

Private sector opportunities in Thailand's new solar PV program



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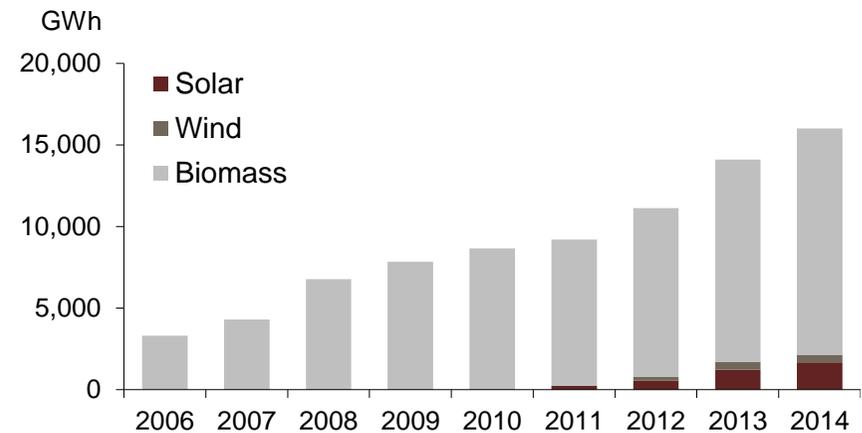
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This presentation draws in part on analysis done by AWR Lloyd and Macquarie Securities in "New solar targeting gas deficit" 30 Oct 2014

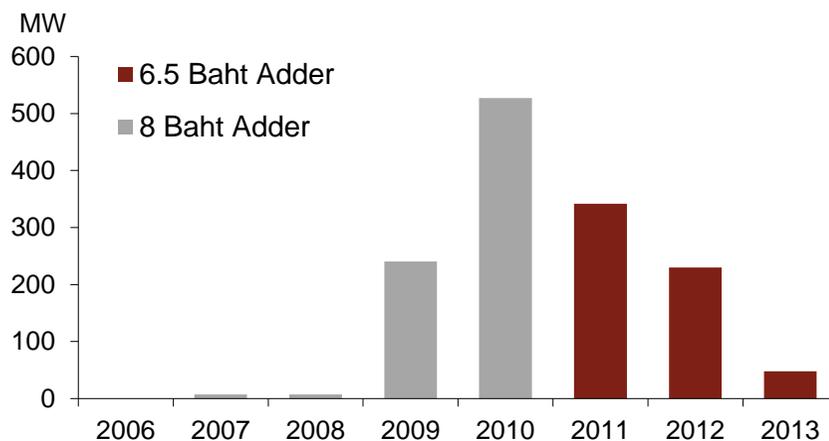
Thailand has a sophisticated renewable energy industry

- Thailand has by far the most successful renewable energy program in Southeast Asia.
- 2.2 GW of biomass capacity currently accounts for over 6% of total power produced
- A successful first stage of Thai solar PV will see 1.3GW on line soon - accounting for another 1%
- These projects are part of a long standing Thai commitment to alternative energy.
- Capable government and strong regulatory framework are a solid platform for next round.

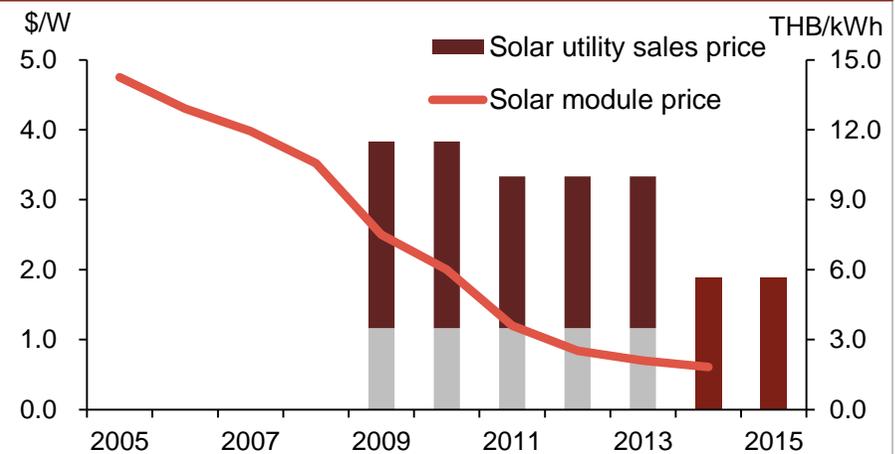
Large amount of renewable energy on grid



