

17th INTERNATIONAL CONFERENCE & EXHIBITION ON LIQUEFIED NATURAL GAS (LNG 17)



LNG for Power in Small Emerging Markets

David Haug
Arctas Capital Group

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International Organizers



Host Association



Who is Missing from the LNG Club?



- Oil and LNG price divergence has exploded LNG importers
- Huge synergies in replacing oil with LNG for power plants
- Small emerging markets (SEMs) most impacted by high oil prices
- But, SEMs have been left out of the LNG Club
- This paper predicts that will change

The SEM LNG Market Potential

- Over 40 SEM countries with no or little gas
- Of these, over 25 have >500MW of installed power
- If only 25% of this capacity ran on gas, it would require over 400MM mmbtus/yr
 - 120 x 170,000 cm cargoes
- Savings from LNG could finance lots of new FSRUs/terminals/power plants

Replacing \$100 Oil with \$12 LNG



- \$5 Henry Hub + \$3.00 liquefaction+ 1.00 transport = \$9/mmbtu, + \$1 regas = \$10/mmbtu
- Over \$30 mm/yr savings with \$12 LNG vs \$100 oil (100MW) – finances new power plant in 3 years

Oil (WTI per barrel)	#6 Oil per mmbtu /per mwh	#2 Oil per mmbtu /per mwh	LNG per mmbtu /per mwh	LNG Annual Savings per 100MW baseload	
				#6	#2
\$80	\$14.33/\$114	\$18.29/\$137	\$12/\$90	\$17M	\$33M
\$100	\$17.30/\$141	\$22.63/\$168	\$12/\$90	\$34M	\$55M
\$120	\$21.04/\$168	\$26.98/\$202	\$12/\$90	\$55M	\$78M

Are Power Prices High Enough to Justify LNG?

