Research Intelligence

Direct PPAs:

New Opportunities to Drive a Sustainable Future for Thai Businesses



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Contents

Introduction	3
The Role of Direct PPAs in Thailand's Energy Market	4
Opportunities and Threats of Direct PPAs for Thai Businesses	13
The Domestic Development of Direct PPAs	17
Krungsri Research view: Direct PPAs present a real opportunity for Thai businesses to transition toward a sustainable energy system	19
References	22

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Introduction

In the contemporary business world, sustainability is increasingly being viewed as a core corporate goal, but at the same time, Thai companies are facing a broad range of challenges, including increased volatility in energy prices that is then pushing up operating costs, greater demand from investors to implement the ESG (environmental, social, and governance) framework, rising pressure from overseas trade partners to adopt 100% use of renewables, and the deepening impacts of international environmental legislation that requires exporters to demonstrate evidence that they have taken concrete steps to reduce their carbon emissions (e.g., the European Union's Carbon Border Adjustment Mechanism). Moreover, in addition to pushing players to shift to the use of clean energy, these changes are becoming entrenched as key requirements for companies that wish to preserve their competitiveness, maintain their presence in the market, and continue to attract investment inflows over longer time horizons.

One effective way for companies to respond to these challenges over the long term is by buying electricity from renewables-based suppliers via a direct Power Purchase Agreement (PPA). This is because direct PPAs provide a means by which companies can simultaneously gain direct access to clean energy while mitigating energy price volatility, and—with the market increasingly valuing the strength of companies' environmental commitments—sharpen their competitiveness.

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The Role of Direct PPAs in Thailand's Energy Market

What are Direct PPAs?

Direct Power Purchase Agreements, or Direct PPAs, are agreements in which electricity is purchased directly between a generating company (for example, a producer of renewables-powered energy) and an end user (a company or other type of organization) without the supply being mediated by the national power grid.[1/] These agreements thus differ from more traditional arrangements, in which the grid buys power from suppliers and then acts as a monopoly provider to distribute this to users.

Key Features of Direct PPAs:

1) These are long-term commitments that are typically made for 10 to 25 years, thus ensuring secure supplies and markets on either side of the exchange.
2) Because these involve a pre-agreed price, exposure to global volatility in energy markets is much reduced.
3) Users are supplied directly by the renewables generator (e.g., a solar or wind farm).
4) Electricity generating companies may also use the national grid as a pathway for electricity distribution, but under a Direct PPA, they provide electricity exclusively to their end users.
5) These may involve the issuing of Renewable Energy Certificates (RECs), which provide proof that a company's power is sourced from renewables.

Opening up access to direct PPAs will thus give businesses a greater and more flexible range of options when purchasing renewable energy. This approach can also help control long-term costs and, when necessary, demonstrate that electricity is sourced from clean energy suppliers, showing that the company operates in accordance with ESG principles.

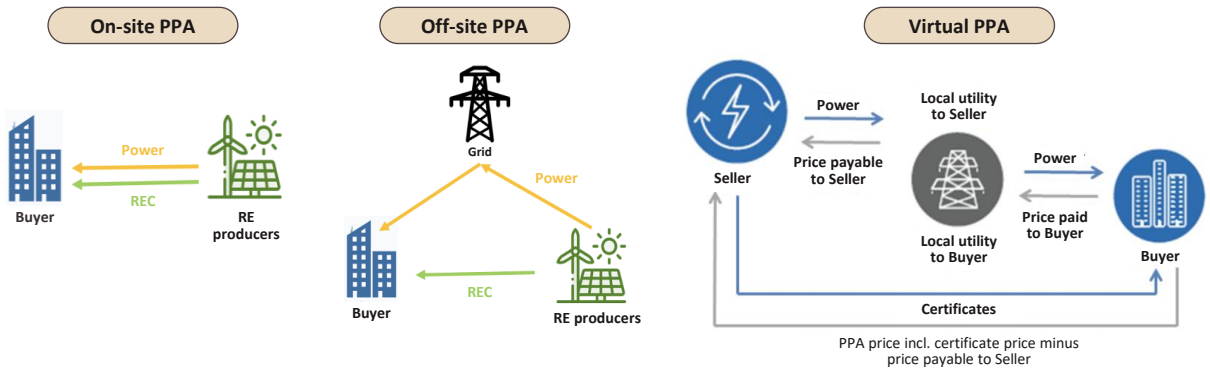
Direct PPAs can be categorized into three types according to their installation setup and connection to the power grid (Figure 1).

1) **On-site PPAs: Under these schemes, suppliers are responsible for installing power-generating equipment on site for the end user**, for example rooftop solar systems installed on factories, commercial buildings, or warehouses. This then allows electricity to be delivered directly without passing through any transmission network, which in turn helps eliminate both transmission losses and wheeling charges (i.e., the fees levied by the company transmitting the electricity). However, installing systems on site is only feasible where the location is large enough to accommodate the equipment, and the available space ultimately determines the maximum possible generating capacity.
2) **Off-site PPAs: With these setups, electricity generation is physically separated from the end user,** with the renewables generator distributing electricity to the latter via transmission lines. This model is suitable for large-scale developments that are built to exploit the advantages offered by particular sites, such as areas that benefit from high levels of solar insolation or particularly strong winds. Building in these areas then allows providers to operate with high levels of efficiency and to generate large quantities of electricity, but this comes at the cost of higher operating expenses and greater transmission losses.

1/ The term Electricity Authority refers to the Electricity Generating Authority of Thailand (EGAT), the Metropolitan Electricity Authority (MEA), and the Provincial Electricity Authority (PEA)."

Figure 1

Structure of Direct PPA by Installation Type and Power Grid Utilization



Source: Energy Regulatory Commission (ERC)

3) **Virtual PPAs[2/]: With these, end users agree to purchase renewable energy certificates (RECs) from generators while continuing to use electricity delivered by the grid.** This is suitable for companies that need to demonstrate their use of clean energy, typically as a way of meeting their ESG commitments, but that are currently unable to invest in the necessary infrastructure themselves or that face constraints on the installation of generating equipment on site.

Direct PPAs in the Thai Context

The domestic development of direct PPAs rests on a solid legal and operational foundation, and because this then allows the market to generate a range of solutions, businesses that are looking to source renewable power are better able to meet their needs.