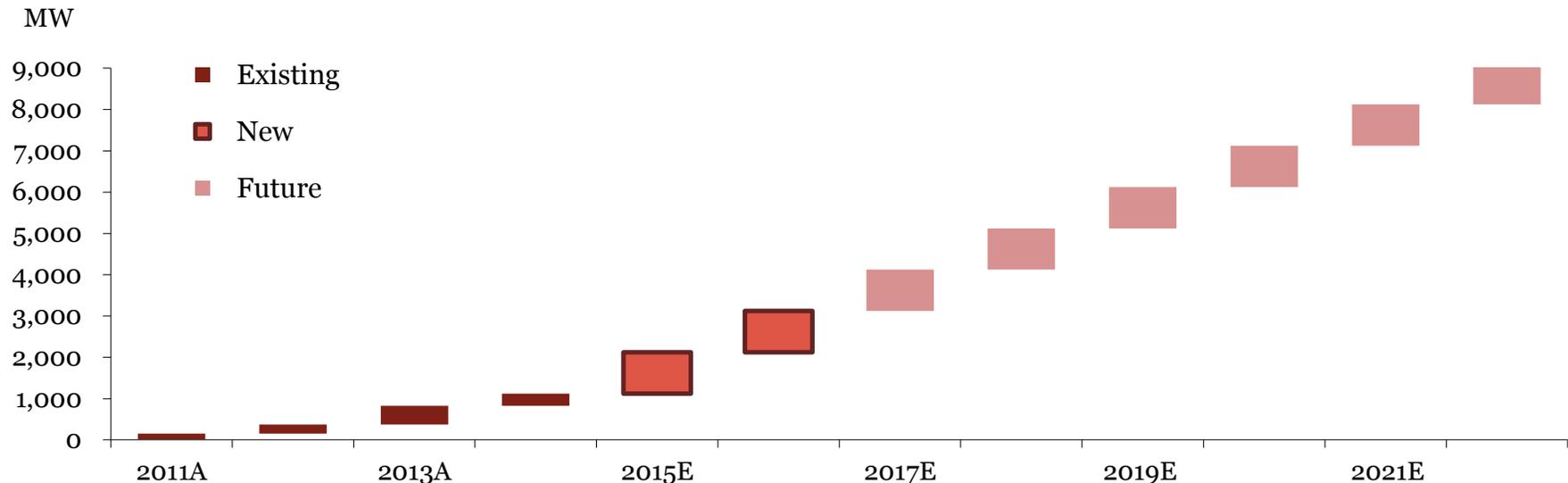
Thai solar first round of development



Falling solar tariffs and panel prices



New opportunities in three segments



Three pathways to Solar PV growth

- **Utility scale:** Vast majority of current Thai capacity – and new short-term prospects - are at utility-scale.
- **Rooftop:** Less than 5% of Thai solar PV comes from rooftop applications now. This could change drastically.
- **Government and cooperatives:** Brand new, unproven business model - may take some time - but could represent an interesting opportunity.

Thailand Solar PV Blue Sky Scenario

- Thailand has plans to import massive volumes of LNG as gulf gas supplies wane over next ten years.
- This makes marginal cost of new Thai power higher than the marginal cost of new Solar PV.
- In a Thai Blue Sky Solar Scenario, this could be annual additions of 1GW through 2022.
- This sounds ambitious and there are constraints, but other countries that were behind Thailand have made or planned even larger additions.

