Thailand

SOLAR ENERGY PROFILE

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Set the Stage for Solar to Play
a Much Greater Role in
Thailand's Energy Mix

SOLAR
MAGAZINE

Thailand Solar Energy Profile

Results of General Election Might Set the Stage for Solar to Play a Much Greater Role in Thailand's Energy Mix

INTERVIEWER: Andrew Burger
INTERVIEWEES:

- **Ulrich Eder**, managing director of the Bangkok-based law firm Pugnatorius
- **Noah Kittner**, senior researcher in the Group for Sustainability and Technology at ETH Zürich and a former visiting researcher at Thailand's Chulalongkorn University's Energy Research Institute
- **Sopitsuda Tongsopit**, Energy Policy Analyst at University of California Davis' Policy Institute for Energy, Environment, and the Economy, its Institute of Transportation Studies and a partner at the Creagy Company Ltd.

The first ASEAN (Association of Southeast Asian Nations) member state to institute the equivalent of a feed-in tariff (FiT), more solar power capacity has been installed in Thailand than in any other of the 10 ASEAN members. That's a diverse group that, along with Thailand, ranges from Cambodia, Laos and Myanmar, Indonesia and the Philippines to Brunei, Vietnam, Malaysia and Singapore.

Thailand's solar and renewable energy potential far exceeds what's been installed to date, however. Thailand has the one of the largest, and the most diverse, bases of renewable energy resources of any ASEAN nation, according to national and international assessments, which means there's plenty of room for growth.

Political instability in the wake of the military takeover of the government in 2014, a shifting, uncertain energy policy environment and a large surplus of natural gas and coal-fired power generation capacity installed during a period of large-scale utility grid investment and rapid expansion all cloud the outlook for solar and renewable energy growth and development , however. So do environmental concerns, most prominently air quality that seasonally reaches unhealthy, very unhealthy or even worse levels of particulate matter 2.5 (PM2.5) in Bangkok and other Thai cities.

Postponed several times, the first general election since the military takeover of the Thai government is due to be held in March. Rules strictly limit its openness, but nonetheless, the election may help clear the air, reduce uncertainties and lead to the establishment of a more certain policy and institutional framework conducive to solar and renewable energy growth and development.

In addition to providing a snapshot of solar energy in Thailand, Solar Magazine spoke with two leading academic researchers and a senior partner in a law firm that advises and assists investors looking to put capital to work in Thailand's solar and renewable energy sector to gain insights regarding the outlook for industry growth and development going forward.

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Chapter 1:
Surpassing the 3-gigawatt solar power milestone

A solar power milestone was reached in Thailand in 2017 as cumulative installed capacity surpassed the 3-gigawatt (GW) mark.

