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BENEFITS TO JAMAICA

OF

ELECTRICITY PRODUCTION

IN THE SUGAR INDUSTRY

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I. Executive Summary

The economic health of the sugar industry can be significantly improved by encouraging cogeneration of excess electricity for sale to the grid.

Cogeneration projects are commercially proven and are not technically innovative. Similar projects have been accomplished and are profitable in both Hawaii and developing countries such as Mauritius. Electricity cogeneration projects can contribute significantly to the continuing effort to upgrade efficiency and productivity in the sugar industry, as well as to reduction of petroleum imports.

A cogeneration strategy for the Jamaican sugar industry has three key characteristics:

1. It can easily be complementary to any national energy policy that might be implemented by the Government.
2. Sugar factory revenues from electric power sales to the grid could mean the difference between profit and loss for each factory where a cogeneration project is located.
3. Private investment, including foreign investment, can be attracted to cogeneration projects.

This paper summarizes the opportunity for the sugar industry, and in Section VI, identifies policies and actions that the Government may wish to consider to initiate the process.

II. Introduction

The Jamaican economy has three major productive sectors: bauxite/alumina, tourism, and agriculture. Fluctuations in economic contributions from the bauxite/alumina and tourism industries, coupled with a declining agriculture sector and a high level of dependence on imported petroleum, have made a significant contribution to foreign debt accumulation.

Depending on international markets and economic conditions, the principal earner of foreign exchange alternates between the bauxite/alumina and tourism industry. Both sectors, like sugar, are susceptible to serious disruption from forces beyond Jamaican control. The sugar industry has the opportunity, in electric power cogeneration, to reduce its vulnerability to non-Jamaican market forces.

Since independence, the agricultural sector has been in continual decline. It is, however, still the major employer of labor and contributed 8.3% of GDP in 1987. Within the agricultural sector, the sugar industry is the dominant contributor. Like other areas within this sector, it too has been in decline during most of the past twenty years.

Worldwide trends threaten the sugar industry in its present make-up. Sugar industries in many developing countries have realized that technological advances in processing and biotechnology are threatening to make conventional sugar industries obsolete. Developing countries are now actively looking for ways to counter the threat to continued viability of the sugar industry.

One important advance is the highly efficient cogeneration of electricity and steam. The technical principals behind cogeneration are not new. In fact, all sugar industries in most developing countries derive energy from cogeneration. Simply put, cogeneration is a process in which a fuel (wood, petroleum, coal or bagasse-in the case of the sugar industry) is burned in a boiler to produce steam. A portion of the steam is passed through a turbine to produce electricity, and the remainder is used to process the cane juice into sugar.

What is new, in recent years, is the opportunity to burn bagasse and supplemental fuels with extraordinary efficiency. A number of developing countries who derive electricity from petroleum (the Dominican Republic, Guyana, the Philippines, Thailand, Mauritius, and Costa Rica) are now implementing, or evaluating in some cases, this technology. These countries are intent on duplicating efforts in places like Hawaii and Reunion where electricity cogeneration has already been successfully installed.

The important role that a resurgent Jamaican sugar industry can play in terms of GDP, employment, and foreign exchange earnings provides the Government with a major incentive to encourage diversification and modernization of the industry. At the same time, Jamaica's dependence on imported oil for meeting most of its energy needs has resulted in an ongoing priority for the development of indigenous energy resources, to lower foreign exchange outlays and to control energy costs. Combining these

two considerations, if the sugar industry is to survive, careful consideration of the cogeneration option stands out as a practical option.

III. Sugar Industry Status

Despite its varied fortunes and attention from the government over successive administrations, sugarcane remains the largest single crop grown in the country. Over the past two years, there has actually been an increase in the acreage devoted to sugarcane, despite efforts on the part of the government to substitute other crops. However, total present acreage is significantly less than when the country was producing 500 000 tons of sugar per year. The sugar industry is still the major earner of foreign exchange, and employer, in the agricultural sector. It currently employs about 16 percent of the total labor force.

In comparison to sugar industries in other developing countries, the Jamaican industry can safely be called inefficient. It has survived primarily from the preferred markets it enjoys within the European Economic Community and the United States. About 70 percent of the 1987/88 production was exported under quotas of 11,045 short tons to the United States and 125,000 long tons to the United Kingdom. The foreign exchange earnings from sugar exports were \$73.4 million in 1987 and increased to \$86.7 million in 1988. Domestic demand for molasses has been increased by the ethanol industry (petronol and Tropicana International) in response to the U.S. CBI requirement for an increase in Caribbean origin feedstock for ethanol exported to the U.S.

