Country Case Studies: Thailand & Tanzania Feed-in Tariffs and Small Power Producer Regulations

Workshop on grid-integration of small scale decentralized renewable energy (DRE) systems Victor Menezes Convention Centre (VMCC), IIT Bombay (Mumbai)

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ระเบียบการรับซื้อไฟฟ้าจากผู้ผลิตไฟฟ้า พลังงานหมุนเวียนขนาดเล็กมาก IN IN IN IN

การไฟฟ้านครหลวง : การไฟฟ้าส่วนภูมิภาค

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Technical regulations:

- Allowable voltage, frequency, THD variations
- Protective relays
 - 1-line diagrams for all cases:
 - Induction
 - Synchronous
 - Inverters
 - Single/multiple
 - Connecting at different voltage levels (LV or MV)
- Communication channels



Commercial regulations:

- Definitions of renewable energy, and efficient cogeneration
- Cost allocation
- Principle of standardized tariff determination
- Invoicing and payment arrangements
- Arbitration

+ Standardized Power Purchase Agreement (PPA)

Evolution of Thai VSPP regulations

- 2002
 - VSPP regulations drafted, approved by Cabinet
 - Up to 1 MW export, renewables only
 - Tariffs set at utility's avoided cost

Biogas from Pig Farms

Reduces air and water pollution Produces fertilizer Produces electricity 8 x 70 kW generator Ratchaburi

Biogas from Pig Farms





Korat Waste to Energy – biogas ... an early Thai VSPP project

 Uses waste water from cassava to make methane

Produces gas for all factory heat (30 MW thermal) + 3 MW of electricity

3 x 1 MW gas generators



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 - Up to 1 MW export, renewables only
 - Tariffs set at avoided cost (bulk supply tariff + FT)
- 2006
 - Up to 10 MW export, renewables + cogeneration
 - Feed-in tariff "adder" (premium payment)
 - Paid by ratepayers
 - If > 1 MW then utility only pays for 98% of energy (utility incentive to facilitate VSPPs)

Rice husk-fired power plant

- 9.8 MW
- Roi Et, Thailand



Bangkok Solar 1 MW PV

• Signed PPAs for 767 MW of PV (SPP + VSPP)





Lopburi 73 MW PV (over 1,000 rai = 160 hectares)



Solar thermal electricity

- 5 MW, 135 MW planned
- 900 Million baht (180 baht/watt = US\$6/watt) but costs expected to decrease 20 to 30% to 135 baht/watt
- Commissioned in Kanchanburi on Nov 2011
- Signed PPAs for 1343 MW of solar thermal

VSPP project pipeline as recorded in EPPO data













PPAs signed for additional 4318 MW

Solar trends in Thailand

MW Solar installed in Thailand Feb 2007 – Dec 2011



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- 2009
 - Tariff adder increase, more for projects that offset diesel

Thai VSPP feed-in tariff adders

Fuel	Adder	Additional for	Additional for	Years effective	
		diesel offsetting	g3 southern		
		areas	provinces		
Biomass					
Capacity <= 1 MW	\$ 0.015	\$ 0.030	\$ 0.030	7	
Capacity > 1 MW	\$ 0.009	\$ 0.030	\$ 0.030	7	
Biogas					
<= 1 MW	\$ 0.015	\$ 0.030	\$ 0.030	7	
> 1 MW	\$ 0.009	\$ 0.030	\$ 0.030	7	
Waste (community waste, non-hazardous industrial and not organic matter)					
Fermentation	\$ 0.074	\$ 0.030	\$ 0.030	7	
Thermal process	\$ 0.104	\$ 0.030	\$ 0.030	7	
Wind					
<= 50 kW	\$ 0.134	\$ 0.045	\$ 0.045	10	
> 50 kW	\$ 0.104	\$ 0.045	\$ 0.045	10	
Micro-hydro			-		
50 kW - <200 kW	\$ 0.024	\$ 0.030	\$ 0.030	7	
<50 kW	\$ 0.045	\$ 0.030	\$ 0.030	7	
Solar	\$ 0.238	\$ 0.045	\$ 0.045	10	

Assumes exchange rate 1 Thai baht = 0.029762 U.S. dollars

Tariff = adder(s) + bulk supply tariff + FT chargeBiomass tariff = \$0.009 + \$0.049 + \$0.027

= \$0.085/kWh

Current VSPP challenges & responses

Challenge	Response
1. PPA speculators	Bid bond (200 baht/kWh) (\$6/kW). No adder if >1 yr past Scheduled Commercial Operations Date.
 2. Little diversity (generators online mostly >1 MW biomass owned by sugar, rice mills) 	4% interest loans up to 50 million baht (\$1.6 million) per project. Government loaned 4 billion baht (\$133 million) to 13 banks at 0.5% interest.

