

# Revitalization of the Jamaican Dairy Sector III

Biogas as an Option for Enhancing  
International Competitiveness

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# The State of Milk Production in Jamaica

- Secular decline in milk production since liberalization in 1992
- Self sufficiency at 9.5% cf. 24% in 1992
- Sustainability of primary production severely challenged by spiraling input costs

# Cost of Production vs Farm-gate Price 2004-2008 (J\$)\*

	2004	2005	2006	2007	2008
Ave. Var. Cost	19.13	22.32	23.70	30.56	38.59
Ave. Farm Gate Price	22.00	24.00	26.00	28.33	41.84
<b>Major Cost components as %AVC</b>					
Purchased Feed	39.0	39.0	29.9	33.1	35.9
Labour	13.0	13.0	24.3	16.9	22.5
<b>Utilities</b>	<b>7.0</b>	<b>7.0</b>	<b>6.5</b>	<b>10.1</b>	<b>9.6</b>
Pasture Maintenance	4.0	4.0	5.4	2.3	1.7
Vet & Med	3.0	3.0	3.4	4.3	2.4
*Exchange rate as at July 05, 2010 – J\$86:US\$1					

# Changes in Input Costs – 2000- 2008

Input	2000	2005	2008	2008:2000
Fertilizer N (J\$/kg)	29.81	65.83	119.33	3.00
Concentrate Feed (J\$/kg)	8.39	14.80	24.96	1.97
<b>Electricity (J\$/kWh)</b>	<b>7.50</b>	<b>14.78</b>	<b>27.86</b>	<b>2.71</b>
Hired Labour (J\$/man hr)	74.75	137.5	162.9	1.18
Weighted Ave. Input Cost	20.14	27.31	50.33	1.49
Ave. Var. Cost/L	15.91	22.23	38.59	1.42
Farm Gate Price/L	22.14	24.00	41.84	0.89

# Efficiency of Milk Production: Jamaica vs. US and New Zealand\*

	Jamaica	US	N. Zealand
Ave. Var. Cost (\$US/L)	0.53	0.36	0.26
Farm Gate Price (US\$/L)	0.57	0.41	0.37
Indicative Margin (%)	7.5	13.9	0.42
Stocking Rate @ grazing (cows/ha)	2.1	2.3	2.7
Yield per Cow (L/yr)	2363	7105	3790
Output/ha (L/yr)	4,867	16,340	10,250
Concentrate Feed Price (US\$/kg)	0.29	0.20	0.30
Milk: Feed Price Ratio	1.96	2.05	1.23
Labour Cost (US\$/man hr)	1.87	11.38	8.0
<b>Electricity Cost (US\$/kWh)</b>	<b>0.32</b>	<b>0.12</b>	<b>0.18</b>

\*Based on 2008 data

# Reducing Electricity Costs

- Electricity rates have spiraled at a rate of 30% annually between 2005-2008
- Instability in world petroleum markets suggests alternative energy as key strategy in improving competitiveness
- Biogas evaluated as sustainable alternative to Grid Electricity

# Electricity Consumption on Sample Farms

Farm No.	Total Cows (X)	Annual Output (Litres)	Energy Consumption (kWh)		Monthly Cost (J\$)	Ave. Cost (JS/kWh)
			Monthly	Daily (Y)		
1	45	41,793	624	20.8	15,003	24.05
2	70	52,001	543	18.1	14,060	25.88
3	95	195,029	1438	47.9	33,694	23.44
4	35	94,648	1269	42.3	32,109	25.31
5	440	1,100,050	8149	271.7	201,960	24.78
6	220	514,318	3906	130.2	114,145	29.22
7	195	300,037	3378	112.6	92,898	27.50
8	330	639,897	5152	171.7	141,618	27.48

$$Y = 0.6626X - 9.90$$

$$R^2 = 0.918; \text{ s.e. }_{xy} = 27.42$$

# Relationship between Milk Yield and Electricity Consumption in 2009

- Indicated output – 10.01 L/kWh consumed
- Electricity cost per litre – J\$2.60
- Annualized electricity consumption – 205 kWh/cow

# Biogas as Preferred Option?

- Dairy cow voids as faeces, 25-30% daily dry matter intake
- Biogas potential of cow faeces –  $0.300\text{m}^3$   $\text{CH}_4/\text{kg}$  faeces total solids =  $6\text{kWh}/\text{m}^3$
- Jamaica Hope cow producing 10 litres/day and consuming 13kg DM potentially generates 7.0 kWh vs. requirement of 0.66kWh
- Biogas may replace 90% fossil fuel in a diesel-driven electricity generator

# Bio-Digesters – Herd Size: Cost Relationships

Breeding Cows	Biogas Output (m <sup>3</sup> /day)	Electricity Generation (kWh/d)	Electricity Consumption (kWh/d)	Digester Size Req. (m <sup>3</sup> )	Estimated Cost (J\$M)
50	33	198	23.2	100	3.3
150	100	590	89.5	200	5.4
250	150	990	155.8	300	7.1
350	230	1380	222.0	350	7.8
450	300	1780	288.3	400	8.5

# Benefit: Cost of Biogas/Electricity

	Traditional 1200 -COW	Specialized 1200-COW	Sp. 440-COW	Tr. 250-COW	Sp. 60-cow
Electricity Use (kWh/d)	785.2	785.2	281.6	155.8	29.9
Bio-digester Req (m <sup>3</sup> )	750	750	320	240	45
Inc. Cap. Invest (J\$M)	14.54	14.54	7.79	6.40	1.64
Energy Saving (J\$M/yr)	8.60	8.60	3.08	1.71	0.33
Sales to Grid (J\$M/yr)	8.70	8.70	3.11	1.72	0.33
<b>Diff. Unit Cost of Prodn. (J\$/L)</b>	<b>-1.30</b>	<b>-0.84</b>	<b>-0.60</b>	<b>-0.47</b>	<b>+0.70</b>
<b>Incremental NPV (8%;14 yr)</b>	<b>+63.3</b>	<b>+95.2</b>	<b>+28.9</b>	<b>+10.4</b>	<b>-0.27</b>

# Conclusion

- Reduction in on-farm electricity costs – important strategy in improving competitiveness
- Biogas offers a feasible option for improving financial performance on dairy farms above 60 cows
- Benefits are primarily through cost savings, revenues from sales to grid and reduced unit production costs.
- The added benefits from reducing the carbon footprint of cattle farming, provides further justification for adoption of biogas/electricity generation.