

# Major innovative clean energy projects: lessons for the growing regional industry



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Phil Napier-Moore, Lead Energy Advisor



# Presentation Summary

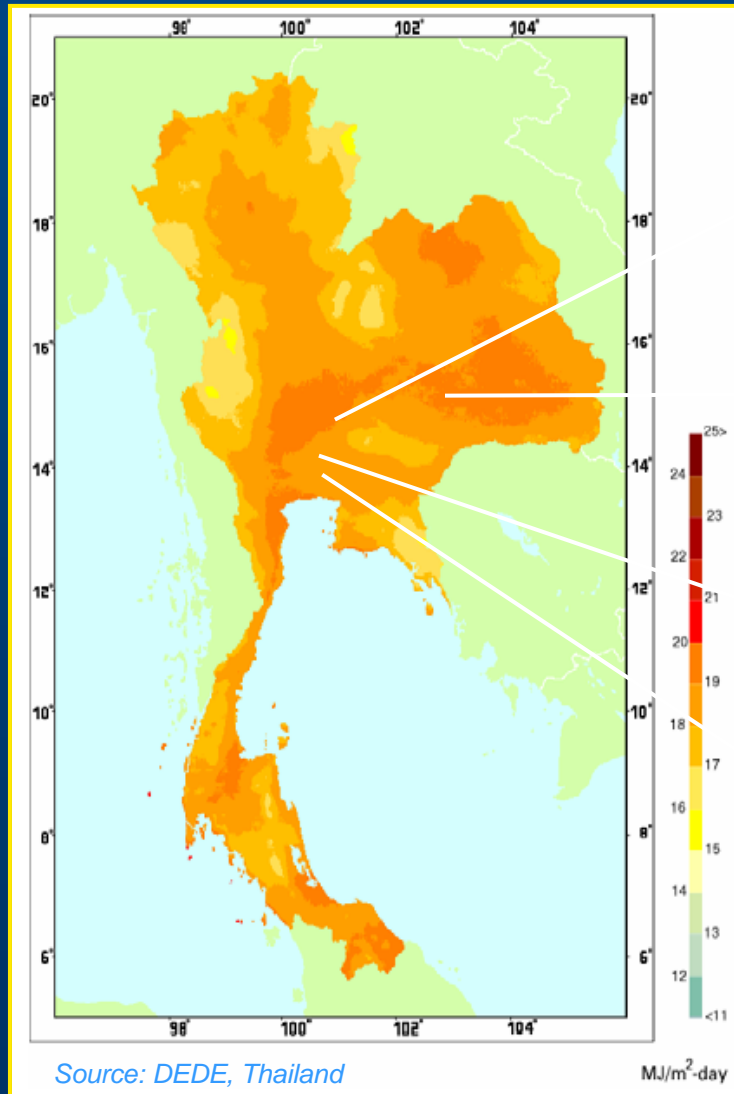
- Solar & wind industry growth in Thailand
- Available resource and current projects
- Technical challenges
- Commercial challenges
- Looking ahead

# Solar and Wind: developments since 2009

<u>Installed Capacity Expectations (MW)</u>	<u>Solar PV</u>	<u>CST</u>	<u>Wind</u>
<i>Previously installed, as of 2009</i>	7.3	-	4.5
<i>Thailand National Target (2012-2016)</i>	95		375
<i>MM expectations by end 2011</i>	> 200	~ 10	~ 360
<i>New project pipeline</i>	~ 1100	~ 1900	~ 1600

- Innovative project technology
  - Demonstration of new parabolic trough technology developments
  - High efficiency tandem junction thin-film PV at NED project
- Innovative commercial structures – warranties can be more sophisticated than European practice