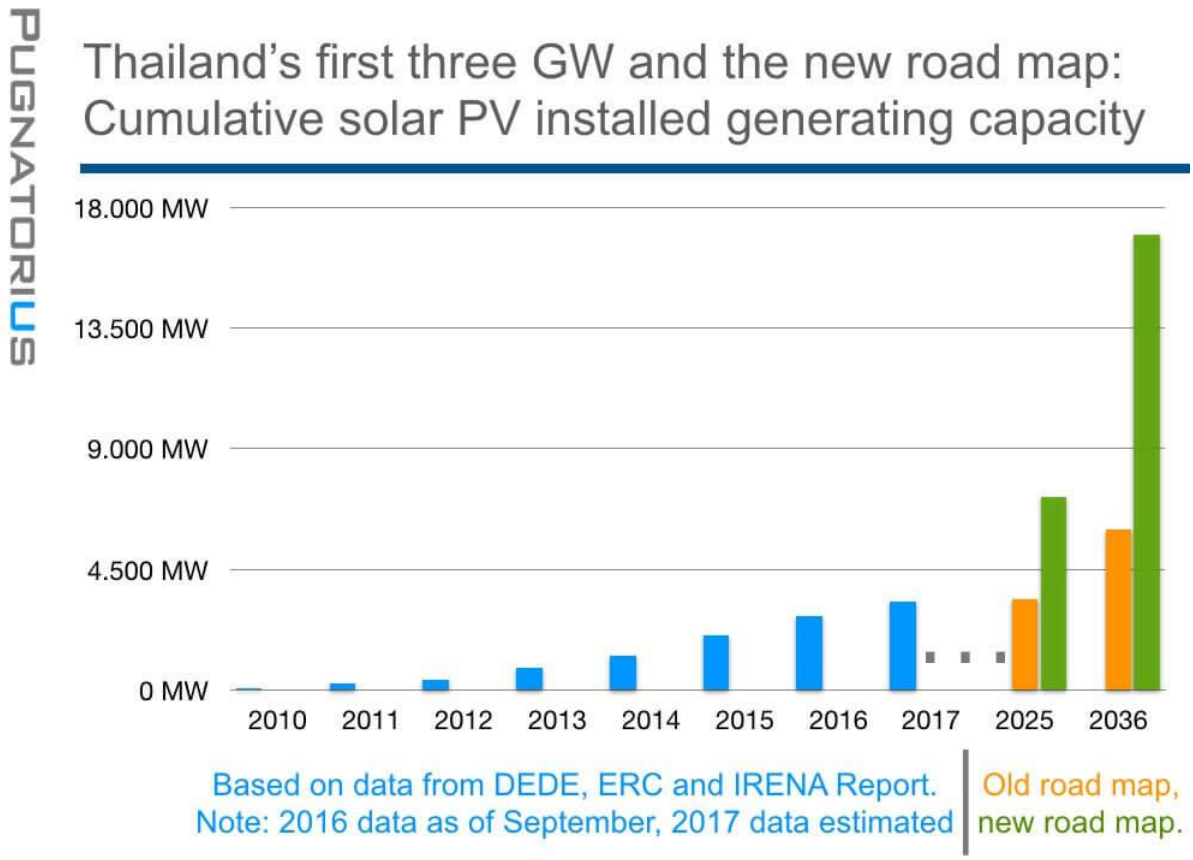
> *At the beginning of 2019, Thailand looks back to eight tumultuous years of mostly favorable solar energy developments and a few failures. While 2010 saw the first significant installations of solar panels, the year 2017 marked the achievement of a significant milestone, a total of 3 GW of solar installations in the Land of Smiles. This amounts to 50 percent of the 2036 target under the current 20-year road map (AEDP 2015).*

— Ulrich Eder, managing director of the Bangkok-based law firm Pugnatorius, wrote in Seven Opportunities: Solar Energy Thailand Update 2019.

Alternative Energy Development Plan for Thailand During the Period 2015-2036

Renewable Energy	As of 2015	Target in 2036
1. Solar Cell	1,298.51 MW	6,000 MW
2. Wind Energy	224.47 MW	3,002 MW
3. Biomass	2,451.82 MW	5,570 MW
4. Biogas (Wastewater/sludge)	311.50 MW	600 MW
5. Biogas (Energy crops)	Pending	680 MW
6. Waste (Municipal Solid Waste)	65.72 MW	500 MW
7. Waste (Industrial Waste)	Pending	50 MW
8. Small Hydro Power	142.01 MW	376 MW
9. Hydro Power	Pending	2,906.40 MW*
Total in MW	**4,494.03 MW**	**19,684.40 MW**

Source: Renewable Energy Industries Club, Federation of Thai Industries FTI, 25 March 2016



Thailand's first three GW and the new road map: Cumulative solar PV installed generating capacity
Source: Pugnatorius

Utility-scale solar power farms account for nearly all the solar power capacity that has been installed in Thailand to date — well above 90 percent according to one study. Similar to an FiT, a "solar adder" fueled the rapid growth. Authorities abolished the solar adder in 2015 amid concerns about over-investment and over-expansion that would leave the government in a fiscal hole, as it did in Spain earlier this decade.

Government review of projects was put on hold, which has resulted in a backlog of solar power projects awaiting approval. In the meantime, Thailand's Ministry of Energy shifted its focus to developing a policy framework and approving solar and renewable power projects that demonstrate grid parity.

> *We have proven in several pilot projects that we can expand on our success to promote more electricity generation from renewable resources at a price which we call grid parity at 8 cents (per kilowatt hour) on a wholesale basis.*

— Energy Minister Siri Jirapongphan was quoted while speaking at an international energy conference in April 2018.

