

***Selling renewable energy profitably to the grid:
The evolution and results of
Very Small Power Producer (VSPP) Regulations in
Thailand and Tanzania***

Regional Energy Conference

Phnom Penh

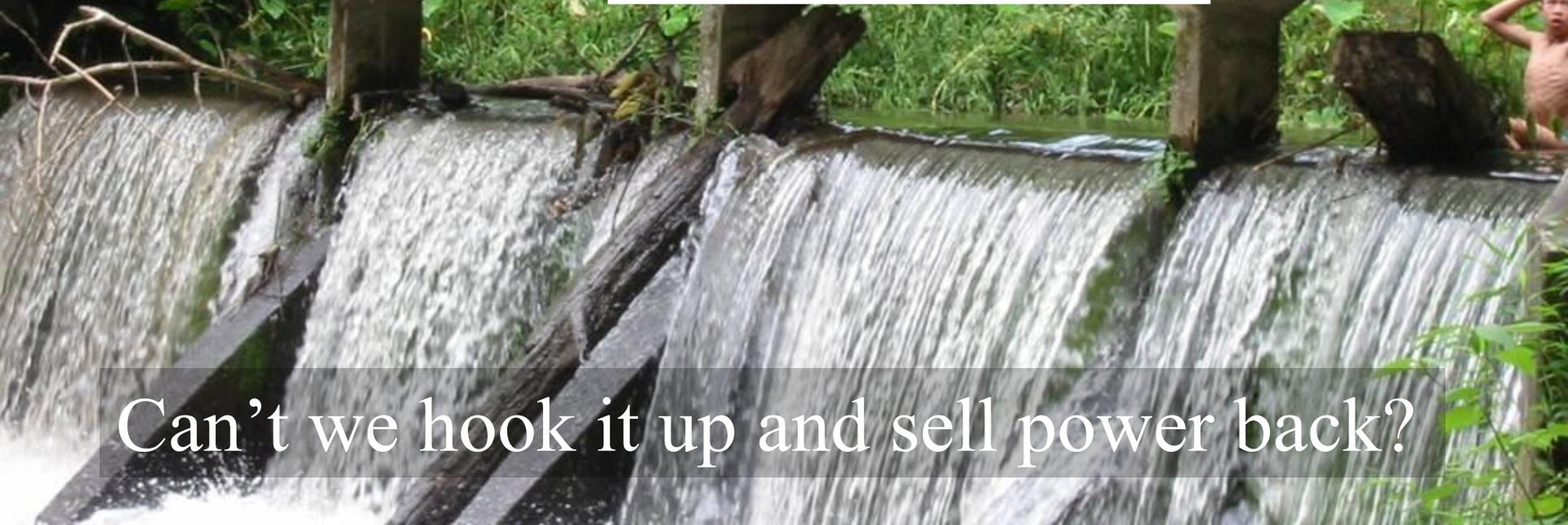
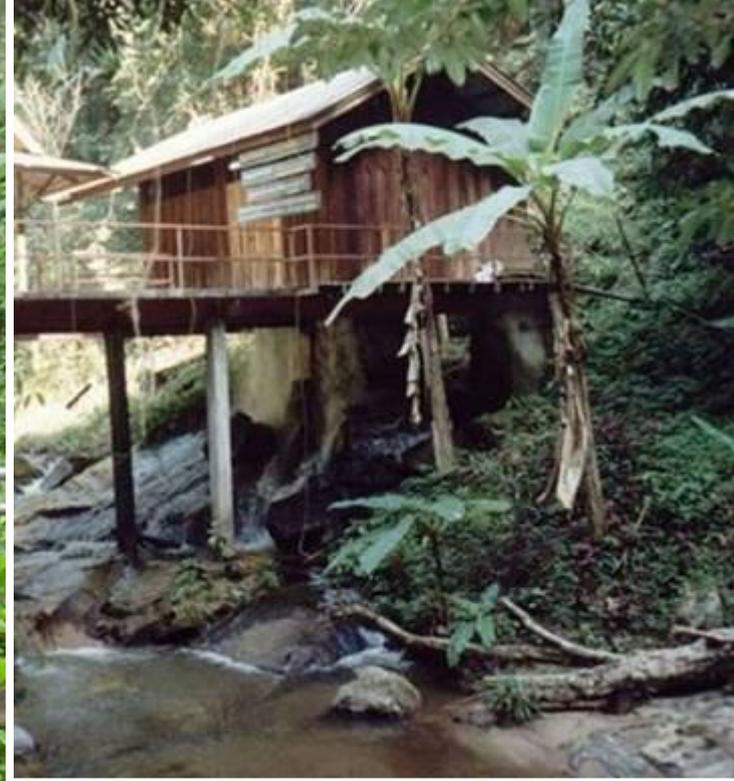
Cambodia

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Can't we hook it up and sell power back?

