4gw-of-solar-and-wind-by-2030-offsetting-coal-shutdowns/>

¹² Ferry, Timothy, "Offshore Wind Projects Face a Series of Challenges," *Taiwan Business TOPICS*, October 16, 2020, <https://topics.amcham.com.tw/2020/10/offshore-wind-projects-challenges/>

¹³ Oung, Angelica, "Peak Electricity Usage Hits a New Record: Taipower," *Taipei Times*, July 15, 2020, <https://www.taipetimes.com/News/biz/archives/2020/07/15/2003739922>

¹⁴ "Taiwan to hold August referendum on restarting Lungmen," *Nuclear Engineering International*, January 28, 2021, <https://www.neimagazine.com/news/newstaiwan-to-hold-august-referendum-on-restarting-lungmen-8476909>

¹⁵ Hancock, Edith, op. cit. These are expected to refer to Chinshan (Jinshan), Kuosheng, and Maanshan, and likely assumes that Lungmen Nuclear Power Plant will not be commissioned. Fitch estimated this to be equivalent to approximately 2.9 GW of capacity removed from the grid. However, it is worth noting that the total nameplate capacity exceeds 2.9 GW and is closer to 5.8 GW.

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Land-based solar projects in Taiwan are also immensely political, with margin compression for developers and decreasing availability of suitable land. This is partially a result of natural constraints imposed by geographical conditions of the mountainous island and extensive urbanization along flatlands, but also of anthropogenic challenges such as commercial difficulties acquiring a significant plot of land for development, along with red tape imposed by regulatory processes for project approvals. In general, prohibitive costs and project development challenges significantly impede the growth potential and deployment pace for utility solar in Taiwan.

According to Bloomberg New Energy Finance, for example, ground-mounted solar PV projects may cost twice as much to build in Taiwan as their equivalents in China.¹⁶ Other sources have also cited Taiwan's relatively high solar costs.¹⁷ These cost premiums are due to complexities around land ownership and permitting, higher land prices and scarcity, more expensive modules and labor costs, as well as a lack of competition in the contractor market.

Finally, despite the vibrant offshore wind market and extensive investments from several European firms, challenges remain with wind power generation as well. Government mandates on localization mean a balancing act between attracting the right developers and investors on the one hand, and the political and economic objectives of the Taiwan government – which wants to create a local supply chain to serve as a basis of exports to other countries in the region – on the other hand. Additionally, Taiwan's strict localization regulations, where the government has required developers to source a significant proportion of its supply chains from local providers, may have contributed to the costs of offshore wind projects. The significant lag time in setting up local manufacturing facilities, along with complex negotiations with governments and local stakeholders, both contribute to delays in bringing projects online.

While the discussion in Taiwan has largely focused on the power sector, it is worth noting that pathways to a 1.5-degree Celsius compliant scenario under the Paris Agreement will require that Taiwan addresses other hydrocarbon end-uses as well. Heavy industries, particularly iron and steel, cement, and chemicals, can be a significant emitter and are difficult to decarbonize given its reliance on fuels for heat and other processes. In addition, the decarbonization of mobility would also require electrification or the adoption of low-carbon alternatives such as Liquid Natural Gas (LNG)/Compressed Natural Gas (CNG) or hydrogen vehicles.

Taiwan has a promising R&D base and the technological resource to explore key technologies for industries and mobility (such as hydrogen), but the government has yet to demonstrate clear support or a subsidy framework for such technologies. Taiwan does not possess a hydrogen strategy, for example, in comparison to leading markets in Europe and in stark contrasts to the ambitions of its neighbor Japan. Taiwan's broader energy ambition in non-power sectors pales in comparison to the well-established targets for renewables.

Key Levers for the Next Chapter

The future of the Taiwan energy transition is complex. Despite its many challenges, Taiwan has made great strides developing its solar and offshore wind sectors. Taiwan has reached 5,867 MW of installed solar capacity, and its position as a leading offshore wind market in Northeast Asia is acknowledged by the international business

¹⁶ Scott, Mike, "Buying Clean Energy In Asia Set To Get Easier As Firms Demand 100% Renewable Power," *Forbes*, December 17, 2020, <https://www.forbes.com/sites/mikescott/2020/12/17/barriers-to-buying-clean-energy-in-asia-set-to-fall-unleashing-growth>

¹⁷ See Feigenbaum, Evan A. and Hou, Jen-yi, op. cit. Solar project development and Levelized Cost of Energy also sourced from confidential discussions with developers.