"Unfortunately, the whole market has been in a wait-and-see modus for far too long," Eder told Solar Magazine. "The modernization backlog of Thailand's regulatory framework for solar energy development creates growing legal challenges. To base substantial investment decisions on drafts laws and governmental publications is not advisable. The uncertainties under the upcoming general election add a bitter taste to this."

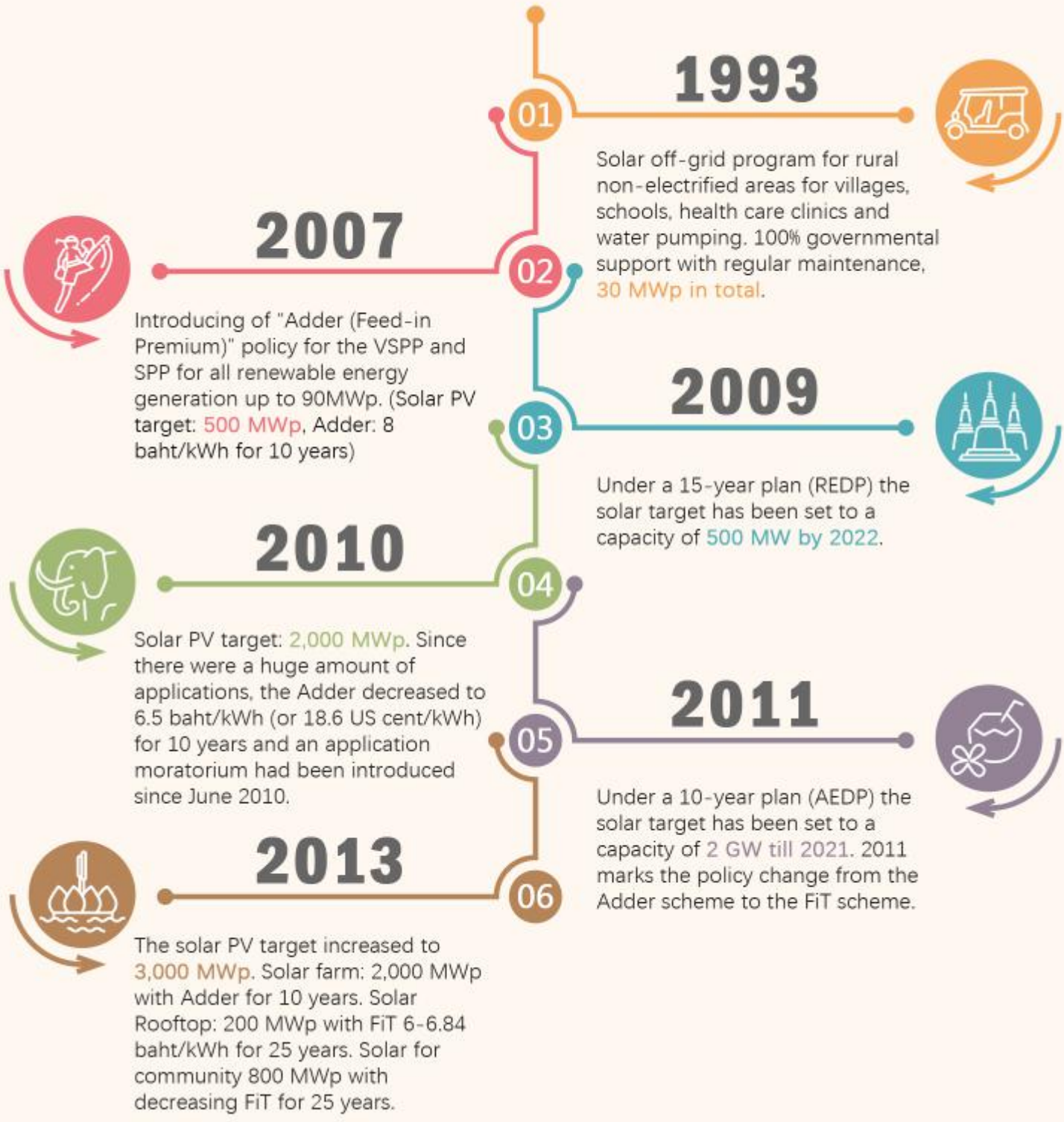
Typically, there has been more capital than deals available in Thailand's solar energy sector to date, according to Eder. "The show-stopper is the uncertainty on several levels. It starts with the pending legislation, the political risk of a policy change for solar developments, technological progress that might devalue current facilities, and the unforeseeable cost of evolution in this highly competitive industry. We see cannibalization effects between the currently dominant, land-based solar farms, the much greater adaptability of solar rooftops and the multiple advantages floating solar facilities offer," Eder said.