- **Type 1: Direct PPAs distributing through private networks (Figure 2)**

These involve the purchase of electricity directly from generators, with this then distributed through private networks to end users. Private-sector operators are thus solely responsible for all associated investments and costs, including those related to the construction of the network and its maintenance and upkeep, together with the licensing fees that need to be paid by electricity generators and distributors. Naturally, generators also set their own prices, and because these need to take into account operating costs, these tend to move with changes in investment overheads, which may be higher than those of the national grid. With these systems, there is also a risk that supply may be inconsistent and that outages may occur.

This type-1 category may be further subdivided into the following two groups.

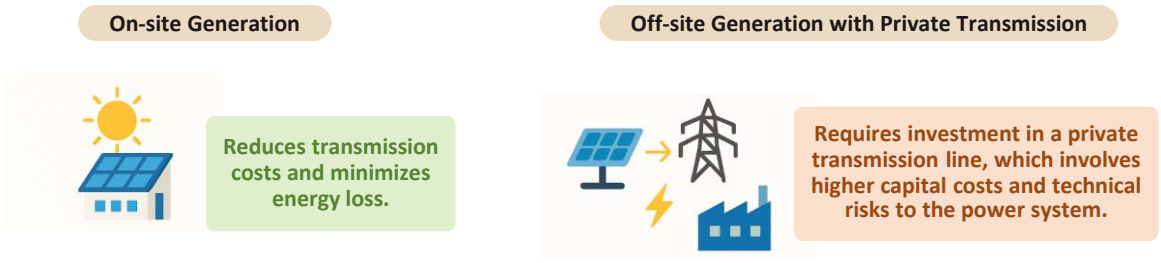
1) ***On-site generation:*** Generating electricity at the point of use eliminates the costs associated with its distribution. These setups are most suitable for use on business premises that are adequately sized and where electricity demand is localized.

2) ***Off-site generation*** using privately-owned transmission systems: By contrast, if the production and consumption of electricity is physically separated, it will be necessary to invest in a distribution network, and so these arrangements are best suited to projects that take advantage of sites that offer high-potential as sources of electricity (e.g., areas that benefit from intense wind or sunlight that can be converted into electricity). This, though, needs to be balanced with the additional network costs and the higher risk of interruptions to supply.

2/ Currently in the pilot phase in Thailand (Source: ERC Sandbox: Thailand's Pilot Virtual PPA and How RECs and Virtual PPAs Can Further Its Decarbonization Goals).

Figure 2

Model of Direct PPA through Private Electricity Transmission Lines



Source: MEA, PEA, Krungsri Research

- **Type 2: Direct PPAs distributing through the national grid (Figure 3)**

These projects take advantage of the national grid's pre-existing infrastructure, and this then avoids the need for additional investment in private distribution networks. This also has the advantage of providing greater power system reliability compared with Type 1 PPAs.

These can also be subdivided into two smaller categories.

1) ***Utility Green Tariffs (UGTs):*** These use the national grid to aggregate electricity generated from renewables and then to distribute this to end users via the 'Green Tariff'. Because the process is intermediated by the grid, end users are not responsible for managing electricity generation or purchasing, nor do they need to invest in building transmission lines. This has the advantage of reducing contractual complexity and operational costs, making it suitable for businesses that prioritize convenience and reliability in procuring renewable energy.
2) ***Third Party Access systems (TPAs):*** These arrangements allow third parties to connect to and take advantage of the national grid. Suppliers and end users thus agree a contract for the direct supply of electricity, with a TPA service provider acting as an intermediary between the two to manage grid access and other technical matters. Because these arrangements give end users more freedom in choosing suppliers that are a match for their business needs and in addition, allow them to negotiate prices directly with suppliers, these are generally regarded as improving competition and choice within the market. TPA agreements will thus be an important tool in liberalizing Thailand's electricity market.

Figure 3

Model of Direct PPA through the Utility Power Grid



Source: MEA, PEA, Krungsri Research

Direct PPAs organized as UGTs are thus most suitable for companies that wish to simplify operations while maintaining a high level of electricity supply reliability, whereas TPAs will help increase choice and provide greater freedom for companies that are sourcing power generated from renewables, and over longer timeframes, this will drive further liberalization of Thailand's electricity market. Being able to choose a model that fits an individual company's procurement and usage needs will, together with stability and clarity in government policy, be important factors in allowing the private sector to plan effectively for investment in energy management and corporate infrastructure.

This will be particularly so when TPAs are implemented and fully operational since these will help to improve flexibility, transparency and competition within the market. These will also have the advantage of serving as an important vehicle through which innovations and new energy technologies can be disseminated (e.g., peer-to-peer energy trading),[3/] and over the long term, this will then help improve the efficiency of the country's energy system and put it on a much more sustainable footing.



3/ This business model operates on an interconnected platform that serves as an online marketplace where consumers and producers "meet" to trade electricity directly without the need for intermediaries.

Box 1 Differences between UGT and TPA

The implementation of Direct PPA in Thailand is driven by two main mechanisms: Utility Green Tariff (UGT) and Third Party Access (TPA), both of which have distinct roles and characteristics, as shown in Table 1.

Table 1

Differences between UGT and TPA under the Direct PPA system

Topic	UGT (Utility Green Tariff)[4/]	TPA (Third Party Access)
Main Authorities	Ministry of Energy, the three electricity authorities (EGAT, MEA and PEA), and ERC	Ministry of Energy and the three electricity authorities
Key Characteristics	• Electricity authorities act as intermediaries procuring renewable energy for distribution to users without direct investment in power plants. • Prices are determined based on the Green Tariff rates set by the government, namely UGT1 (non-source specific)[5/] and UGT2 (source specific).[6/]	• This model allows third parties to connect to the EGAT's electricity grid system with a management and connection contract. • The producer and the user directly make agreement on the price. • The process is more complex but offers higher flexibility.
Objectives / Benefits	• Helps businesses purchase renewable electricity directly, reducing costs while supporting ESG goals. • Suitable for general businesses.	• Suitable for large-scale electricity users with high consumption and Net-Zero goals, such as Data Centers or large industries. • Serves as a pathway toward liberalizing Thailand's electricity market.
Progress / Implementation	The pilot project targets 2,000 MW during 2025–2027. • Services with a total volume of 2,000 million units per year. As of January 23, 2025, approximately 600 million UGT1 units had been requested by interested applicants. • UGT2 is still under preparation and not yet open for service (data as of September 2025).	• Currently under development of the legal framework and Wheeling Charge rate[7/] structure • Service tariffs are expected to be finalized and implemented in the near future.

