

# Solar PV Generation Cost Trends and Variations across the ASEAN region, 2010-2020

*– Implications for Policy and Project Development –*



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# Session Topics

- **Cost trends and benchmark returns**
  - Solar irradiation resource, given regional climate & data
  - Capital and operational cost benchmarks
  - Current tariff rates
  - Current financial returns
- **Implications for Policy and Project development**
  - Further project cost reductions
  - Solar irradiation measurements

# Mott MacDonald Introduction

**16k**

*staff*



We work in

**150**

*countries*



**£1bn**

*turnover*



***Employee  
owned***

# Asian Renewable Experience: Solar

- A top global firm in power sector consultancy with pioneering role in the solar and wind sector for 15 years
- Strong global track record: > 8GW for Solar; > 60GW for Wind
- Strong presence from our network of 26 offices throughout Asia
- Supported **4.4 GW** of Solar projects in Asia Pacific
- Supported **2.7 GW** of Solar projects in SE Asia (Malaysia, Myanmar, Philippines and Thailand)
- Supported the majority of the operational solar plant capacity in SE Asia
- Compiled **Regional Technical Guidelines for PV plant financing** in SE Asia – disseminating to investors with GIZ in Philippines, Malaysia and Indonesia



WINNER  
Asia Pacific Technical  
Adviser of the Year  
Mott MacDonald



# ***Regional Project Financial Benchmarks***

# Benchmarking Study Approach

- Employs database of 200 operating regional PV plants
- Key study inputs
  - Solar resource data; considering mid-range national resource
  - Past engineering, procurement & construction (EPC) costs
  - Past operation and maintenance costs
  - Other capital and operating costs (typical)
  - Feed-in tariff rates by country, where defined
- Full details available in White Paper published in April 2016, for the Solarplaza PV trade mission to SE Asia

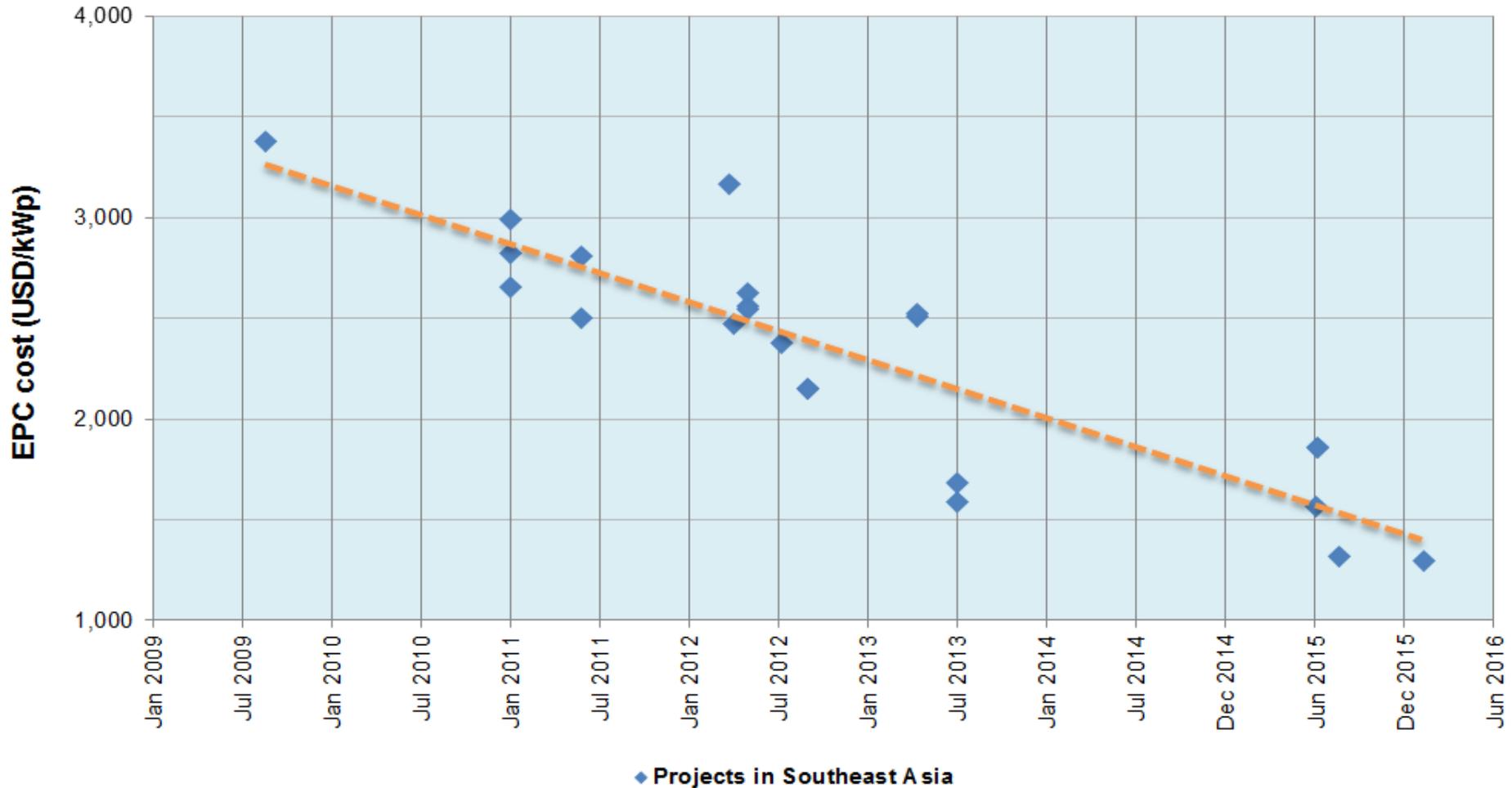
*Ref. "Benchmark PV plant generation costs in Southeast Asia", 8 April 2016 ([www.pvtrademissionvietnam.com/news-1/white-paper](http://www.pvtrademissionvietnam.com/news-1/white-paper))*