Pugnatorius has identified three industry drivers:

1. The prosumer, who can switch between producer and consumer roles;
2. Blockchain technology, which facilitates open, peer-to-peer energy trading; and
3. Development of smart microgrids operated by private companies.

Chapter 2:
A brief history of time in Thailand's solar energy

*Reproduced courtesy Pugnatorius Ltd.



07

2014

Solar PV target increased to 3,800 MWp. Solar farm 1,800 MWp with Adder for 10 years, solar farm 1,000MWp-applied before June 2010, changed from Adder for 10 years to FiT 5.66 baht/kWh for 25 years, solar rooftop 200 MWp with FiT 6-6.84 baht/kWh for 25 years and solar for community 800 MWp – changed to solar for governmental agencies and agricultural cooperatives – with FiT 5.66 baht/kWh for 25 years.

08

2015

Phase 1 of the Agency and Agricultural Cooperatives Program (Agro-Solar). Under the AEDP 2015 plan, the target solar capacity has been set to 6 GW till 2035.

09

2016

Pilot project for Solar PV rooftop (for self-consumption) of 100 MWp and phase 2 of the solar for government agencies and agricultural cooperatives. 67 projects have won the right to sell a combined 281.32 megawatts (MW) of solar power to the national electricity grid for 25 years. Under the 2016 pilot project, the Energy Policy Management Committee divided in a resolution as of February 24, 2016, the 100 MW into 10 MWp for households (below 10 kWp) and 40 MWp for commercial use for EGAT and PEA each.

10

2017

Semi-firm and non-firm PPAs have been introduced which require hybrid renewable energy facilities. The new roadmap increases the 2036 target from 6 GW to 17 GW. The first "SPP hybrid firm" tender, launched in 2017, has a combined power-generating capacity of 300 MW with a FiT of THB 3.66 for the whole 20 year period. The ERC announced that they received applications from 85 firms with a combined capacity of 2,464 MW and that most shortlisted firms offered a FiT below THB 2.50.

11

2018 January

Announcement of public tender for solar farms of totaling 269 MW, based on semi-firm power purchase agreements. These projects seem to be abandoned.

Chapter 3:
Ventures into distributed solar and small-scale renewable energy

The Thai government and power industry have also experimented with using small-scale solar, as well as hydro and biomass, to electrify off-grid communities and improve lives and livelihoods in agricultural and remote areas. Poorly conceived and executed, and poorly coordinated with other, much larger natural gas generation and grid expansion initiatives, a small, initial solar home systems-based rural electrification program failed to much media attention back in the early 2000's, Noah Kittner, senior researcher in the Group for Sustainability and Technology at ETH Zürich and a former visiting researcher at Thailand's Chulalongkorn University's Energy Research Institute, recounted in an interview.

Memory of the initial program's failure persisted nonetheless, leaving solar with a bad reputation in Thailand. Conditions didn't really start changing for the better until the fourth quarter of 2017 when the Energy Ministry ended a decades-long restriction prohibiting households and commercial buildings from selling electricity generated by on-site solar power and other distributed energy systems to Thailand's two state-run distribution utilities.

Utility customers had been selling surplus electricity generated by rooftop solar PV systems and other behind-the-meter generators to distribution utilities MEA or PEA, via small power producer (SPP) or very small power producer (VSPP) adder programs. The new FiT, at the time it was announced, reportedly allows behind-the-meter power generators to sell surplus power to MEA, the distribution utility for the Bangkok greater metropolitan area, or PEA, which serves the rest of the country, at a rate below 2.6 Thai baht (USD0.08) per kilowatt-hour (kWh).