Challenge	Response
3. VSPP not well integrated into Power Development Planning	Not much yet, but Thai NGOs have developed/advocate
(PDP) process	"alternative PDP"



Reflections -- Thai VSPP

- Low-key, local approach kept utilities from being threatened
- Thailand's path to full generation-cost FIT started successfully with tariffs based on avoided cost
 - Initial trickle of applications gave utility time to build capacity to implement program
- Feed-in adder **very** successful in attracting projects
- Incentivize utility (utility pays for only 98% of energy from projects >1 MW)
- Challenges arising as program grows, largely being addressed



Evolution of Tanzania SPP regulations

- Approved by regulator August 2009
- Up to 10 MW export, renewables & cogeneration
- SPP Tariffs at average of long run marginal costs (LRMC) and short run (SRMC)
 - Grid-connected SPP tariff (2010): 110.3 TZS (\$0.074)/kWh
 - 132.36 TZS (\$0.088)/kWh dry-season Aug-Nov
 - 99.27 TZS (\$0.0663)/kWh wet-season Jan-Jul, December
 - In rural mini-grid areas offsetting diesel (2010): 368.87 TZS (\$0.24.6)/kWh
- 4 PPAs signed by November 2010



Lumama 150 kW Grid Soon to expand to 300 kW



FPC Sugar Factory Cogen bagasse



SPPs In Operation

Project	MW	Type of Resource	Status
ACRA Tanzania	0.3	Hydro	In Operation / Community based
TANWAT	2.34	Biomass -wood	Selling 1 MW (2010)
TPC Co-Generation	15	Bagasse	Selling 10 MWe to TANESCO (2010)
Katani Power Plant	0.3	Biomass - Waste	Operation - Pilot

SPPs in Preparation

Project	MW	Type of Resource	Status
Sao Hill Energy	15	Biomass -wood	Applied Licence
Chipole – Own use & sell to the grid	0.4	Hydro	In operation – additional 3MW planned
Mwenga	3.36	Hydro	PPA Signed with TANESCO
Ngombeni Mafia	1.4	Biomass	PPA Signed with TANESCO. Under construction
Kilombero Sugar Co.	10.6	Bagasse	Applied Licence
Tanzania Sisal Board	0.5	Biogas	Applied License
Kitonga Mini Hydro	10	Hydro	Applied License
Andoya Hydro Electric Co.	0.5	Hydro	Business plan
Kilocha Hydro	12	Hydro	In discussion with REA
Kilombero Mngeta	3	Hydro	In discussion with REA

Where we are now...

- Completed
 - All documents passed public review and are approved for use.
 - Several PPAs signed with TANESCO and licenses applied
- Ongoing
 - TANESCO in process of establishing SPP cell



Where we are now...

- Completed
 - All documents passed public review and most are approved for use.
 - Several PPAs signed with TANESCO and licenses applied
- Ongoing
 - TANESCO in process of establishing SPP cell
 - SPP Working Group composition and function
 - Discussions between EWURA and REA on how to coordinate better, done, but may be refined further.
 - Determine tariff review methodology for projects selling electricity at retail

Challenges

Challenge

- Inadequate financial resources to support the initiative
- Inadequate private sector participation in investment
- High interest rates loans from commercial banks
- Land ownership and water rights for SPPs projects especially wind farms & mini-hydro plants
- Low Tariff and non-cost reflective

Response

- WB has established a facility, engage interest of other financial institutions
- Conducive Environment, rules and publicize
- Promote other sources mix grant and loans
- Include land ownership & water rights in RE Policy

□ Adapt policy in future?

Challenges 2

Challenge

- Lack of experience of key project promoters with skills in project management
- Lack of Renewable Energy Policy
- Lack of interest on the part of potential Off-takers (TANESCO)

Response

Capacity building (REA)

- Government needs to set policy targets, etc.
- Improving through regular discussions with utility

Thank you

For more information, please contact <u>mbawala@ewura.go.tz</u> <u>chrisgreacen@gmail.com</u>

Thai VSPP regulations available at: <u>http://www.eppo.go.th/power/vspp-eng/</u> Tanzania SPP regulations available at: <u>www.ewura.go.tz/sppselectricity.html</u>