# Solar PV – Resource & New Projects



NED 73 MW, Lopburi

SPC 6 MW, Korat

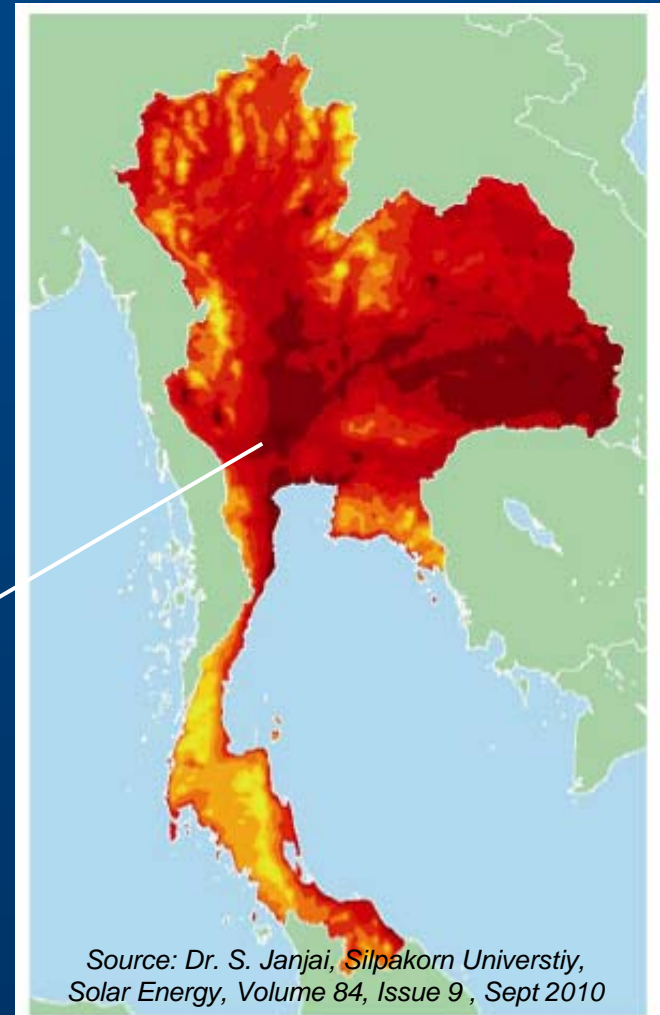
Bangchak 34.5 MW, Ayudthaya

Yanhee 3 MW, Ayudthaya

# CST – Resource & New Projects

- Earlier stage than PV – limited direct solar resource requires reductions in technology costs for local application
- Significant interest and several pilot demonstrations