System Installed Generating Capacity

Type of Power Plant	January 2019	
	MW	%
EGAT's Power Plants		
- Thermal	3,647.00	8.61
- Combined cycle	7,358.00	17.37
- Renewable energy	3,030.18	7.16
- Diesel	30.40	0.07
- others	500.00	1.18
Total	**14,565.58**	**34.39**
Purchase		
Independent Power Producers	14,948.50	35.30
Small Power Producers	8,957.82	21.15
Import	3,877.60	9.16
Total Purchase	**27,783.92**	**65.61**
Grand Total	**42,349.50**	**100.00**

Source: Electricity Generating Authority of Thailand (EGAT)

Thailand had a really innovative policy to promote very small power producers and distributed energy resources — not just solar, but small hydro-power, biomass, etc. Farmers and agricultural communities did benefit from this, and it helped boost private participation in the power market in that small hydro-power plants and solar farms could get a power purchase agreement with the utility.

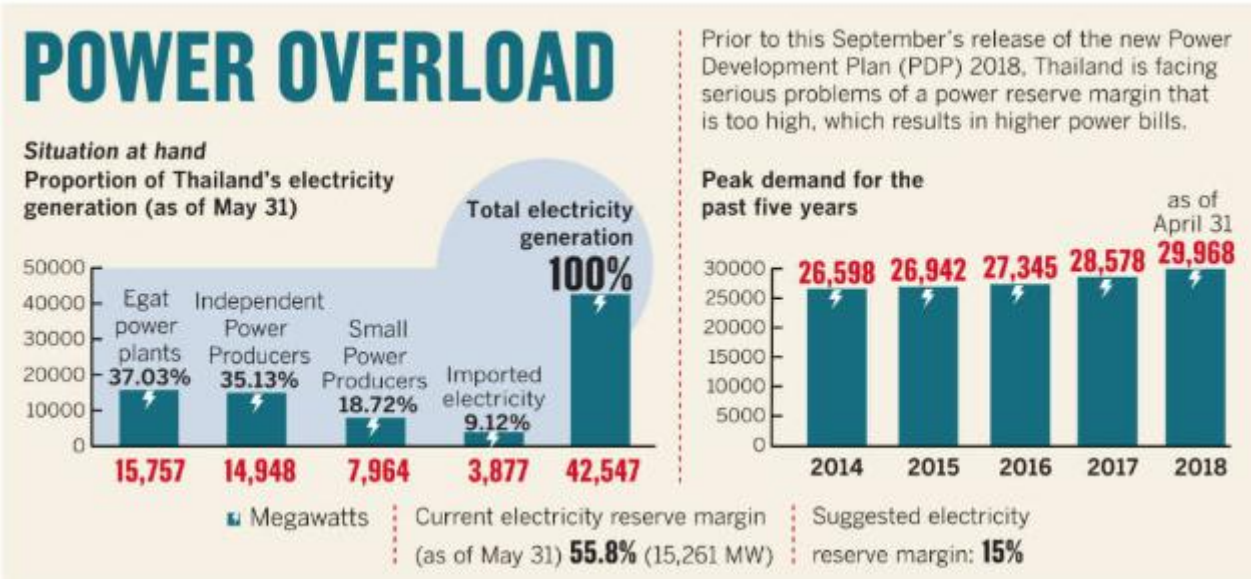
— Kittner told Solar Magazine

Can growth of solar and other environmentally friendly energy resources make a substantial contribution to alleviating poverty and realizing Thailand's sustainable development, rural and national electrification, international greenhouse gas reduction and climate change goals all at the same time?

"It really depends on policy objectives and designs," Sopitsuda Tongsopit, Energy Policy Analyst at University of California Davis' Policy Institute for Energy, Environment, and the Economy, its Institute of Transportation Studies and a partner at the Creagy Company Ltd., said in an interview. Tongsopit also led the Thailand Solar PV Roadmap Initiative, a project that Kittner contributed to, as well.

"Thailand in the past has experimented with targeting low-income customer groups for off-grid solar, but the failure of this program was well-documented in the literature and has not yet been learned by politicians. During the Yingluck (Shinawatra) administration (ended in 2014), there was also a solar farm program announced to increase income for agricultural cooperatives, but the design of the program did not result in income redistribution as the policy intended," Tongsopit told Solar Magazine.

Thailand's energy authorities, as is the rule worldwide, focuses almost exclusively on energy supply while neglecting the demand side of the energy consumption-production equation, Tongsopit points out. On balance, that's been to the detriment of establishing open, competitive energy markets that take social and environmental factors into account, as well as energy consumers, energy markets and industry, and Thai society.