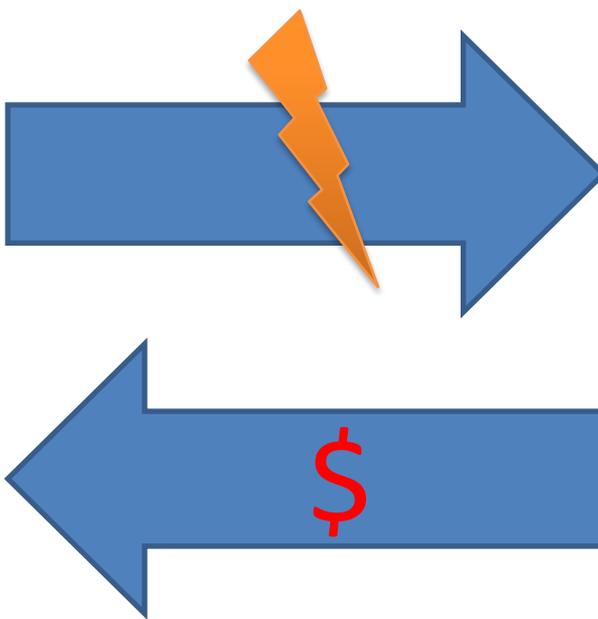


ระเบียบการรับซื้อไฟฟ้าจากผู้ผลิตไฟฟ้า
พลังงานหมุนเวียนขนาดเล็กมาก

การไฟฟ้านครหลวง : การไฟฟ้าส่วนภูมิภาค

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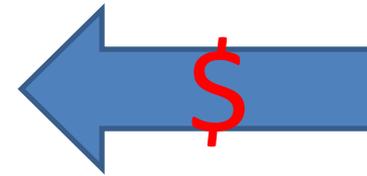






Technical regulations:

- 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 avoided cost (bulk supply tariff + FT)
- 2006
 - Up to 10 MW export, renewables + cogeneration
 - Feed-in tariff “adder”
 - If > 1 MW then utility only pays for 98% of energy
- 2009
 - Tariff adder increase, more for projects that offset diesel

Thai VSPP feed-in tariffs

Fuel	Adder	Additional for diesel offsetting areas	Additional for 3 southern provinces	Years effective
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 charge