5MW Parabolic trough, Kanchanaburi



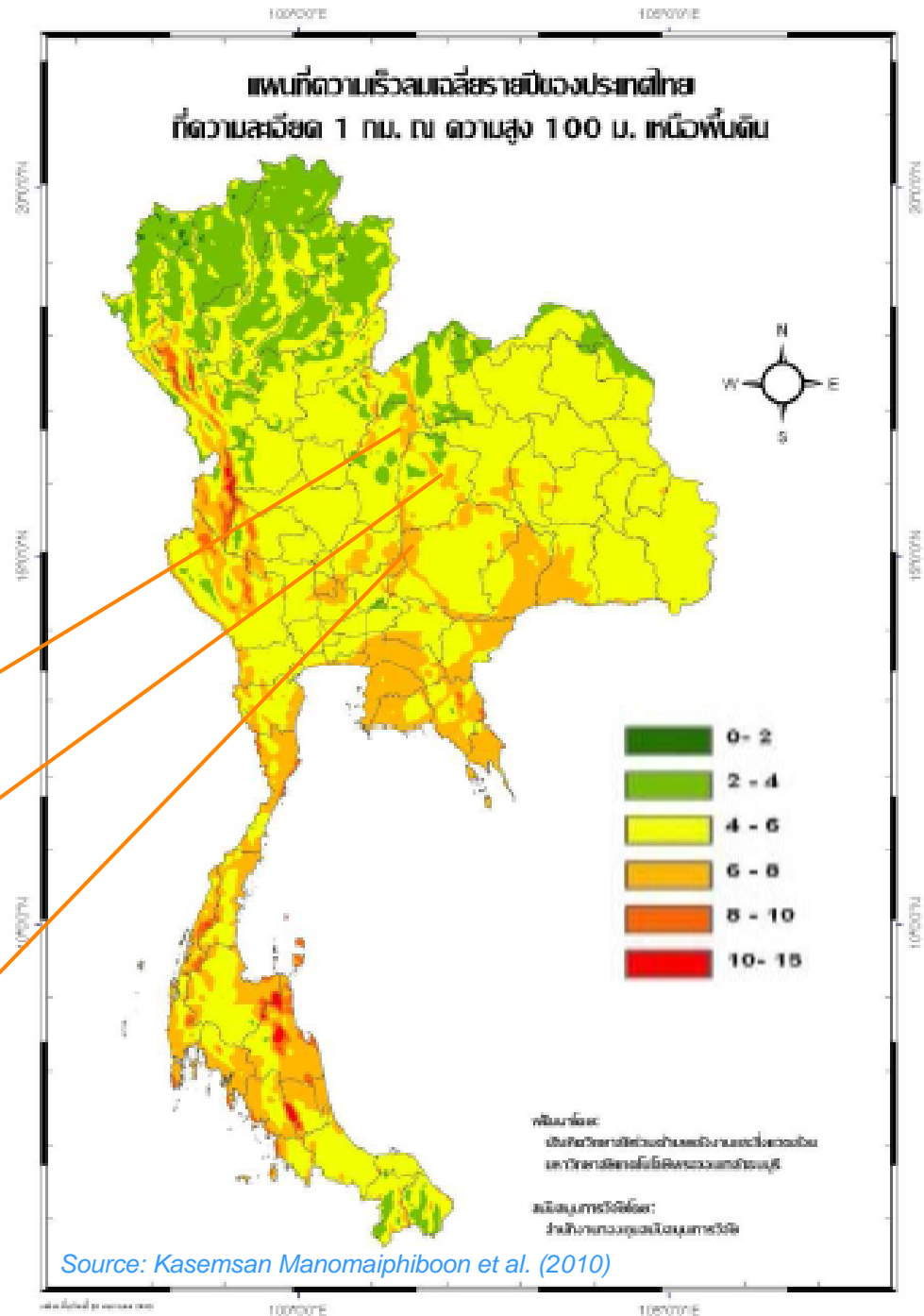
# Onshore Wind – Resource & New Projects

Annual Mean Wind Speed  
(m/s)  
(1 km resolution, 100 m AGL)

Khaokor 60 MW, Petchaboon

Thepsathit 90 MW, Chaiyaphoom

Huay Bong 207 MW, Korat



# Technical Challenges

- Lack of technology-specific design experience
- Equipment rating methods appropriate for local conditions?
- Uncertainty of grid requirements – inverter and wind turbine approval process loosely defined
- Grid reliability going forward, with increasing intermittent renewable penetration, an unknown
- Availability of supplier O&M teams – complexity, in-house O&M staff training and base skill levels

# Commercial Challenges

- EPC contractors with both skills and local experience?
  - Lender requirement for EPC wrap?
  - Financial strength/diversification of supplier backing warranties
- Performance guarantees – wide variation for solar PV
- Delay damages – often weak vs international practice
- Accurate monitoring of plant performance not yet standard practice
- Limited resource data to inform guarantees offered
- Regulatory certainty...

# Looking ahead

- Thailand is achieving significant industry growth with an average regional solar resource and relatively low wind resource
- Lessons for the region
  - Regulatory frameworks to provide incentives
  - Localisation of manufacturing, EPC and O&M capability
  - Training – from technicians to financiers
  - Standards and certification procedures
  - Resource data collection

# Thank you !



[philip.napier-moore@mottmac.com](mailto:philip.napier-moore@mottmac.com)

[www.power.mottmac.com](http://www.power.mottmac.com)