Source: Electricity Generating Authority of Thailand (EGAT) NATION GRAPHICS

"I would say that to date, the utility-scale solar farms and rooftop solar systems that have come online resulted from a policy that focused on energy diversification, and there were no major policy elements that intended to help the poor," Tongsopit said. "As more solar electricity comes online, fossil-fuel combustion is displaced but it doesn't reduce the build-out of large-scale fossil-fuel based generation capacity. This is because Thailand's power sector planning still focuses mainly on the supply side and has not adequately incorporated demand-side options such as end-use efficiency and behind-the-meter options, such as distributed solar PV and energy storage. As a result, we have overcapacity of stranded power plant assets that result in higher retail tariffs for ratepayers."

Chapter 4:
Thailand Energy Strategy 4.0

That said, residential and commercial-industrial solar power systems are becoming more common in Thailand, Kittner pointed out. More broadly, straightforward economics, more specifically ongoing declines in the installed costs of both solar energy and advanced battery-based energy storage systems, is leading Thailand's energy authorities to refocus on implementing policies, rules and regulations that can spur growth of distributed solar and other local, renewable energy resources.

"Thailand's 4.0 Energy Strategy is trying to promote electric vehicles and solar. I would pay attention to energy storage technologies, as well," Kittner said. "I think we will see more focus on distributed applications in urban areas," he continued. "Local self-consumption is becoming more and more attractive in Thailand. Grid power demand peaks at around 2-3 PM, which coincides with peak solar power generation…Solar could provide more on-demand generation to meet those peak loads."

Thailand's new energy development plan prioritizes integration of higher shares of solar energy on to the grid, Kittner continued. "There is more of a cognizant push to reduce reliance on imported gas for electricity and solar is a big part of the energy puzzle," he said.

Moreover, public awareness and interest in solar and renewable energy is growing, Kittner added. “I would point to the opposition movement to block a coal-fired power plant in Krabi to highlight the public attitude toward pollution, especially in biodiversity hotspots. The recent attention being paid to the air pollution crisis highlights that,” he said.

In a study published in January, ASEAN grid flexibility: Preparedness for grid integration of renewable energy, Kittner and two other researchers concluded that Thailand is among the most prepared nations in ASEAN when it comes to integration of high shares of solar PV on to the grid without causing major issues.

A core aspect of discussions regarding construction of an ASEAN Power Grid, “Thailand wants to act as the transmission corridor to channel excess hydroelectric power from Laos all the way to Singapore,” Kittner explained. “Thailand’s solar industry could benefit from this arrangement if the transmission system allowed for Thailand to use the interconnections with Singapore, Malaysia, and Laos as a balancing tool.”

In their new study, the researchers highlight that the ability to trade solar and other forms of renewable power with neighboring countries could reduce the costs of renewables-grid integrating higher percentages of solar in Thailand. “However, this may not be necessary until solar’s share of the electricity mix reaches in excess of 25 percent, and that might not happen for a while,” Kittner noted.

Chapter 5:
Solar in Thailand's energy mix: What lies ahead?

Thailand's government isn't forsaking fossil fuels, however; quite the contrary. The Energy Ministry is moving forward with plans to field bids from independent power producers (IPPs) to add a lot more fossil-fuel power generation capacity. IPPs will be invited to bid for 8,300 MW of power generation capacity in 2019 in what is to be the fourth round of IPP bidding conducted by the Energy Ministry. Previous rounds, in 1994, 2000 and 2013, resulted in contracts being awarded for building out of a combined capacity of 14,948 MW. Permanent energy secretary Kulit Sombatsiri was quoted as saying the new IPPs will be developed at large sites and fueled by natural gas, coal and diesel.

Looking forward, Pugnatorius expects government-owned Chinese solar energy industry players to enter the Thai market on a massive basis sooner rather than later. "We've had lots of experiences with them in the previous year," Eder added. "They still have to adapt to the Thai market and conditions, but there is no doubt that they will manage this soon," Eder said.

Furthermore, the focus of these Chinese market entrants isn't so much on profitability as it is on market entry and gaining market share and long-term market power, he added. "Such long-term thinking will drive Thailand's solar industry, and there is nothing to complain about such approach."