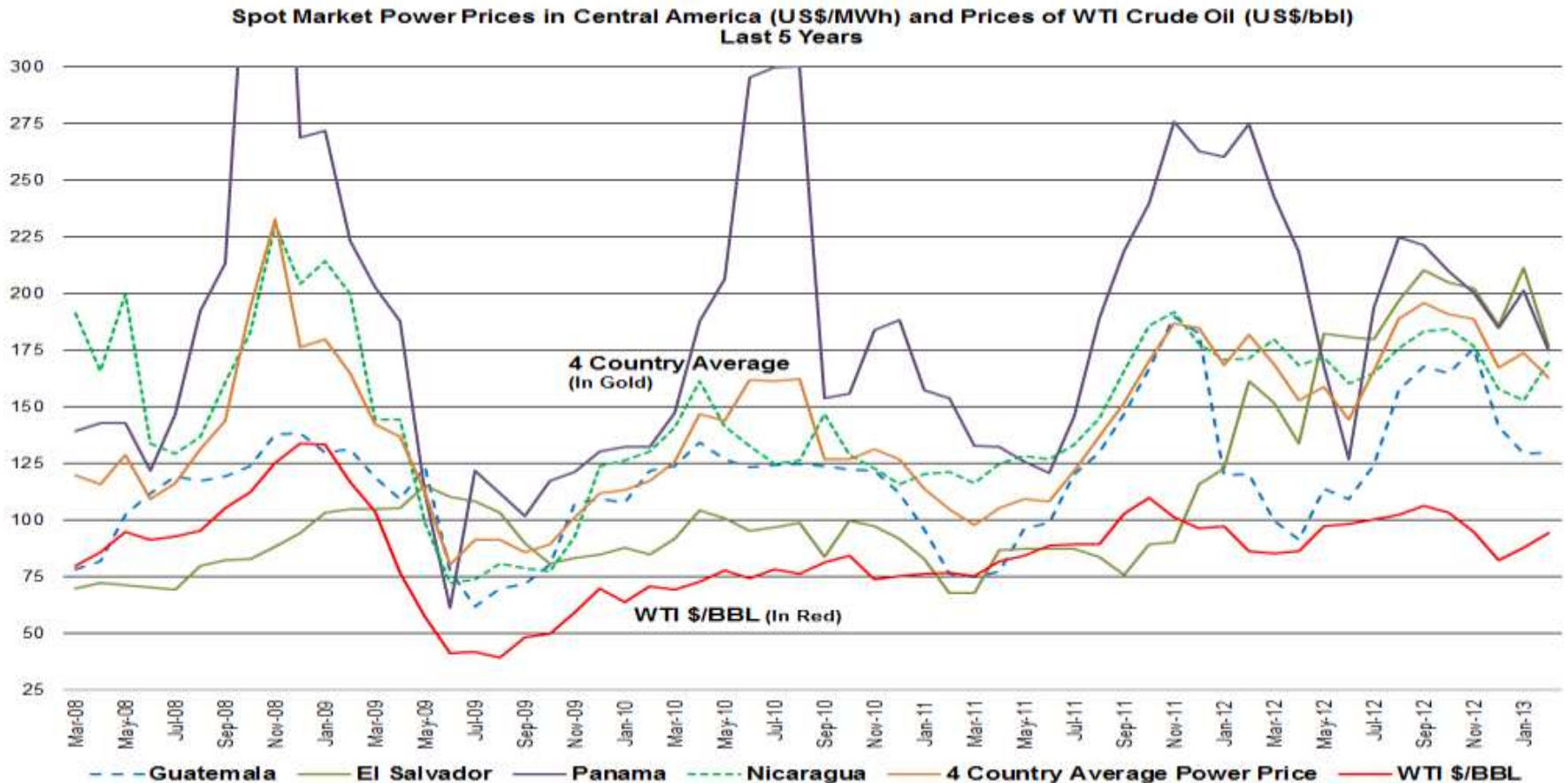


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- Many SEMs have wholesale marginal power cost \$150 - \$200 per MWh and retail power costs \$300 - \$400 MWh (U.S. is closer to \$10/MWh)
 - SEM power cost is unpredictable, driven by oil
 - Creates uncompetitive industry and exports
- Marginal “spot” prices in Central America regularly exceed \$150 - \$175/MWh when oil is \$90-\$100/barrel
- \$130 - \$140/MWh all-in provides good return for new power plant/FSRU combo, even with \$12 LNG

All-in cost of new LNG power is lower
than marginal cost using oil

Spot Market Power Prices in Central America (\$MWh) & Prices of WTI Crude Oil (\$/bbl) – Last 5 years



The Puerto Rico Experience



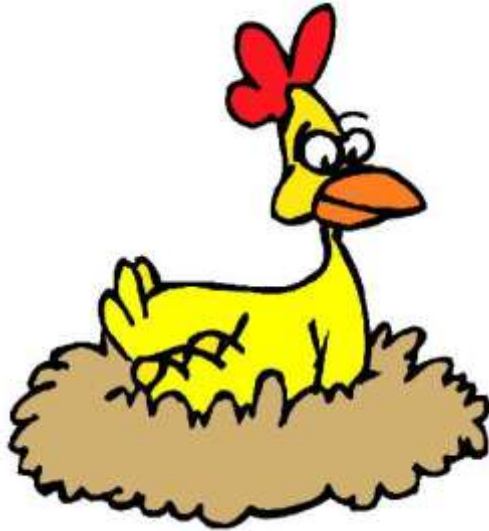
- Virtually all power from oil before 2000
- Added 530MW power plant co-located w/LNG terminal
 - Inlet air chilling increased efficiency and output
 - Produced huge excess desalinated water using “waste” heat
- LNG contract linked to basket of non-oil indexes including gas + inflation
- Significant reduction in power prices, oil exposure
- Runs on #2 diesel & propane if no LNG supply
- Private lenders financed with long-term non-recourse loan

Why hasn't Puerto Rico been repeated?

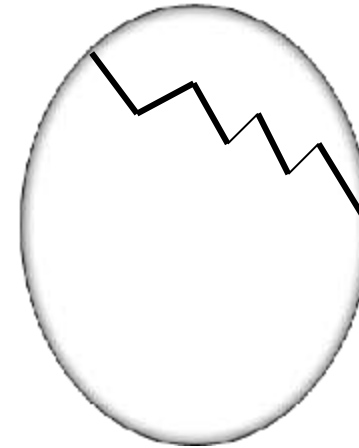
- Ten\$ of Million\$ have been spent trying in Bahamas, El Salvador, Hawaii, Philippines, Jamaica, Honduras
 - Derailed by politics, squabbles, unrealistic expectations, uninformed plans
- Only Dom Rep got a terminal (same developer/offtaker, but no financing)
- Using big-country models won't work for SEMs
- Difficult for SEMs to get LNG suppliers interested

The Chicken or the Egg?

Which comes first?