Biomass tariff = \$0.009 + \$0.049 + \$0.027 = \$0.085/kWh

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



Biogas from Pig Farms

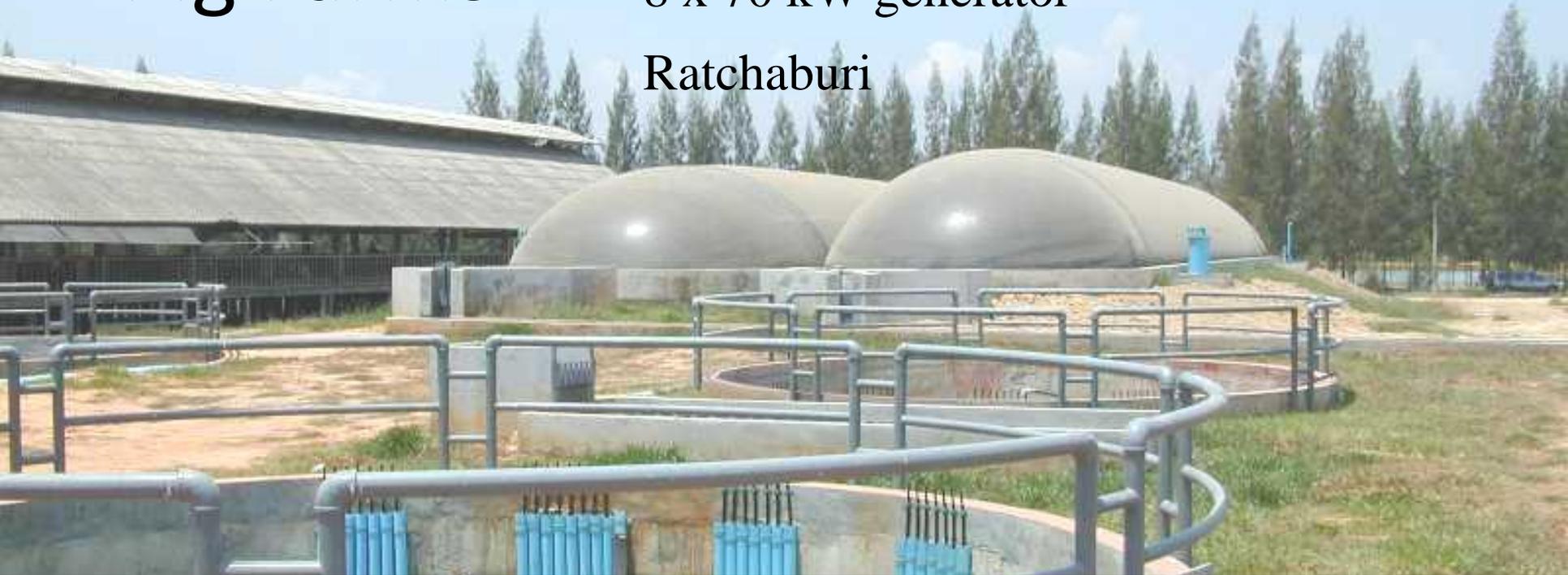
Reduces air and water pollution

Produces fertilizer

Produces electricity

8 x 70 kW generator

Ratchaburi



Biogas from Pig Farms



Micro hydropower



- 40 kW
- Mae Kam Pong, Chiang Mai, Thailand

Rice husk-fired power plant

- 9.8 MW
- Roi Et, Thailand



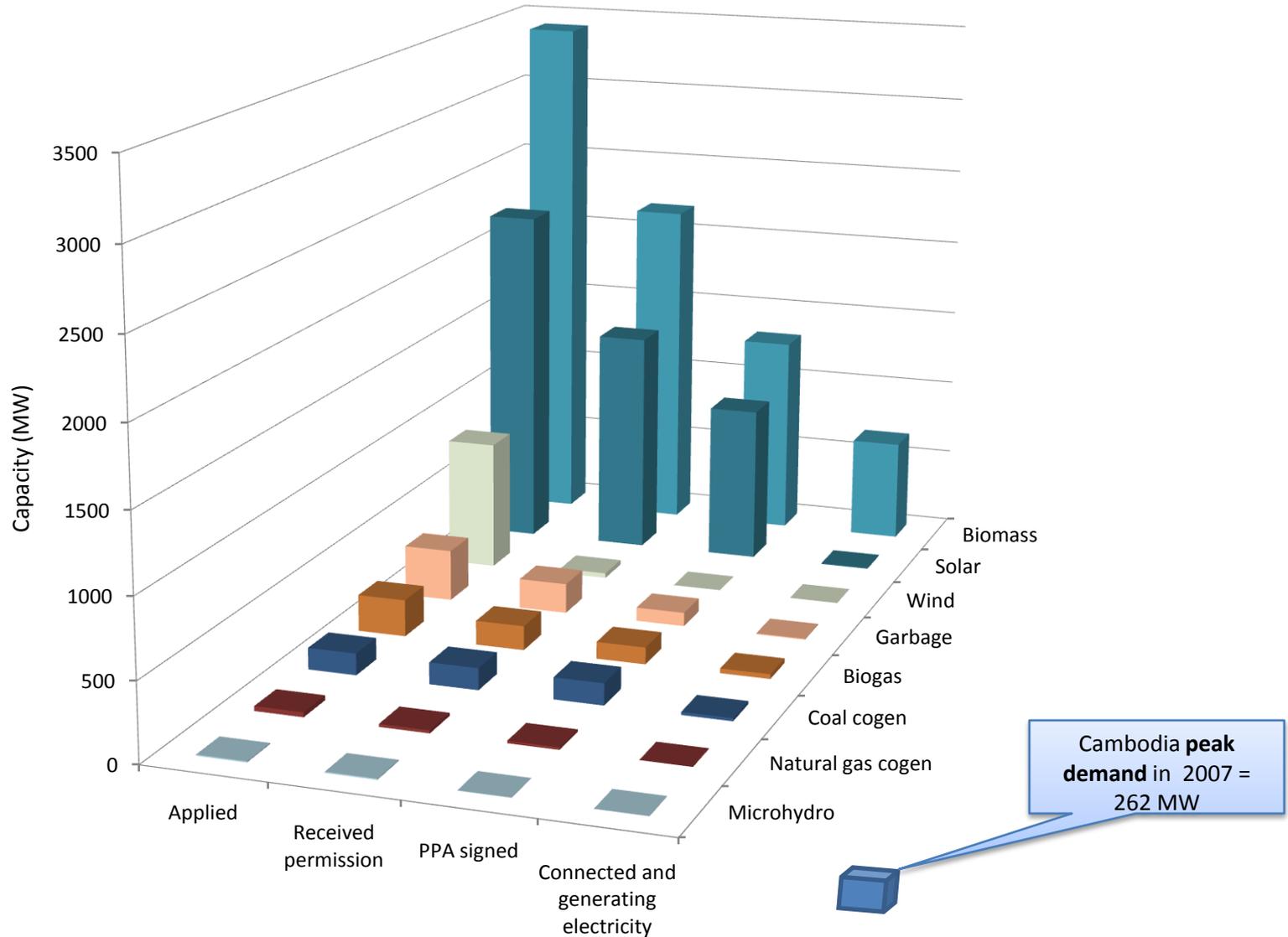


Bangkok Solar 1 MW PV

- Project size: 1 MW
- Uses self-manufactured a-Si



Thai VSPP MW applied, received permission, PPA signed, and selling – as of September 2009



Evolution of Tanzania SPP regulations

- 2009
 - Approved by regulator August
 - Up to 10 MW export, renewables & cogeneration
 - SPP Tariffs at average of LRMC and SRMC
 - Grid-connected SPP tariff (2009): \$0.066/kWh
 - In rural mini-grid areas offsetting diesel (2009): \$0.26/kWh
 - First 2 PPAs signed September

More than 60 countries have similar regulations in place...

Table R10. Cumulative Number of Countries/States/Provinces Enacting Feed-in Policies

Year	Cumulative Number	Countries/States/Provinces Added That Year
1978	1	United States
1990	2	Germany
1991	3	Switzerland
1992	4	Italy
1993	6	Denmark, India
1994	8	Spain, Greece
1997	9	Sri Lanka
1998	10	Sweden
1999	13	Portugal, Norway, Slovenia
2000	13	—
2001	15	France, Latvia
2002	21	Algeria, Austria, Brazil, Czech Republic, Indonesia, Lithuania
2003	28	Cyprus, Estonia, Hungary, South Korea, Slovak Republic, Maharashtra (India)
2004	33	Israel, Nicaragua, Prince Edward Island (Canada), Andhra Pradesh and Madhya Pradesh (India)
2005	40	Karnataka, Uttaranchal, and Uttar Pradesh (India); China, Turkey, Ecuador, Ireland
2006	43	Ontario (Canada), Argentina, Thailand
2007	49	South Australia (Australia), Albania, Bulgaria, Croatia, Macedonia, Uganda
2008	61	Queensland (Australia); California (USA); Gujarat, Haryana, Punjab, Rajasthan, Tamil Nadu, and West Bengal (India); Kenya, the Philippines, Poland, Ukraine