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community, which continues to pour investments onto the island. Despite delays in the process, offshore wind players remain optimistic regarding market conditions, and they are expected to competitively participate in the third auction round for offshore wind, which will put another 1,000 MW up for grabs for selected projects.

Nevertheless, Taiwan is facing the very real possibility of not being able to meet all of its mid-decade targets without switching up policy, technology, and commercial drivers to address key concerns. In this context, Taiwan can still pull many key levers as options to accelerate its energy transition and to capitalize on its current trajectory.

On the renewable energy technology side, Taiwan is well-positioned to exploit other key advantages by building on its existing high technology base and early demonstration of relatively high-TRL innovations. For example, while utility-scale ground-mounted solar is expected to run into regulatory and technical challenges, some of these could be alleviated through a policy and deployment focus on floating solar. As a technology, floating solar PV has a positive outlook in a market like Taiwan, and is set to break free of its niche perceptions as market insiders increasingly come to terms with its abilities to address Taiwan's land constraints, high real-estate costs, and urbanized environments. In addition, floating solar offers key upsides for efficiency and water conservation.

Other immediately adjacent novel technologies are also available to Taiwan. With vast offshore wind potential, Taiwan can tap into even greater wind resources with floating offshore wind deployment, allowing it to situate offshore wind farms at even better locations to encourage greater annual energy production.

While the evolution of the power market structure is one step in the right direction, implementation of a modern, flexible grid remains largely under-explored in Taiwan's public policy. Yet as a technologically advanced society, Taiwan's energy space holds ample runways for upgrades. Grid edge technologies and concepts are likely to see deployment in Taiwan, thereby opening up new business models and new business opportunities. Grid edge refers to a multifaceted and modernized interface between intelligent "smart" grids and smart applications/sources of energy – such as smart buildings, Electric Vehicles (EVs, including charging infrastructure), and the presence of "prosumers" (energy consumers who might also produce energy for sale back to the grid).

Furthermore, early R&D is blossoming in Taiwan and could be strengthened with nuanced policy and fiscal support. The tradition of promoting academic-to-industry collaboration is a key legacy of Taiwan's former developmental state apparatus, and should be fully maximized in its modern-day reincarnation. For example, research into Battery Electric Vehicles/Fuel Cell Electric Vehicles (BEV/FECV) and into hydrogen applications (particularly in mobility and industry), is underway by Taiwan universities. Several research centers depict promising advanced research that could benefit from further government support for bridging R&D, pilot/demonstration schemes, and ultimately commercialization. The proximity of research and deployment space in science parks provide development clusters that could act as focal point for such targeted support.

Taiwan is unlikely to pivot further without addressing the broader issues surrounding energy consumption by its industrial base. Taiwan companies are already seeing increasing pressure to "green" its supply chain and its manufacturing, and companies are taking steps toward making needed changes. For example, in March 2021 Air Liquide completed construction on the first stage of its 25 MW ultra-pure, low-carbon hydrogen electrolyzer plant in the Tainan Technology Industrial Park. The company expects that the green hydrogen produced at the new plant will serve both the local semiconductor market and be used for other applications. Promoting such green energy

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investments must be a policy priority to reinforce Taiwan's position in global supply chains.

The Taiwan government is also well aware of the need to accelerate green investments into major infrastructure promotion plans. Recent initiatives include a National Development Council (NDC) financing mechanism that is expected to precipitate a total investment of NT\$100 billion (US\$3.5 billion) in related infrastructure projects.¹⁸ As the government stimulates investment and economic growth, however, Taiwan faces challenges like many other industrialized nations – economic growth is often inevitably accompanied by an increase in resource use and emissions. Bloomberg, for example, reported that the Taiwan economy grew the fastest in 10 years during the first quarter of 2021, driven by an exports boom.

As policymakers in Taiwan strive for sustainable growth, it must be aware of the need to mitigate the corresponding potential increase in energy intensity and emissions intensity. The need to decouple economic growth and energy demand growth is therefore fundamental to its green growth, and investment in the build-out of renewables infrastructure and technologies. This could reinforce the positive relationships between development, exports, and climate ambitions. After all, if energy demands continue to increase without sufficient efficiency measures, regulatory reforms, or rapid growth in renewables, Taiwan will undoubtedly face an uphill journey to fuel its growth without resorting to other more politicized technologies – such as natural gas and nuclear.