Utility scale: Moving fast

Investment snapshot

- Projects are moving very quickly.
- Current pipeline of over 1GW should get developed within 2015-2016
- Real investment opportunities exist now with holders of applications.
- Projects may have EIRRs over 14%, but new acquisitions will be below this.
- Developers may have sent a lot of time and money on projects, reducing returns.

Background

- Energy Regulatory Commission publically lists companies at the Waiting for Approval stage.
- Some may be as much as four years old.
- Profitability driven by ability to reduce costs through scale and lower cost of debt.
- Structured as Very Small Power Producer (VSPP) projects with individual PPAs under 10MW.

Utility-scale: Key points

Pipeline	1,054MW
Project size	Individual PPAs are under 10MW as they awarded under VSPP PPAs are bundled into larger projects some over 100MW
Tariff	5.66THB/kWh
Debt	Standard packages 15 plus year tenor possible Interest rates between 5.5 - 6.5%
Status	Projects previously in the "Waiting for Approval" list have been fast tracked for COD by 2016 Likely to be awarded in at least two separate tranches
Revaluation and Exit	Scale of projects could make public listing or Yieldco type structure possible
Opportunity	Partner with PPA applicant for rapid access to Thai market, but at lower return level
Comments	Once the current Waiting for Approval Pipeline is approved, there is little visibility of the next step for utility-scale projects

Solar rooftops: Long-term growth opportunity

Investment snapshot

- In early days in Thailand providing less than 5% of total Solar PV supply.
- Supported to date largely through FIT program, but now seeing purely commercial projects.
- Could be the biggest growth segment and produce a large portion of Solar PV power in the future.
- Large number of different Thai companies are involved in the segment.

Background

- Thailand has had a solar rooftop PPA program in place, but it has moved slowly.
- But many new rooftop projects are being done on commercial terms.
- Profitability driven by lower installation costs and offset of higher retail prices.
- May require a net metering program to achieve meaningful scale.

Solar rooftops: Key points

Pipeline	70MW government PPAs Private sector programs
Project size	10kW to 1MW
Tariff	6.16 - 6.96 THB/kWh for PPAs
Debt	May be part of mortgage Leasing model under consideration
Status	No commercial opportunities remaining in PPA pipeline Some residential left Other commercial projects occurring outside of government structure
Revaluation and Exit	Public companies own and are pursuing substantial rooftop assets
Opportunity	Rooftop solar at a certain scale is commercially viable now As power tariff rise this will become increasingly true There does not appear to be any constraints from available space
Comments	Inability to sell power back to the grid is a significant limiting factor on project sizing and profitability

Government and Agricultural Cooperatives: One to watch

Investment snapshot

- New and unproven business model.
- Risks come from government role and difficulty in obtaining financing.
- Companies with a unique skillset and relationships may figure out business model.
- It may be still possible to get first mover advantage although returns may be lower.
- Private Investment in State Undertakings Bill (PISU) may be key tool.

Background

- Thailand has twenty government ministries and seven kinds of cooperatives.
- Agricultural Cooperative Federation of Thailand
- Ministry and Bank of Agriculture and Cooperatives

	# of coops		# of members		Share capital	
	#	%	# Mn	Avg	Mn \$	Avg /\$
Agricultural	3,571	57%	5.9	1,668	848	142
Non-agricultural	2,642	43%	4	1,537	12,849	3,395
Total	6,213		9.9	1,612	13,697	3,538

Government and Cooperatives: Key points

Pipeline	800 MW
Project size	Under 5MW
Tariff	5.66THB/kWh
Debt	Uncertain
Status	Early stages, new program
Revaluation and Exit	Exit plans such as IPO or Yieldco structure could be complicated by government ownership Might be possible to create structure suitable for funds
Opportunity	Get in on ground floor and bundle projects for better returns Project of adequate scale may be done under PISU Act Projects would have to be done in partnership with government agency or cooperative
Comments	Projects may be easier to execute if bundled projects are under a single agency (Ministry, Province, etc.) Projects may require local content at least until <100MW capacity is exhausted.