2009 (early)	63	Australian Capital Territory (Australia); South Africa

Note: Cumulative number refers to number of jurisdictions that had enacted feed-in policies as of the given year. A few feed-in policies shown have been discontinued. Many policies have been revised or reformulated in years subsequent to the initial year shown. India's national feed-in tariff from 1993 was substantially discontinued but new national feed-in tariffs were enacted in 2008. Three countries with feed-in tariffs are not shown because year of enactment is unknown: Costa Rica, Mauritius, and Pakistan. Source: All available policy references, including the IEA online Global Renewable Energy Policies and Measures database and submissions from report contributors. See also Endnote 35.

Source: REN21, *Renewables Global Status Report: 2009 Update*



Does VSPP make sense for Cambodia?

- 90% of electricity from diesel.
- \$0.18/kWh (urban)
- \$0.30 to \$0.90/kWh (rural)
- 400 Rural Energy Enterprises (REE)s providing to 67,000 households
 - Reluctant to upgrade equipment from inefficient old diesels to gassifiers, micro-hydropower, etc. because of uncertain EdC expansion.
- VSPP regulations provide guarantee of a market for power in areas where EdC expands grid.



A 200 kW Combo Gasifier in an REE



Concluding thoughts

- VSPP regulations enable small generators together to profitably make substantial contributions to electricity generation.
- Zero / small carbon footprint
- Useful for decreasing diesel expenditures for rural electrification
- VSPP projects help develop local engineering / project development capacity.
- English versions of regulations available online
 - Read, adapt for your own country

Thank you

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This presentation available at:

www.palangthai.org/docs

VSPP regulations available at:

<http://www.eppo.go.th/power/vspp-eng/>

And

www.ewura.go.tz/sppselectricity.html