The National Energy Policy Council, Thailand's highest energy policy-making agency, raised the country's 15-year renewable electricity goal to 30 percent in June 2018. Working with Thailand's Energy Ministry, to assess solar and renewable energy potential across ASEAN and lay out a road map to double renewables in the energy mix, IRENA, the International Renewable Energy Agency in a study released in 2017 concluded renewable energy penetration in Thailand could reach 37 percent while reducing energy costs, greenhouse gas emissions and other forms of environmental pollution at the same time. The resulting, estimated savings: **USD8 billion per year**, excluding savings associated with the human and environmental health benefits expected by transitioning from reliance on fossil fuels to renewable energy resources.

Chapter 6:
Thailand's renewable energy and climate change goals

Will Thailand meet, if not exceed, its short and long-term solar, renewable energy and greenhouse gas emissions goals?

"Up until now Thailand always over-fulfilled its renewable energy projections and plans far beyond their scheduled timeline," Eder said. "However, its future reputation as an ecological paragon will depend on the accomplishment and management of its massive waste problem, especially with respect to plastic waste. Whether solar energy can make its own contribution to reduce air pollution and waste remains to be seen."

"I think that Thailand could easily meet their renewable energy goals for 2025 without incurring large costs to the consumer or utility. Will they? I am not sure given this depends on entrenched political interests and also inertia in the natural gas market, as well as the availability of natural gas," Kittner said. "However, I am confident that solar and storage are much more economically viable than any fossil fuel option — especially since much of the gas is imported."

> *Solar is already incredibly cheap. The challenge is grid integration, and I think that expanding regional power trade with neighboring countries to balance excess solar production and incorporating new forms of battery storage into the grid would drastically increase the utilization of renewables in Thailand.*

Kittner also sees the potential for greater amounts of distributed, local solar energy to alleviate poverty in some cases. "The urban solar microgrids I have studied with Jiab Tongsopit are not really official microgrids, but they drastically reduce the cost of electricity to rental units in low-income areas. In Bang Bua Khlong, the electric utility would have one connection with the manager of an apartment building who then charged monthly electricity bills to the tenants. The apartment manager typically marked up the price of electricity and took a cut. However, some of the apartments have integrated solar into their own local system and reduced energy bills," Kittner explained.

Most significantly, replacing fossil-fuel electricity with solar can improve air and environmental quality in Thailand. “That may be the most important benefit — both to human health and poverty — as air pollution is a silent killer. Solar can help avoid the most hazardous levels of smog and ozone formation if implemented at a large scale,” Kittner said.

Kittner went on to identify fostering investment in innovation and a commitment for Thailand’s state-run utilities to accommodate the burgeoning solar industry as keys to attracting and channeling capital into solar energy development and lowering energy costs for consumers. “Of course solar can clean the air and address climate change, but the biggest benefit now is that it costs less to build than a coal plant and provides lower-cost electricity ,” he concluded.

Read the Profile at: https://solarmagazine.com/solar-profiles/thailand/

Appendix

The Story Behind Solar Energy Profiles

The solar energy industry has gained significant development over the past few decades, while making vast and impressive contributions to accelerating the transition to renewable energy, better addressing the climate change and creating a greener living environment for human beings. However, from a global perspective, the solar development is uneven–many regions in the world which have huge solar potential along with many benefits to residents lack a robust ecology comprised of various aspects including strong social awareness, consistent governmental support, mature technology systems, effective policies and regulations, and adequate capital. These regions are mainly in developing areas, like Africa, Asia, and South America, occupying a large proportion of the world's population. In the meanwhile, there are still some 1 billion people across the globe have no electricity access; most of these people are living in rural communities of the areas mentioned above–many practices have proven that solar energy deployment is an ideal means to alleviate energy poverty.

Aiming to make the public to get to know more about and obtain good understandings of the potential, states, and obstacles of the solar energy development in these regions and areas, Solar Magazine launches the Solar Energy Profiles column and will publish profiles for different countries regularly. We will concentrate our efforts on the developing as well as the less developed countries first since they have received less attention. We hope that these profiles composed of official statistics, market analyses and expert insights can catch more attention from international policymakers, development organizations and associations, technology professionals, and investors to form a strong cohesion to accelerate the solar energy deployment and address the energy issues.

More Profiles: https://solarmagazine.com/solar-profiles/

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