When it comes to key policy levers to signal confidence and stability, many options remain in place for Taiwan. Strong and clear messaging could include demonstrating an actionable roadmap on green growth and for net-zero emissions. For example, in September 2020 a group of Democratic Progressive Party (DPP) legislators introduced a proposal that would allow Taiwan to achieve net-zero carbon emissions by 2050. While net-zero targets are becoming increasingly common, a 2050 target could provide the required vote of confidence and additionally spur policy discussions on an ambitious interim target.

¹⁸ "President Tsai Reaffirms Commitment to Expanding Renewable Energy," *Taiwan Today*, November 12, 2020, <https://taiwantoday.tw/news.php?unit=6&post=188893>

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Conclusions & Recommendations

There are major overlaps in planned energy technology deployment and policy priorities between the U.S. and Taiwan. Energy trade ties will therefore not just be about deepening economic and commercial ties, but will also fundamentally be about promoting national security and sustainable development on both sides.

That includes increasing access to indigenous sources of energy; reducing the economic and political risks of energy dependence; improving energy resilience within the economy (as well as grid resilience while facilitating high renewables penetration); increasing efficiency, competitiveness, and resource savings; and establishing key industrial policies that will leverage the technological strengths of both nations to drive green innovation and green growth.

As Taiwan progresses along its own green growth journey, there is already a clear interest in Taiwan exporting its developing expertise. For example, the Taiwan government launched the “*Green Trade Promotion Program*” in 2011, and there are significant related trade promotion and investment efforts led by the Taiwan External Trade Development Council (TAITRA). In addition, direct government outreach and bilateral engagement efforts is taking place on energy issues with Taiwan’s neighbors – Japan and South Korea – who share great similarities with Taiwan in their energy transition efforts.

Given their shared challenges and issues of mutual interest, Taiwan and the U.S. could take advantage of expanded cooperation on energy. For one, a deepened focus on joint projects in renewable technologies could be critical in certain high-growth markets. In addition to both nations being relatively new markets for scalable offshore wind, the U.S. west coast could, similarly to Taiwan, also be a potentially strong locale for floating offshore wind. Similar geological requirements and industrial synergies could be the basis for sharing lessons not only on effective policies but also on commercial and technological terms.

Given the highly urbanized nature of the Taiwan economy, and the potential for expanded grid-edge and distributed technologies, Taiwan is also likely to explore virtual power plants and other technologies to promote deployment of the Internet of Things (IOT) concepts and to incentivize *prosumerism* on the grid. This could be critical to aggregating rooftop solar and other distributed resources, including flexible resources from smaller grid players, storage, and EVs.

Technologies, business models, and policies deployed in Taiwan could be highly relevant to U.S. cities with an interest in expanding their green footprints. Various other low-carbon technologies relevant to Taiwan industrial and social structures are also set to play a big role in the de-carbonization of the U.S. economy – from storage solutions (batteries and other storage mediums) – to electric/hydrogen vehicles, to technologies for industrial energy uses, and to digitalization of the grid.

As the Tsai Administration continues to push for deepening economic ties and exploring business partnerships with the U.S. – be it through negotiating a BTA, by reinvigorating negotiations under the Trade and Investment Framework Agreement (TIFA), or by focusing on the EPPD relationship – climate change and regional energy security are likely to serve as key priorities for both sides. Working as partners, the U.S. and Taiwan can build a greener future together.

Abbreviations & Acronyms

BEV	Battery Electric Vehicles
BTA	Bilateral Trade Agreement
CDP	Carbon Disclosure Project
CNG	Compressed Natural Gas
DPP	Democratic Progressive Party
EPEAT	Electronic Product Environmental Assessment Tool
EPPD	Economic Prosperity Partnership Dialogue
EV	Electric Vehicles
FECV	Fuel Cell Electric Vehicles
FiT	Feed-in Tariffs
GW	Gigawatt
IOT	Internet of Things
ITRI	Industrial Technology Research Institute
kWh	Kilowatt Hour
LNG	Liquid Natural Gas
MOEA	Ministry of Economic Affairs
MOU	Memorandum of Understanding
MW	Megawatt
NDC	National Development Council
NPP	Nuclear Power Plant
PPA	Purchasing Power Agreements
PV	Photovoltaics
R&D	Research & Development
RED	Renewable Energy Development
TAITRA	Taiwan External Trade Development Council
TIFA	Trade and Investment Framework Agreement
T-REC	Taiwan-Renewable Energy Credit
TRL	Technology Readiness Level