Utility-scale program happening fast

▪ Solar PV pipeline is already advanced

- The next round of solar PPAs will come from projects that have made applications, invested in project development, and have been waiting to move for some time.
- Rumors about the new program have been around for several months.

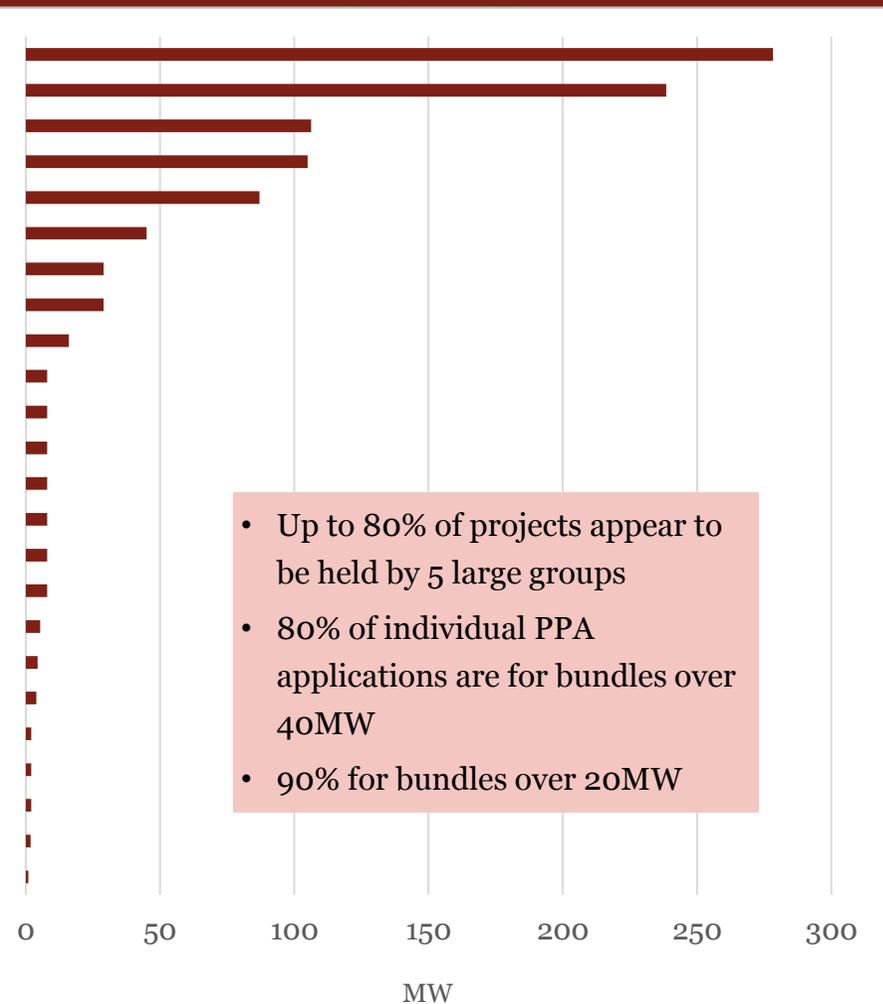
▪ Economics looks good

- 5.66 THB FIT gives EIRR of c. 14% and IRR of 10%.
- This could be improved with better debt packages or higher tariff level for Southern provinces.
- But this would assume that you obtain the PPA now at no cost without expenses.
- In reality all PPAs have owners and they require compensation for the investments and profits.