Source: EGAT, MEA, PEA, Krungsri Research

4/ On November 7, 2022, the National Energy Policy Council (NEPC) approved the policy and guidelines for determining the Utility Green Tariff (UGT) rates. Subsequently, on June 14 and November 22, 2023, the Energy Regulatory Commission (ERC) approved the regulations and tariff structure for the Utility Green Tariff, which were announced in the Royal Gazette on January 8, 2024. The tariffs are divided into two types: 1) UGT1 – Non-Source-Specific Utility Green Tariff, and 2) UGT2 – Source-Specific Utility Green Tariff. (Source: Public Hearing on the Draft Proposal for the Utility Green Tariff Rates, January 16–31, 2024.).

5/ Businesses pay the regular electricity tariff plus an additional premium charge, initially set at approximately 0.0594 baht per unit. Green electricity is sourced from existing renewable power plants in the system, making it suitable for businesses that wish to start using green electricity without complexity.

6/ Electricity users who wish to specify the source of green electricity are provided with Renewable Energy Certificate (REC) services from new renewable power plants. The government has established a new tariff structure that directly reflects the generation costs of those power plants, with a service contract period of 10 years.

7/ The Wheeling Charge refers to the cost of using the electricity transmission and distribution infrastructure of the Electricity Authorities.

Current Landscape & Key Market Drivers

Benefits of using direct PPAs

Direct PPAs offer a wide range of benefits for businesses, power producers, commercial end users, and the country at large. **For companies,** direct PPAs serve as a key mechanism to reduce costs and manage risk arising from volatility in energy prices, address ESG requirements, and comply with international trade and environmental standards, thereby contributing to national competitiveness. **For power generation companies**, direct PPAs will guarantee more stable markets, providing incentives to invest in renewables (e.g., rooftop solar, and wind and solar farms) and related technologies, such as energy storage systems and smart grid applications.

Meanwhile, at the national level, the use of direct PPAs will improve overall energy security, reduce dependency on fossil fuels, attract additional FDI inflows, and contribute to the development of new supply chains related to rooftop solar installations and AI-powered energy platforms. In addition, clear policy support from the government will help accelerate the energy sector's transition to clean energy.

Commercial factors driving change

1) **ESG and corporate sustainability requirements:** These are becoming an ever-more significant factor in the contemporary business environment, as reflected in the significant shift by institutional investors at leading global powerhouses and the greater weight that these are now putting on ESG issues. For example, BlackRock has called on companies that they invest in to engage in public ESG reporting, while Vanguard has pledged its support for players that invest in ESG implementation. There is thus a risk that organizations that neglect or overlook ESG-related issues will lose competitive advantage to rivals that address these issues, and one consequence of this could be that they then face higher business costs.

2) **Requirements imposed by international trade partners or supply chain commitments:** The RE100 initiative has now been joined by over 400 major global corporations, including Apple, Google, Microsoft and Amazon, but in addition to pledging to the use of 100% renewable energy themselves, membership also requires that a corporation's suppliers do likewise. Apple has therefore requested that over 200 of its suppliers switch to the use of clean energy and that they commit to transitioning to net zero emissions.[8/] Thai businesses thus need to step up their own commitments to the use of renewables if they are to maintain their current positions within transnational supply chains.

3) **Cost pressures:** Companies are particularly motivated to reduce their exposure to price volatility in energy markets, and direct PPAs are able to facilitate this since these typically involve 10-25-year supply contracts. This allows companies to manage long-term costs more effectively, though in addition, these contracts may offer the additional attraction of undercutting grid-supplied power.[9/] This is especially the case for major consumers of electricity, such as large petrochemical plants, which can draw 100-200 gigawatt hours of power annually. For players such as these, savings can easily run into double-digit percentages,[10/] which translates into cost reductions of tens or even hundreds of millions of baht per year, though the exact extent of the savings will depend on the tariff structure, the size of the project, and the details of the individual PPA.

8/ On Thansettakij. (April 18, 2024). Apple expands investments in clean energy and water initiatives worldwide.
9/ KPMG, Corporate PPAs: The Future of Renewable Energy Procurement in Asia-Pacific, 2023.
10/ Example: CKD Thai implemented a Solar PPA and reduced its electricity costs by approximately 25% (NC-net, 2024).