# Regional Solar Irradiance Profile

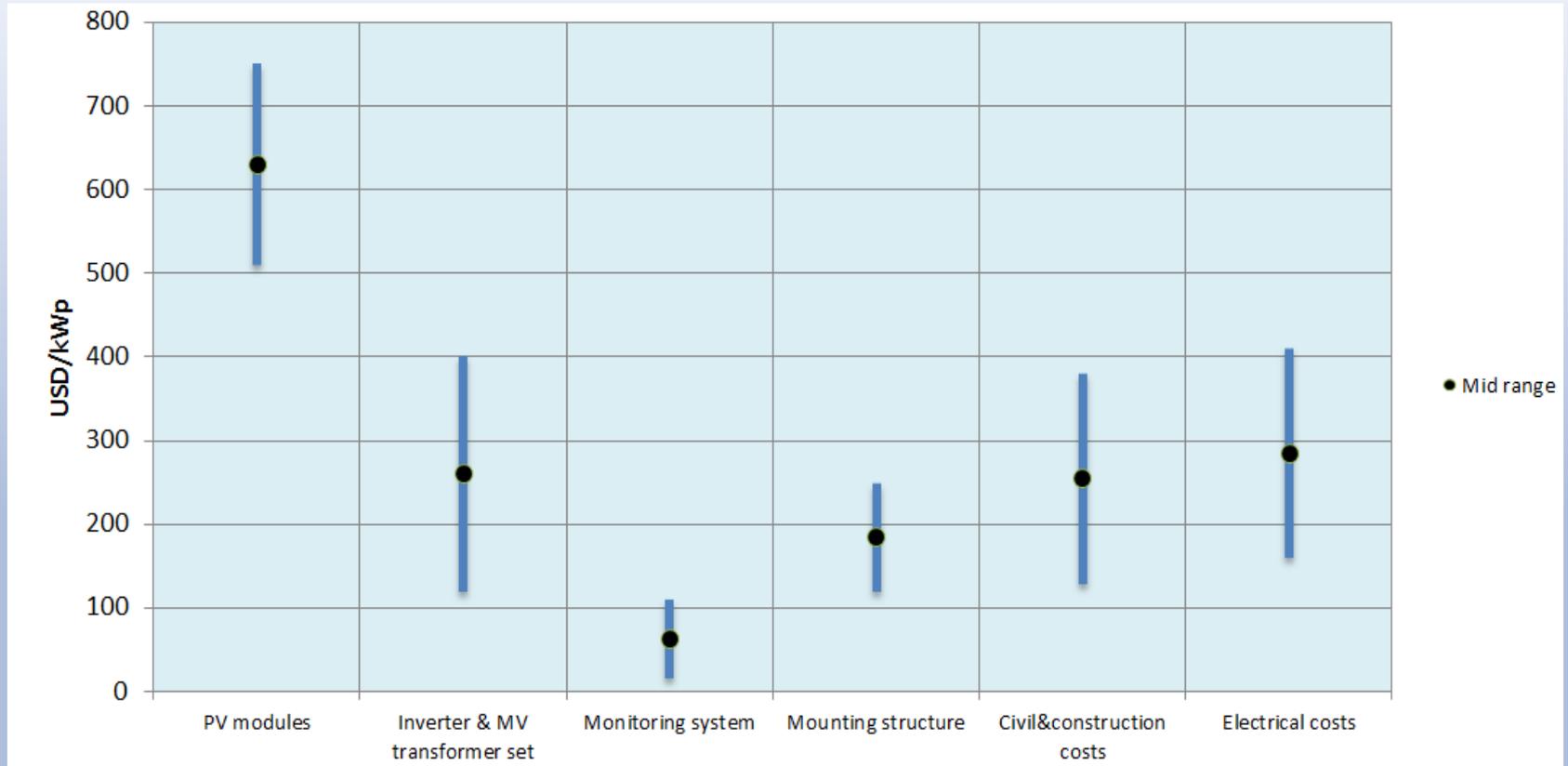


# Historical EPC Cost Trend



*N.B. Representative plants, 2009 – 2015, excluding interconnection works*

# Wide Range in EPC Component Costs



*N.B. Typical range of key EPC cost components for SE Asia PV plants over 2013 – 2015, excluding interconnection works*

# SEA Solar Project Tariffs – Public Information

<b>Country</b>	<b>Tariff Basis</b>	<b>Indicative Rate (USD/kWh)</b>
Malaysia	Competitive bidding	-
Myanmar	Bilaterally negotiated	-
Philippines	Fixed	0.19
Thailand	Fixed	0.16
Vietnam	Fixed	≈ 0.10 – 0.13

# Indicative benchmark generation costs

Country	Indicative Rate (USD/kWh)	LCOE (USD/kWh)		
		$\delta = 10\%$	$\delta = 8\%$	$\delta = 5\%$
Malaysia	-	0.17	0.15	0.13
Myanmar	-	0.14	0.12	0.10
Philippines	<b>0.19</b>	0.17	0.15	0.12
Thailand	<b>0.16</b>	0.17	0.15	0.13
Vietnam	<b>0.12</b>	0.16	0.14	0.12

# *Implications for regional policy and PV project developments*

# Implications: Project Cost Expectations

- Regional project costs not so far low enough to support a thriving PV market at the lowest proposed national tariff levels
  - Significant scope for cost reduction, as already shown by other regions
  - Region specific factors can also be a genuine cost driver, however, e.g. natural hazards, infrastructure
- Typical diagnosis for low costs: regulations to support a predictable, large project market in which firms can invest in their supply chain

# Implications: Project Revenue Expectations

- Most of Southeast Asia has exceptionally limited ground-measured solar resource data
  - Ground-measured data is essential to validate satellite data