▪ And deals are being done right now

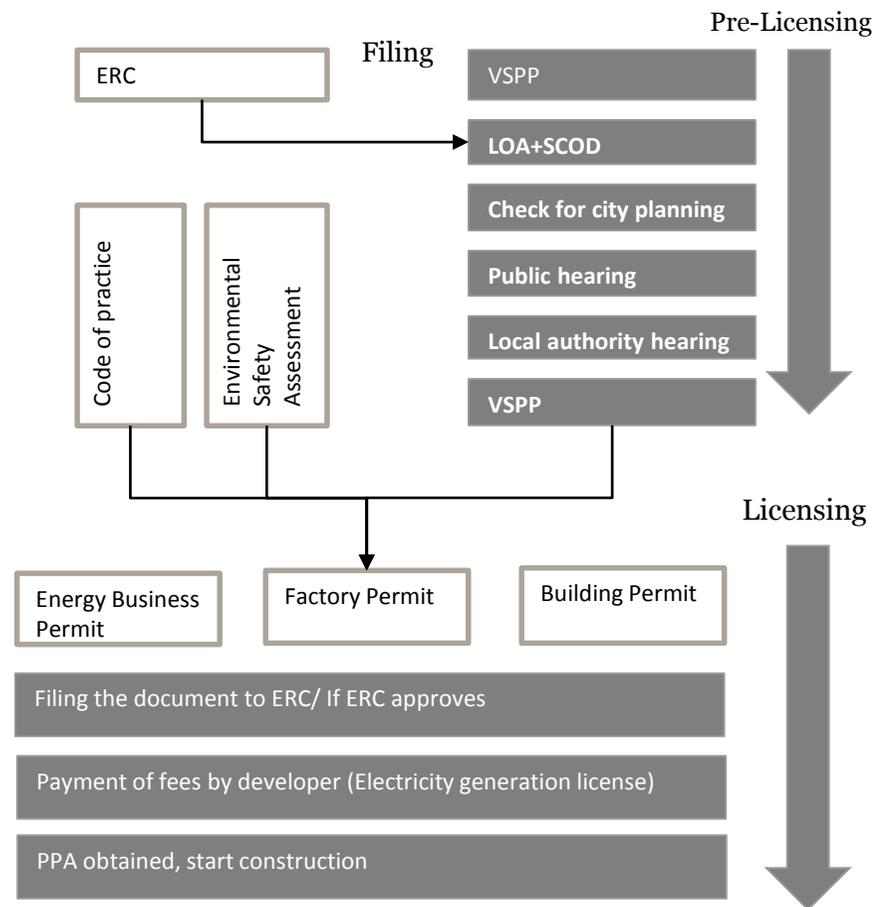
- Thai government fast tracking program and setting tough deadlines – forcing action.
- Developers and investors already talking.
- Opportunity could be completely closed within a few months for utility-scale projects.