Policy and Regulatory Drivers of Change

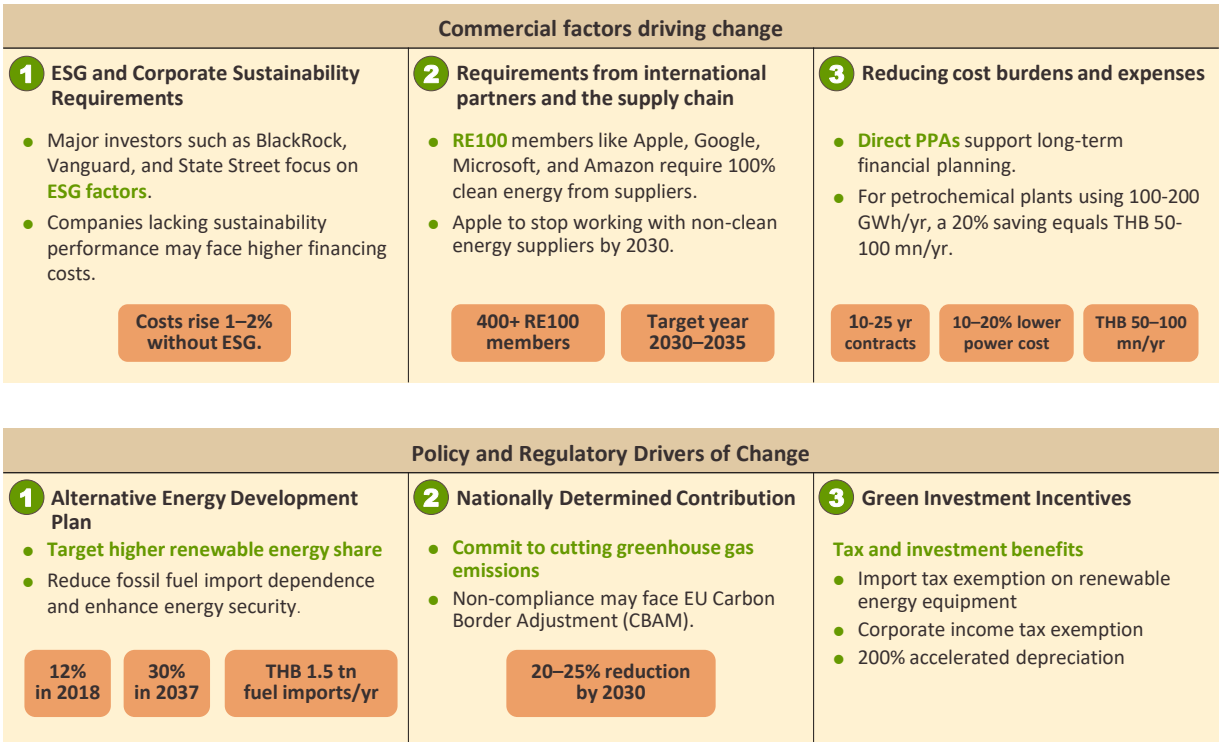
1) **The 2018-2037 Alternative Energy Development Plan (AEDP)** promotes electricity generation from renewable energy and to this end, it has set a goal of raising the contribution of renewables from 12% of supply as of 2018 to 30% by 2037. This will help to cut the bill for imports of fossil fuels from its current level of more than THB 1.5 trillion annually.

2) **Thailand's Nationally Determined Contributions (NDCs),** as outlined in the 2015 Paris Agreement, call for 20-25% reductions in greenhouse gas emissions by 2030 and this will necessarily imply that the private sector will move to a greater reliance on renewable energy sources. Moreover, failure to meet these goals may result in Thailand being downgraded to less favorable trading arrangements, for example as would be the case under the EU's CBAM.

3) **Government investment promotion schemes:** These include the waiving of duties on imports of equipment used by renewables generators, tax exemption for companies investing in energy production, and accelerated depreciation rates on renewables generating equipment (up to 200%). These measures have had a significant impact on costs, thereby helping to increase the appeal of investments in clean energy and encouraging an uptick in investment inflows.

Figure 4

Motivations for Using Direct PPA among Thai Businesses



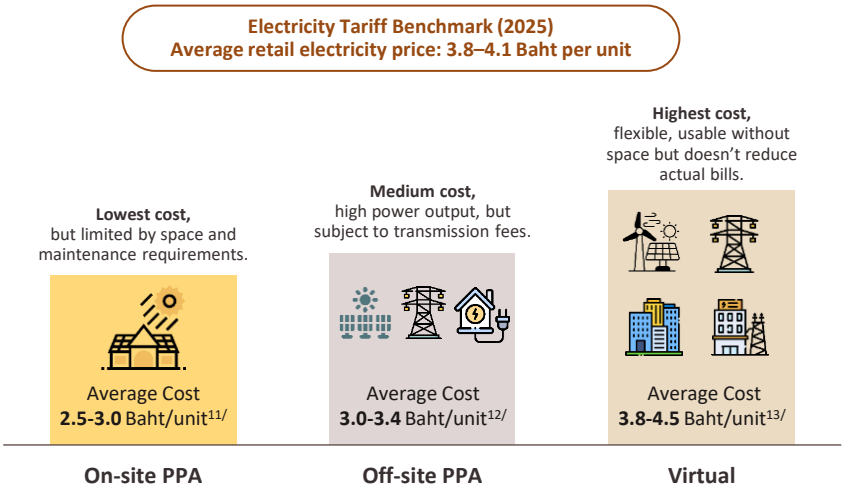
Source: Krungsri Research

In terms of electricity costs

Direct PPAs can generate significant long-term cost savings relative to grid-supplied electricity, especially for companies that consume significant amounts of electricity. This is because suppliers of renewable-powered electricity are able to offer competitive prices without needing to match the price structure of the state supplier, which includes the energy charge, the automatic Ft adjustment, and the addition of wheeling charges. **On-site PPAs are the lowest cost option**, as they eliminate any costs related to the transmission of electricity, though this comes at the expense of restricted production times (solar energy can only be generated when the sun is shining), site-related limitations, and additional maintenance overheads**. Off-site PPAs sit in the middle of the cost curve** since while use of a distribution network imposes greater costs, producers have more flexibility over where they site their facilities and this generally then allows them to generate more electricity. **Virtual PPAs are the most expensive option**, and cost savings may only be negligible since under these arrangements, power is bought from the grid, while companies also have to pay THB 0.2-0.5/unit for their RECs. Nevertheless, for companies looking for a straightforward way to meet ESG requirements that they demonstrate their use of renewables, these remain a viable option.

Figure 5

Comparison of Costs by Direct PPA Model



Source: EPPO, ERC, IREC Thailand, I-REC (International REC)

11/ Based on data from Solar Rooftop providers such as BCPG, SCG Clean Energy, and B.Grimm, the average PPA cost for factories and retail businesses is approximately 2.5–3.0 baht per unit, under long-term contracts (15–20 years) (Thansettakij, April 22, 2025).

12/ The Wheeling Charge applied in the UGT pilot project ranges from 0.25–0.30 baht per unit, in addition to the average electricity generation cost from solar or wind power of 2.7–3.0 baht per unit.

13/ The cost of purchasing electricity from utilities (MEA/PEA/EGAT) is currently 3.99 baht per unit, plus the cost of purchasing RECs (Renewable Energy Certificates) ranging from 0.15–0.50 baht per unit (based on REC market data from I-REC in Thailand and Southeast Asia).