    - More complex microclimates require more validations
    - Private irradiation measurements now often being used
    - Mistakes in solar resource estimation also currently common
- Need for validation of satellite-derived estimates to increase certainty and reduce feasibility study costs
  - Public bodies should measure irradiation at weather stations
  - Private developers and industry associations can pool data



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**Thank you for your attention**



# Related Mott MacDonald Publications

- **“Improving solar resource assessment through in-field data analysis for Solar PV projects in Thailand”**, Renewable Energy World Asia 2015, Bangkok, 2 September 2015. Ubol, K.; Cherdsanguan, N.; Prakorbjanya, M.
- **“Independent Solar Energy Yield Assessment, select Philippine PV plant sites”**, ERC Public Hearing , Key note presenter, Manila, 28 January 2015. Phil Napier Moore.
- **“Solar PV Technical Guidelines for Financiers: Techno-Commercial Risk Mitigation for grid connected PV systems in Southeast Asia”**, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH & Renewable Energy Support Programme for ASEAN (ASEAN-RESP), 1 October 2014. Vendrell, I.; Korsakul, R.; Verojporn, S.; Smithtinand, P.; Indradesa, P.
- **“In-field performance of a polycrystalline versus a thin-film solar PV plant in Southeast Asia”**, Photovoltaics International - 22nd Edition, 18 December 2013. Verojporn, S.; Napier-Moore, PA.
- **“Gaining confidence in PV module performance through laboratory testing, factory audit and analysis of in-field data”**, POWER-GEN Asia, Bangkok, October 2012. Napier-Moore, PA; Verojporn, S.