Thai ERC has list of project applications



But there is a lot to do

Old process had stringent requirements



New process may see these relaxed

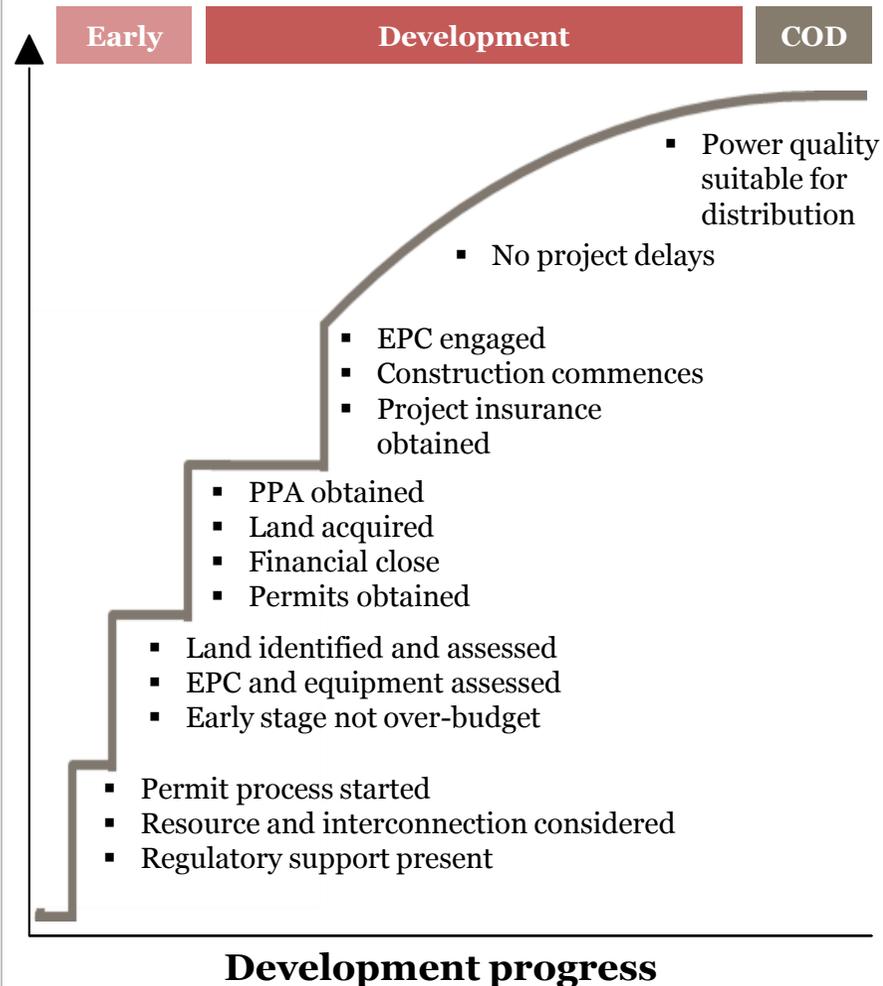
1. Government currently reviewing interconnection plans
 2. Some may be approved next week
 3. This would trigger approval of PPA LOAs
 4. PPAs could be as little as three weeks later
 5. Project CODs for first round of projects to be completed within 2015
- More exceptions may be given in order to meet this timeline
 - Question: How will GOT reconcile new urgency with complex requirements and reality of project development delays
 - Major steps to be done:
 - Land
 - Feeder
 - Investment and financial close
 - Factory Act