Box 2 Case Studies of Direct PPA Implementation in Foreign Countries and Thailand

Figure 6

Case Studies of Direct PPA Implementation in Foreign Countries

Microsoft (USA)	• Invested in Direct PPA with a solar power project of 500 MW in the United States. • Invested in its own Data Center. • Aims to achieve 100% carbon neutrality through renewable energy use.
Google (Europe)	• Invested in Direct PPA with solar power producers and expanded investment in Denmark and Finland to support its European Data Centers. • Sets a target to use 100% renewable energy by 2030. • Helps enhance energy efficiency and sustainability in its operations.
Alibaba Cloud (China)	• In 2023, Alibaba Cloud signed a Direct PPA agreement for a solar power project in Hebei, China, to support its Data Center operations. • Expected to reduce carbon emissions by 290,000 tons per year.

Source: Post Today, 21 January 2025

Figure 7

Case Studies of Direct PPA Implementation in Thailand

Microsoft and Google with Data Centers in Thailand • Microsoft and Google are preparing to invest in large-scale Data Centers in Thailand, with plans to use renewable energy through the Direct PPA system to achieve 100% clean energy consumption in line with their Net Zero targets. • There are plans to implement the Third-Party Access (TPA) system to enable the direct purchase of renewable electricity from producers through the state electricity grid.	<u>Microsoft</u> • Announced the establishment of a Data Center Region in Thailand to support Azure[14/] cloud services and develop global AI infrastructure. <u>Google</u> • Invested in Quartz Computing (a subsidiary of Alphabet Inc.) with a total value of THB 32 billion[15/] (approximately USD 950 million) to build a Data Center in Chonburi Province, Thailand.
GUNKUL and muRata • Gunkul Engineering Public Company Limited is preparing for a Direct PPA with Murata Electronics (Thailand) Ltd., a Japanese electronics manufacturer, to supply 100% renewable energy (RE100) to its factories in Thailand,[16/] which will help reduce energy costs and create a positive environmental image for both companies.	

Source: News Online

14/ A cloud service developed by Microsoft, used to build, manage, and deploy various applications and services. It offers a wide range of tools and capabilities, including data processing, storage, and analytics.

15/ https://www.datacenterdynamics.com/en/news/thailand-board-of-investment-approves-two-more-large-data-center-projects/

16/ https://brandinside.asia/gunkul-murata



Opportunities and Threats of Direct PPAs for Thai Businesses

Carrying out an analysis of the opportunities and threats connected to the development of Direct PPAs will depend on an understanding of external factors and the extent of domestic readiness for these changes (i.e., internal factors) as these relate to society, the economy, the state of technological preparedness, the regulatory framework, and the business environment. In this paper, a PESTEL (political, economic, social, technological, environmental, and legal) framework is adopted to analyze the external factors affecting the market for Direct PPAs. Separately, a SWOT analysis is used to assess the internal factors, which are therefore investigated in terms of their strengths, weaknesses, opportunities and threats. Use of these two analytical tools will help policymakers and stakeholders better understand the state of the overall business landscape and key drivers of the market. This will further allow companies to address their weaknesses and threats and to exploit their strengths and opportunities, thereby boosting the effectiveness and efficiency of long-term strategic planning (see Table 2 and Table 3 for details).

Table 2

PESTEL Analysis of External Factors Affecting the Development of Direct PPAs

PESTEL	Major factors	Impacts on the Market for Direct PPAs
Political factors	• Government support for renewables, including the Alternative Energy Development Plan (this sets the goal of 51% of energy coming from renewables by 2037) and liberalization of the market for TPAs. • The 2050 net zero commitment[17/]	+ Clarity over government policy will help to boost investment in Direct PPAs. – Delays to the passing of relevant legislation, especially for TPAs (not yet fully operational), will erode national competitiveness relative to regional peers.
Economic factors	• Growing demand for renewables from data centers, RE100 companies, export industries, and Evs. • The introduction of the CBAM and similar international trade rules • The high cost of fossil fuels	+ Promotion of investment in renewables and efforts to attract additional FDI – High costs will reduce competitiveness
Social factors	• Increased awareness of the importance of the ESG principles and of the potential impacts of climate change. • Demand from both consumers and RE100 corporations • Renewables projects are typically more popular than new fossil fuel power plants with local communities.	+ Support for companies buying clean energy via Direct PPAs. – High costs will reduce competitiveness
Technological factors	• Development of the smart grid and improvements to energy storage technologies. • Use of artificial intelligence (AI) and the blockchain in energy management applications.	+ New technology will help to raise operating efficiencies and reduce the risk of supply interruptions. – There is a shortage of specialists skilled in Direct PPAs and electricity management systems, and this is a drag on market flexibility.

17/ The Thai government announced on September 29, 2025, its commitment to achieve net-zero greenhouse gas emissions by 2050, in response to global trade challenges and climate change. (Source: www.thaigov.go.th).

Table 2 (cont.)

PESTEL Analysis of External Factors Affecting the Development of Direct PPAs

PESTEL	Major factors	Impacts on the Market for Direct PPAs
Environmental factors	• The carbon neutral and net zero commitments, coupled with pro-environment regulations. • Climate change impacts are accelerating. • Natural disasters (e.g., floods, droughts and earthquakes).	+ Government policies targeting emissions reductions. – Impacts on the production of power from renewables.
Legal factors	• Complex permitting process that takes 6-12 months to complete. • Slow progress on regulatory reform that has left the TPA framework unfinished. • The transmission network is incomplete, and many generating sites are not yet connected to this.	– Delays in establishing clear regulations is creating legal uncertainty for investors and impacting investment decisions.

Source: Krungsri Research

Table 3

SWOT Analysis of Direct PPAs

Strengths	Weaknesses
• Thailand's geography offers significant potential for the generation of clean energy, especially for solar and (in some locations) wind power. • Thailand is the recipient of investment inflows from and is home to many manufacturing facilities operated by transnational corporations that have strict ESG policies. This makes it suitable for the development of direct PPAs supplying power to data centers and RE100 corporations that are considering investing in Thailand. • The government has passed legislation supporting UGT and TPA schemes (the latter is underway), and this demonstrates an institutional willingness to develop the regulatory infrastructure needed for the development of direct PPAs.	• Delays in issuing clear regulations expose investors to the risk that these will change, and so companies will generally hold off on investment decisions until the situation improves. • There is a shortage of specialists with expertise in direct PPAs, energy system management, and renewable energy financing.
Opportunities	**Threats**
• The government's carbon neutrality and net zero pledges, together with the state of environmental legislation, supports additional investment in direct PPAs. • Investment is rising on steadily strengthening demand for renewables. • The development of smart grid, energy storage facilities, and associated AI and blockchain technologies is adding to the security and transparency of Direct PPA systems.	• Thailand faces competition from Vietnam and Malaysia, which have opened their markets for direct PPAs more rapidly. Their clearer regulatory frameworks may attract investment inflows away from Thailand. • Worsening climate impacts and natural disasters may adversely impact energy production infrastructure.