Despite obstacles and entrenched pessimism, the Jamaican sugar industry appears to have started an important recovery. During the 1987/88 crop year, about 2,500,000 long tons of cane were harvested yielding some 216,000 tons of sugar. This output was up 17 percent from 1986/87 sugar production of 184,000 tons. Despite decades of declining sugar production and the recent setback caused by hurricane Gilbert, sugar output is expected to continue to grow in the future, reflecting improved agricultural and processing yields and efficiencies. For instance, a substantial gain in yield per acre was achieved between the 1986/87 and 1987/88 harvest seasons.

Certain sugar mills have planned expansion of the sugarcane fields. Bernard Lodge hopes to plant an additional 1,000 to 1,500 acres of sugarcane in the coming year on newly authorized estate lands. Rehabilitation at the Frome and Moneymusk factories is in process under the Second Sugar Rehabilitation Project, which will also lead to improved sugar processing

efficiencies, and hence yield more surplus bagasse. Prices for sugar in the domestic and export quota market have remained strong, allowing the industry as a whole to be profitable in 1988.

IV. Cogeneration Potential in the Sugar Industry.

Industrial cogeneration in the sugar industry, utilizing bagasse as a primary fuel, has been a long-standing practice in the sugar industry not only in Jamaica but worldwide. All nine Jamaican sugar mills produce a significant fraction of their process steam and electricity through burning the bagasse residue left from grinding sugar cane. Due to industrial inefficiencies and the age of equipment, the Jamaican sugar mills must use additional sources of fuel (e.g. fuel oil and wood). Nonetheless, successful commercial practice in both the developed and developing world shows that an efficiently operated and properly equipped sugar mill is capable of meeting all of its energy needs from bagasse. In fact, the Jamaican sugar industry should have a 20 to 30 percent bagasse surplus available for electricity production for sale, at least part of the year, to the grid.

As noted above, advances in cogeneration technology have significantly improved the amount of electricity which can be derived from a unit quantity of fuel. For example, Jamaican sugar mills produce, on average, 12-15 kWh of electricity for every ton of cane crushed. Over 100 kWh is normally achieved in the Hawaiian sugar industry, and over 60 kWh is attained in Mauritius. These advances have altered the economies of electricity production from bagasse. The cost of sugar production is reduced, and any surplus electricity can be sold at a profit to the power company. Moreover, electricity produced from a cogeneration system is less costly than electricity derived from a system which only generates electricity.

Electricity can be cogenerated for sale to the grid either seasonally, or year-round, depending on the availability of fuel. Cogeneration equipment has the ability to utilize more than one source of fuel. This means a sugar factory can use cogeneration technology to function both as a sugar factory and an electricity production facility during the sugarcane grinding season, and then switch to full-time electricity generation during the off-season. Sugar factories converted to use multiple fuels through the installation of modern cogeneration equipment would burn bagasse during the grinding season as the primary fuel, and would burn coal, fuel, oil, wood, or peat for the remainder of the year.

Based on 1987 Sugar Industry Research Institute (SIRI) grinding season data, and assuming private capital investment in

new turbines and boilers (but with no other major investment in factory operations), the potential electric power contribution from the three largest Jamaican sugar factories, produced from surplus bagasse alone, could be 10-20% of the total electric power produced by JPS in 1987. In an average month, more than half of this electricity (about 40 MW) would be available for sale to the grid.

V. Benefits of Expanded Cogeneration in the Sugar Industry.

Expanded modern cogeneration in the sugar industry offers three primary benefits.

First, it can be a critical element of a strategy to revitalize the sugar industry.

Second, it creates access to private capital investment.

Third, it adds flexibility to the options for national energy strategy, by providing a new electricity source from indigenous resources.

Sugar Industry Revitalization

Improving sugar industry efficiency obviously requires many advances, of which investment in new equipment is but one. The possibility of attracting local or foreign private investment in an almost obsolete sugar industry is minimal. However, the possibility of obtaining private investment in a modern diversified sugarcane processing industry, which sells sugar and electricity is significant. Potential consequences of a cogeneration strategy may therefore include:

- o Phased modernization of sugar mills.
- o Secure employment opportunities in rural areas.
- o Increased sugar factory revenue, from either surplus electricity sales or reduced electricity purchases, or from both.
- o Reduced vulnerability to shifts in world sugar markets.
- o The potential for mills to be a major non-petroleum based source of electricity for sale to the grid.
- o Reduced foreign exchange expenditures.