LNG Supply



LNG Receiving Terminal

- SEMs can't get traction unless someone commits first

Key challenges for SEMs to get LNG



- How to finance the FSRU
 - Governments, utilities hoping someone else will pay
 - Lack of credit FSRU providers typically want
 - Development bank and some local financing available
- Traditional LNG suppliers want good credit, oil index, long-term off-take (Japan, South Korea, Taiwan)
 - Few solid credits in SEMs
 - Pricing based on oil is useless when problem is oil pricing
 - Long-term off-take credit may need to be power utility or PPA, not single gas buyer's balance sheet

It's not so easy to fall in love

Challenges in small emerging markets for new facilities:

- Transparency
- Politics overruling good sense
- Clear, working legal system
- Track record with other large private infrastructure
- Is there consensus on adding LNG for power?
- Is there consensus on ownership?
 - private market-tested,
 - private with cronies, or
 - part or wholly public

Changes Driving New LNG Power Markets...



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- In the last 10 years, huge jump in spot LNG - - from 2 ½ % to 30% of trade while volumes doubled
- Big increase in uncommitted LNG vessels
- US exports will create pricing flexibility
 - Exports to Central America, Dom Rep already allowed
 - Cheniere pricing creativity & transparency will transform opportunities in the region
 - Short transport distances lower costs, enhance logistics
 - Small-scale liquefaction finally underway
 - Colombia--Wison/Black & Veatch for Pacific Rubiales/Exmar

...Create New Projects from Tested Ideas

- Floating Infrastructure
 - Build a jetty and LNG will come
 - FSRU supplier takes minimal country risk vs. land terminal
 - We've had floating power plants for years
- Power plants that can use multiple fuels
 - Ability to burn #2 oil, LPG = more LNG supply options
- Spot LNG strategy ("merchant" facility)
 - Operate on spot until attractive long-term contract is offered
 - Don't need great credit or balance sheet, just cash
 - De-risks suppliers as well

At LNG 17:

- 15 countries with FSRUs
 - Most are good credits for large countries
- Large emerging markets (China, India, Brazil) have LNG imports now
- No small emerging markets (SEMs) have LNG or FSRU

Which SEMs might get LNG?

Central America



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- + History of successful private power
- + Good tariff pass-through and payment history
- Several small countries, no perfect location
- +/- Public bidding creates challenges
- Specific country issues
 - Guatemala
 - El Salvador
 - Panama



Dominican Republic

- + Existing LNG terminal
- + Many private power plants
- + Many engines already installed that can burn gas
- History of non-payment for power
- 3 years of stalemate between existing LNG terminal and buyers



Philippines



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- + FSRU project announced (Energy World)
- + Lots of private power plant success
- + Large population
- + Gas discovered offshore, but small quantities
- + Sophisticated local banks/finance
- politics



Jamaica

- + 40¢ power prices
- + Large industrial (Alcoa) to provide solid anchor
- + Possible willingness to try a different approach
- +/- Hired many experts, but did not follow best advice
- Several recent false starts
- Tried to procure power, LNG supply, LNG terminal separately
- Did not address credit issues (i.e., no government guarantee)
- Politics always a challenge



Ghana

- + Relatively prosperous country
- + Large sophisticated power utility now (VRA) directly involved
- + Much use of diesel fuel; high non-hydro power prices
- + Could become regional gas import hub
- +/- Discoveries of offshore oil and gas:
 - Is LNG infrastructure cost worth it?
 - Can't we just wait for offshore reserves?
- Competing interest groups haven't agreed on one import scheme
- Pipeline from Nigeria also creates ambiguity



Colombia

Exports and Imports Together?

- + Heavy hydro baseload can't support power needs during “El Nino” droughts
- + Excellent credit, strong private power sector
- + Government committed to LNG
- + One export project under development
- Lack of consensus on gas reserves or need
- Lack of single buyer for LNG imports



Other possible surprises

- US Islands
 - Puerto Rico #3
 - Guam
 - US Virgin Islands
 - Hawaii

Predictions for LNG 18

- 3-5 FSRUs committed to SEMS
- 1 or more will rely completely on spot LNG pricing – i.e., no long-term contracts
- 1 or more will rely on long-term contracts with supplier diversion contemplated; non-payment expected and risk priced
- Most likely countries: Philippines, Ghana

Huge \$ synergies for LNG to SEMS will create large projects, large savings, large profits

It's Simple, Dad



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