Source: Krungsri Research

Tables 2 and 3 show that thanks to the positive impacts of government policy, demand from Thai businesses, pressure from overseas trade partners, and the inflow of investment funds into the development of new technologies, **the domestic market for direct PPAs has substantial growth potential**. Moreover, these provide clear support for companies working towards meeting the ESG goals, while Thailand has also been blessed with many sites suitable for use in the generation of clean energy. **Nevertheless, challenges remain, specifically in the areas of legislation, infrastructure, human capital, regional competition**, and the ever-present possibility of a shift in government policy.

To address these issues, Thailand needs to convert market headwinds into tailwinds. This is especially so with regard to regulations, which need to be streamlined and clarified, and in particular, the development of the TPA framework must be completed. **The government also needs to develop a more comprehensive set of incentives to attract investment into the development of technologies** connected to smart grids and energy storage, as well as into work on digital platforms. The industry's skill shortage remains another area of concern and measures to deal with this will need to focus on **the development of greater expertise** in the areas of direct PPAs and related technologies. Nevertheless, success in these endeavors would help to increase the market's long-term flexibility and would go a long way towards establishing direct PPAs as a key mechanism for helping companies engage in strategic planning and to more effectively manage their energy supplies. More broadly, this would also sharpen the ability of Thai corporations to compete effectively on the world stage.

Strategic recommendations

Having carried out a macro assessment of the factors influencing opportunities and threats to the development of direct PPAs, the next issue to be addressed is a consideration of how businesses should best move forward. Players in different sectors of the economy will need to choose the PPA model that is the best fit for their electricity consumption and general needs, though the selection process will begin with a decision over whether an on-site, off-site or virtual PPA is best since making the right choice here will be a key determinant of overall success later (Table 4).

Indeed, choosing the appropriate model will not only help to reduce costs and improve competitiveness, but this will also aid the company in better managing risks to its energy supply, all the while boosting the confidence of both investors and overseas trade partners in their operations. Beyond this, greater cooperation between the public and private sectors, including financial institutions, will help to underpin sustained growth in the market for Direct PPAs.

Table 4

Possible Strategies for Different Businesses

Business Type	Strategy	Benefits
Major corporations (energy consumption >10 MW or > 50 GWh/year) *(e.g., data centers, petrochemical plants or other large heavy industries*)	• Invest in off-site generation with private transmission by partnering with clean energy suppliers (e.g., solar or wind farms). • Reduce exposure to risk by developing energy storage solutions. • Control costs by signing long-term (10-25 year) PPAs.	• Reduces long-term costs. • Addresses net zero or ESG concerns and improves corporate image. • Improves confidence in the company among customers and overseas partners.
Mid-sized operations (energy consumption 1-10 *MW or 5-50 GWh/year)* *(e.g., modern trade operations, distribution and logistics centers, or hotels)*	• Begin with an on-site PPA, for example by installing a rooftop solar system. • Use an energy service company (ESCO) since this will help with finance, project implementation, and performance guarantees. This allows businesses to avoid heavy upfront investments and reduces risk.	• Rapidly reduces costs without imposing major investment overheads. • Improves corporate image with regard to sustainability. • Enhances future energy flexibility.
Small operations (energy consumption < 1 MW or < 5 GWh/year) *(e.g., retailers, SMEs, or office buildings)*	• Use a UGT or a virtual PPA since this is the most flexible option. In addition, this allows companies to access sources of clean energy without making associated investments in infrastructure. • To simplify operations and expenditure, use an online platform to connect with clean energy providers. • Improve the corporate image by developing a preliminary plan for adoption of ESG principles. • Increase purchasing power by joining business associations (e.g., the Federation of Thai Businesses and the Thai Chamber of Commerce). This will help to reduce costs and improve contract terms relative to negotiating alone.	• Allows easy access to clean energy without incurring major investment costs. • Reduces both overheads and risk. • Helps to prepare for the full liberalization of the energy market.
Special cases *(e.g., tourist businesses, or hospitals)*	• Invest in small-scale rooftop solar systems as part of an on-site PPA. This will help to generate a unique selling point attracting eco-conscious consumers (e.g., if selling into the green tourism market). • Partner with other businesses, e.g., energy companies or major healthcare groups.	• Helps to establish a presence in the market for green tourism. • Increases income from services. • Reduces costs and enhances flexibility.

Source: Compiled by Krungsri Research



The Domestic Development of Direct PPAs

With businesses under pressure from changes to trade and environmental legislation and approaches to investment overseas, the development of the domestic market for direct PPAs is approaching a turning point as this moves from being simply one option among many to a core determinant of a business's competitiveness. Three primary factors can be identified that are shaping this transition: **government policy**, the most important of these, is moving direct PPAs from being a choice to a necessity; **demand from business** is rapidly expanding the overall size of the market; **and technological advances** are raising efficiencies, lowering costs and enabling further business innovation. Given this context, the following section will discuss significant trends in investment and market growth, as well as areas of technological progress that will further attract inflows of global capital and so accelerate investment in direct PPAs.

- **Investment inflows are increasing, and the market is continuing to expand** on widespread growth in demand for clean energy across much of the economy. This is then stimulating greater investment in renewables both within Thailand and overseas, and downstream from this, direct PPA projects are attracting ever-growing interest.

  1) **Investment by overseas corporations in Thailand, especially by RE100 members**, is rising thanks to the pressures exerted by ESG assurances, net zero pledges, and the introduction of regulations such as the EU's CBAM. In particular, members of the RE100 group will aim to align their operations with their ESG and net zero commitments by securing access to 100% renewables-based power, and as part of this, global leaders in the operation of data centers such as Google, Microsoft, and Amazon Web Services are planning to build these in Thailand and to power these on locally supplied clean energy. Indeed, after Singapore, Indonesia and Malaysia, Thailand is emerging as one of the most attractive investment targets in the ASEAN zone, and more than THB 100 billion in additional foreign direct investment (FDI) is now expected. This will necessarily boost demand for clean energy and should prompt the government to accelerate development of UGT2 and to implement third-party access (TPA) regulations.