- o The potential to provide an economic incentive to protect the natural resources base and the environment, since increased sugarcane production on the hillsides of Jamaica is one of the best options for reducing soil erosion and improving water availability.

Investment Diversification

In order to keep the sugar industry operating, a number of sugar mills will have to make investments in new power generation equipment, whether or not a cogeneration strategy is pursued. In addition, JPS faces serious investment decisions to add power generating capacity. The investments needed represent a serious foreign exchange expenditure, but also present an opportunity. If cogenerated power is not sold to the grid, sugar industry investments will continue to be a burden on the public sector. Cogeneration provides a mechanism through which the government could attract private investment, and thereby reduce the total level of public foreign exchange expenditure in the two sectors. Public sector investment will certainly not be eliminated, but it will be supplemented.

Electricity and Fuel Benefits

At present, the nation's electricity generating capacity is approximately 450 megawatts, consisting of units based in various parts of the island. Substantial new generating capacity is needed in the coming years, both to meet growing demand, and to replace units which are no longer cost effective to operate or repair.

Based on analysis from other developing countries such as Mauritius and Costa Rica, the least cost power investment option may be to convert traditional sugar factories into combined sugar and electricity producing facilities. Whether this will be the case in Jamaica depends on a number of comparative factors, such as:

- o The cost of providing supplemental fuel to make possible year-round production of electricity in sugar factories.
- o The level of investment in transmission systems to tie sugar factories with existing system.
- o The comparative fuel cost, considered in terms of foreign exchange cost and shadow prices, between new power stations and the sugar factory option.

- o The comparative delivered cost per kWh from each facility considering all other factors; operation, maintenance, insurance, etc.

Whether or not sugar industry cogeneration provides the least cost expansion alternative, it offers another advantage: it adds to the range of Jamaica's power investment options. In the absence of an innovative approach, new power investment will add significant public sector debt.

Finally, electric power generation from bagasse is compatible with a flexible national fuels strategy, and reduces dependence, even marginally, on imported fuels. For now, the secondary cogeneration fuel could be residual fuel oil, but this could be switched to coal or peat if dictated by availability and price. In every case, efficient use of bagasse will directly reduce overall dependence on imports.

VI. Government Actions Needed

The limited availability of capital as the major inhibiting factor for electric power capacity investment is being addressed around the world through application of a concept that has proven quite successful in several countries: "independent" electric power generation. Through the enactment of laws in various countries in North America, Central America, the Caribbean, and Asia, private developers have been given the right to build, own, and operate power plants, and the public utility buys this privately generated power at the fair "avoided cost" of its own generation. Over the past decade, this approach has led to the development of thousands of megawatts of privately financed electric power capacity.

By creating positive political, legal, and business conditions in Jamaica, the potential exists to attract sufficient private capital to finance major cogeneration projects. The important preconditions for these projects are to reduce the risks and expand the incentives for private electric power development.

Prior to taking such steps, the Government may wish to satisfy itself that specific sugar factory installations can provide electricity at a cost equal to, or less than, other future options for meeting demand. The Government could utilize the results of a major recent study on the Moneymusk sugar factory, which was completed about two years ago by the U.S. Agency for International Development. The Government could also offer to interested private sector parties a conditional Letter of Intent (LOI) to purchase electricity at the same cost (combining capital cost and operating costs) at which proposed future power plants would generate electricity. With the LOI,

the proposed electricity producer could be expected to conduct a sufficient feasibility study to define the viability of the proposed venture.

Once the Government is satisfied that a specific sugar mill can participate in surplus electricity projects cost-effectively, to spur such projects to implementation with private investment the Government would need to:

- o Formulate clear direction to JPS to purchase the electricity generated. This has already been done by governments in a number of developing countries, e.g. Costa Rica, Philippines and Thailand.
- o Decide on the type of joint venture partnership or other arrangement that will be instituted between Jamaica Sugar Holding Ltd., private investors, and JPS so that such projects can be implemented quickly and efficiently.
- o Negotiate a long-term Power Purchase Agreement with specific project developers for the purchase of electricity, for a time frame in the region of 12-15 years, that would allow the investors both to service debt and pay a return to equity investors.
- o Formulate an investment package for foreign investors, to deal with repatriation of profits, adjustment for inflation and changes in fuel prices, and incentives for exceptional performance.

An increasing number of developed and developing countries are putting the above conditions into place and are successfully encouraging private sector development of electric power. For Jamaica, private power production can have the equally important benefit of contributing to the revitalization of the sugar industry.