Large and capable Thai companies in renewable energy

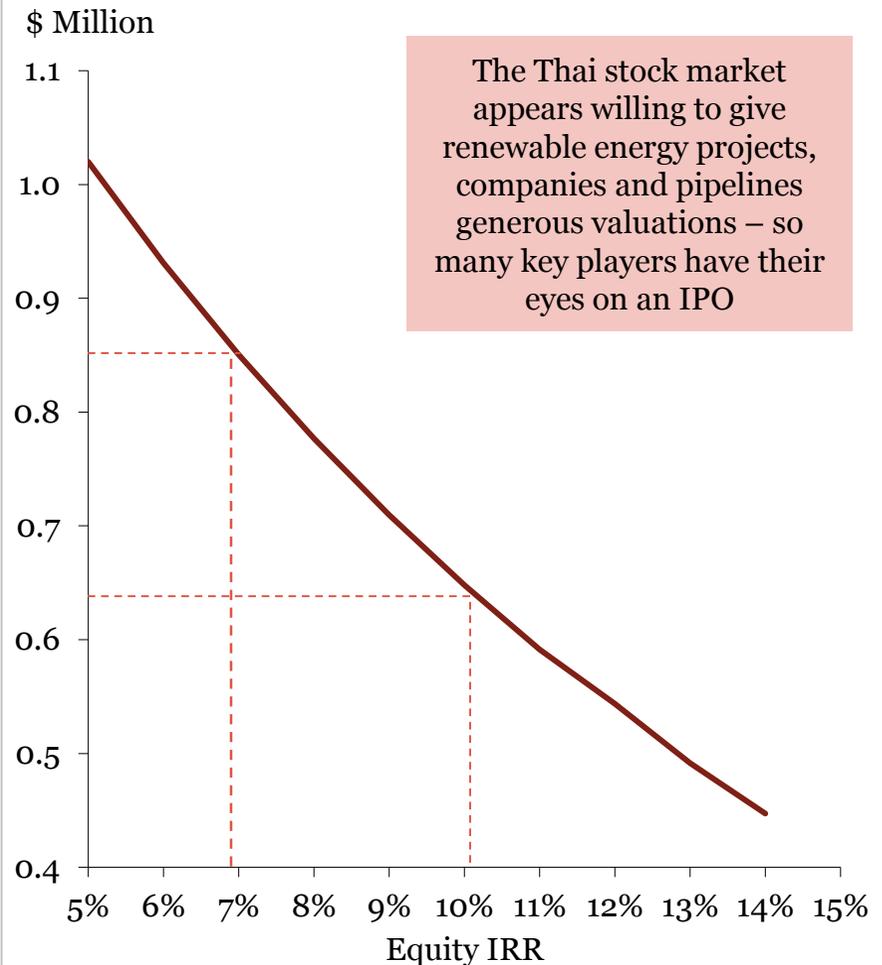
Listed companies	Company Type	Mkt. Cap. (USD M)	Solar (MW)		Wind (MW)	
			COD	Dev.	COD	Dev.
	Utility	4,262	2	-	-	-
	Developer	3,129	98	180	-	386
	Utility	2,746	63	-	90	203
	Utility	2,709	24	20	41	-
	Oil refinery	1,523	142	-	-	-
	Developer	860	260	-	-	-
	EPC	738	39	-	-	-
	Developer	520	85	-	-	-
	EPC	372	4	-	37	-
			716	200	168	589

Thai markets offer opportunities for revaluation

Project de-risk in predictable steps



Revaluation curve

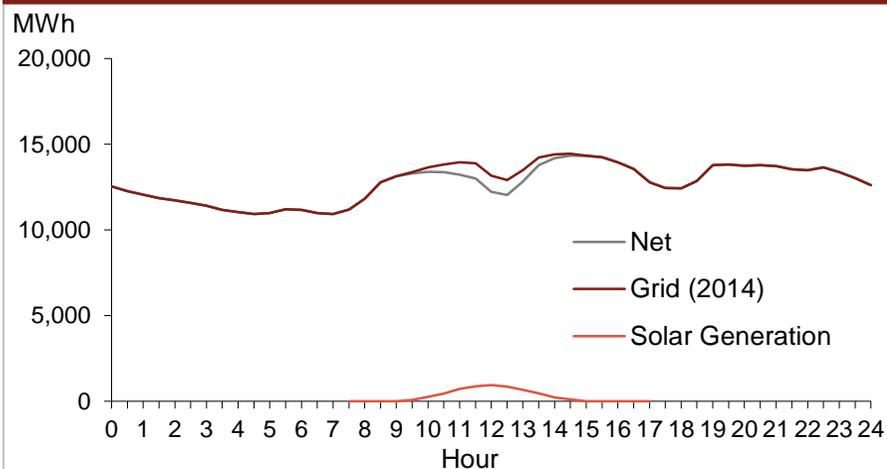


Constraints to growth appear before 2022

Argument for solar PV additions is strong now, but gets tougher with size

- Solar may be favorable to LNG at the level of one new marginal kWh.
- But the argument gets weaker as volumes grow.
- Marginal cost argument depends on reducing fuel costs and capital costs of new gas fired turbines.
- But when volumes are large fuel use is still offset, but gas-fired power plant capital investment would remain unchanged.
- This would not only weaken the argument for solar, but could make gas-fired plants less profitable.
- Sector will have size constraints until this is resolved.
- Batteries and more dispatchable renewable energy sources could provide a solution in the future.

Current Thai solar capacity makes a small impact



But that could change in Blue Sky Scenario