  2) **Thai energy companies are expanding the services that they offer and strengthening their international partnerships.** Leading players including EGCO, BCPG, GPSC, and B.Grimm Power together with companies in target industries that will in the future be heavy consumers of clean energy (including advanced automotive, digital, comprehensive healthcare and the bio, green and circular industries) are starting to increase the range of services that they are involved in, from renewables generation through to energy management. This includes the development of large-scale solar and wind farms, the buildout of which will then help to add to total domestic installed renewables capacity. In addition, these players are partnering with companies in Japan, Germany, and Australia to develop smart grid applications and to accelerate the transfer of advanced technologies. This will then help to develop new value chains connected to energy storage, AI-based energy management systems, and rooftop solar installations.

  3) **Intensifying competition in Southeast Asia is pushing Thailand to speed up the development of the domestic market for direct PPAs**. Elsewhere in the region, Vietnam has moved ahead of Thailand by rolling out a clear regulatory framework and developing the infrastructure necessary to fully support its own Direct PPA market. Indonesia has also introduced measures that will underpin increased use of renewables, partly by opening sites suitable for large-scale wind and solar farms. Given this, if Thailand continues to delay, it may fall further behind other economies in the region, and if this happens, the country will lose opportunities to attract foreign investment and risks being excluded from global supply chains.

- **Further advances in technology will be an important factor improving the stability, transparency and efficiency of direct PPAs**.

Technology is clearly a major driver of growth across almost all parts of the economy, and within the energy sector, digital technologies and energy storage systems have a particularly important role to play in how the industry will evolve. Three areas will be especially important for the future of direct PPAs. ***(i) AI and smart grid technologies*** can be used to provide real-time data analysis, thereby helping electricity producers and consumers better manage the load placed on the system. Current examples of this include the development of smart transformers by the Provincial Electricity Authority (PEA), which has now enhanced its ability to manage electricity usage, and through this, demonstrated how AI can be applied to the development of smart grids. ***(ii) Energy Storage Systems (ESSs)*** can help to address problems with intermittent supply from renewables (Investment is beginning to flow into ESSs linked to large solar farms in the Eastern Economic Corridor). ***(iii) Blockchain and Peer-to-Peer trading*** will improve the transparency and verifiability of electricity trading, though companies will have to wait for the full liberalization of the market for TPAs before this becomes a reality (Table 5).

Table 5

Key Technologies Influencing Direct PPAs

Technology	Important role	Impacts on the Market for Direct PPAs
AI & Smart Grid	Enhances grid management efficiency through predictive analytics and real-time data control, enabling smart demand forecasting and system optimization.	Helps improve the efficiency of energy allocation.
Energy Storage Systems[18/]	Helps store excess electricity generated from renewable energy for use when production is insufficient or during peak demand periods.	Enhances the reliability of direct PPAs by ensuring stable power supply even during non-solar or low-wind periods, reducing peak-load electricity costs, and strengthening system stability.
Blockchain Energy Trading[19/]	Enables transparent verification of energy transactions.	Improves transparency and accountability in Direct PPA transactions by enabling peer-to-peer energy trading and supporting renewable energy system development.
Virtual Power Plant (VPP)[20/]	Integrates small power producers and renewable sources into a unified system for more efficient management.	Improves energy management efficiency.
Demand Response System[21/]	Optimizes electricity use in response to actual demand.	Reduces electricity costs and increases flexibility in load management.

Source: Compiled by Krungsri Research

18/ The PDP 2024 places emphasis on the role of energy storage systems, which are essential for balancing the intermittent nature of renewable energy sources such as solar and wind power.

19/ Blockchain-based energy trading — for example, BCPG, in collaboration with the Metropolitan Electricity Authority (MEA) and Power Ledger, utilizes software to enable peer-to-peer solar energy trading between buildings.

20/ An advanced technology being developed by the Electricity Generating Authority of Thailand (EGAT) to integrate distributed renewable energy resources (DERs) nationwide into a new electricity ecosystem. This system enhances Thailand's power stability and reliability, reduces dependence on fossil fuels, and supports the country's goals of carbon neutrality and a sustainable low-carbon society. (https://www.egat.co.th/home/20250506-art01/)

21/ Refers to the change in electricity consumption behavior and patterns of users on the demand side, aimed at responding to system management requirements, fluctuations in electricity prices during specific periods, or incentive programs designed to encourage consumers to shift or reduce electricity usage during times of high prices or system reliability constraints. (Source: Smart Grid Thailand, https://thai-smartgrid.com)



Direct PPAs present a real opportunity for Thai businesses to transition toward a sustainable energy system

The market development for direct PPAs marks a potentially major turning point for Thai businesses, and this is providing an opportunity for the country to both transition to the green economy and to hone its ability to compete effectively in global markets. Moreover, in addition to lower energy costs for businesses, moving forward with these changes will also allow companies to meet their ESG commitments while simultaneously generating tangible and positive outcomes from investments in renewables. However, in the initial stages of this transition, a wide range of challenges will need to be overcome, including the current inadequate state of energy infrastructure, regulatory confusion, high initial overheads, and a shortage of skilled labor, though these problems can be addressed through cooperation between stakeholders. **In particular, it is imperative that public authorities navigate the existing legislative complexities to establish a clear and consistent regulatory environment, as success in this area will be a key determinant of positive investor sentiment and the long-term growth of the direct PPA market.** Beyond this, ensuring that the energy transition is strong and sustainable will require that the business sector undertakes a strategic shift and strengthens its capacities in the following three areas.

1) **The development of specialized service providers**: To better respond to rapidly growing demand, this will include energy service companies (ESCOs) that have expertise in the design, analysis and management of renewable power systems, and financial service companies that understand both direct PPAs and the clean energy industry, and that are therefore able to help clients better manage risk and access sources of capital.

2) **Investment in research and development**: This will help Thailand transition from being technology consumer to being a technology developer and a source of high-value exports. This would have the additional benefit of deepening linkages to energy supply chains.

3) **The creation of energy-management digital platforms**: These will connect generators, end users, service providers and regulators, thereby increasing the transparency and efficiency of the market.

Making greater progress on these three fronts will help to develop the market, and through this add to its flexibility, reduce the costs businesses pay for their energy supplies, sharpen national competitiveness, and help public- and private-sector bodies meet their ESG and net zero pledges.

Importantly, there is also a major role for government to play in these processes, and if the public sector adopts a proactive stance towards policy, infrastructure development, finance and skills development, this will have a significant impact on the development of a supporting ecosystem that boosts investment and fosters stronger business confidence. Action will thus be necessary across five interacting and mutually supportive areas.

1) **Accelerating the development of third-party access (TPA) protocols**: Because this enables companies that generate electricity from renewables to distribute this directly to business customers via the national grid, TPA-driven liberalization of the electricity market is a cornerstone of the overall development of direct PPAs. Progress on this will deliver benefits across three core areas.

- **Economic benefits**: Using the national grid to transmit electricity is cheaper than using UGT systems so this will lower business costs and pull in greater investment inflows, especially from data center operators and RE100 members. By contrast, failure to move forward with TPA liberalization will put more than THB 1.1 trillion in FDI at risk and will threaten over THB 700 billion worth of investments in the new target industries of EV manufacturers, and digital and green technologies.[22/].

- **Social benefits**: These moves will create high-quality employment opportunities and lift the overall level of skills within the workforce, helping to shift this towards a greater focus on green jobs, although to date, this transition has been slow; over 2013-2022, employment within green industries grew by just 1% (TDRI, July 25, 2025).

- **Environmental benefits**: Naturally, these changes will increase the share of renewables within the national energy mix, thereby accelerating the move to carbon neutrality and net zero.

2) **Overhauling the relevant legislation and streamlining oversight:** Clarifying and simplifying the regulatory environment would go a long way towards building investor confidence and accelerating growth in the market. Moves in this area should include ***expediting the development of technical and safety standards*** to ensure alignment with international norms and ***reducing the timeline for the permitting process*** from its current 6-12 months to something closer to 3-6 months. The latter could be facilitated by greater use of online systems and ***the establishment of 'one stop service centers'***. In addition, ***legislation needs to encompass new technologies***, such as blockchain-based energy trading, AI-powered energy management systems, and the integration of direct PPAs and energy storage systems, thereby modernizing the energy system and making it more flexible.

3) **Providing financial assistance**: Providing financial support to companies will cut their costs and reduce their exposure to risk, thereby speeding up investments in direct PPAs and accelerating growth in the market. Examples of this could include: ***waiving duties on imports of plant and machinery used in energy storage or the generation of clean energy*** (currently set at 5-10%), which would help to cut upfront costs; ***giving tax credits*** to investors in direct PPAs, allowing these to reclaim tax to 100-200% of the value of their investments over a period of 5-10 years; ***establishing a fund to provide low-interest financing*** to Direct PPA projects, especially for SMEs that otherwise have difficulty accessing sources of capital; and ***implementing government-backed credit guarantee schemes*** that ease private-sector access to lower-cost financing while reducing financial risk and strengthening investor confidence.

4) **Developing the necessary energy infrastructure**: If the infrastructure that underpins the market is inadequate, direct PPAs will struggle to make progress, though transmission and energy storage systems are areas of particular concern since these are core facilitators of energy market liberalization. ***The government should therefore step up spending on the development of smart grid infrastructure*** and ensure that this is capable of aggregating supply that may be widely distributed across rooftop solar installations, wind farms and biomass generating plants***. Equally important will be the construction of large-scale energy storage facilities*** since these will be needed to offset fluctuations in the quantity of renewables power entering the grid and so ensure stability of supply. The transmission network will also need to be upgraded to handle bi-directional electricity flows, ***while the establishment of real-time data centers*** will improve market transparency and attract greater investment inflows.

22/ TDRI. (July 25, 2025). "When the State Moves Slowly… The Industrial Sector's Survival Amid Insufficient Clean Energy."

5) **Developing new areas of expertise and upskilling the workforce**: A key factor determining growth in the market for direct PPAs is corporate access to staff with the necessary technical, legal and operational skills and knowledge. The government should therefore respond to this potential bottleneck by working with universities to develop clean energy curricula and courses, providing specialist training and certification, and promoting knowledge transfer from countries that have already substantially increased the share of renewables in their national energy mix, developed and implemented smart grids, and liberalized their energy markets. Examples of the latter include Germany, where the 'Energiewende' policy has resulted in the rollout of a smart grid system that integrates energy supplied from external renewables-based generators,[23/] and Australia, where a blockchain-based peer-to-peer energy trading system is being trialed[24/] and the electricity market is being liberalized.

These five measures will provide key support for the development of direct PPAs and as such, all five need to be implemented concurrently. However, achieving success in this area will help to build a market that is secure, flexible and competitive, and then to carry the country closer towards its carbon neutrality and net zero goals. Additional benefits will also be seen in the consequent improvements to energy security, competitiveness and sustainability.

Over the long term, the full implementation of TPAs will mark a major milestone on the path toward liberalizing the domestic electricity market and introducing genuine competition. This will also help to facilitate the more rapid adoption of new technologies, such as peer-to-peer energy trading, and the development of new business models, and in turn, this will attract major investments into the industry, especially from data center operators and companies looking to fulfil their net zero and ESG pledges. Ongoing government action in this space could also act as a catalyst transforming pressure on the energy sector into opportunities for green growth, job creation, and improvements to national competitiveness. However, the flip side of this is that if the authorities delay further or are only inconsistently attentive to the energy sector, there is a risk that Thailand will miss out on investment opportunities and will see its global competitiveness suffer as its nimbler and more swift-footed regional peers step into the market space that it has vacated. As such, it is imperative that private-sector players, financial institutions, and the authorities coordinate their activities if Thailand is to develop the resilient, stable and sustainable energy system that will be needed to confront the challenges posed by the 21st century and the transition to a world where sustainability is no longer a choice but a necessary precondition for long-term business survival and growth.

23/ Smart grids in Germany: Current situation" by Dena (German Energy Agency)

24/ https://greenreview.com.au/energy/australians-invited-to-join-peer-energy-trading/

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