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Review of Amaila Falls Hydroelectric Project Feasibility Study Report

Kaehne Consulting Ltd

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GOVERNMENT OF GUYANA

REVIEW OF AMAILA FALLS HYDROELECTRIC PROJECT FEASIBILITY STUDY REPORT

JUNE 2002

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GOVERNMENT OF GUYANA

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JUNE 2002

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EXECUTIVE SUMMARY

Guyana wants and needs development of its extensive natural renewable resources, including its important water resources. It has been estimated that Guyana has sufficient water resources to economically develop 7000 MW of hydroelectric power generation over time. With the growing global focus on sustainable energy development and the realization of the importance of water to humanity, Guyana is well positioned to begin the introduction of large-scale hydroelectric power development. Utilization of Guyana's hydrological resource to generate electricity also directly displaces existing diesel based generation, resulting in a reduction in the use of imported fossil fuel and consequent reduction of greenhouse gas emissions. Also, reducing foreign currency payments and lowering exposure to fluctuating world oil prices will stabilize electrical generation costs and consequently enhance both the growth of electricity demand and the long-term economic development of the country.

It is inevitable that medium to large scale hydroelectric power generation will be developed in Guyana. It is also inevitable that the population and industrialization of Guyana will continue to increase, providing a growing demand for electricity and an expanding energy market for projects like Amaila Falls.

Amaila Falls is being developed as a private sector initiative, with Government providing cooperation and support by facilitating the development process.

Based on studies that were carried out in the 1970s, it has been determined that the Amaila Falls project is the most desirable hydroelectric project of its size in the region and should therefore be the first to be developed. Its location is sufficiently remote that it does not pose any major social disruption and it relies on a watershed of 650 square kilometres of relatively unspoilt and unused land. At 100 MW in the proposed first stage, the project is large enough to handle the major portion of GPL's Demerara and Berbice area loads and the Linden area load for many years. While the length of transmission line provides a challenge to the economics of the project, the establishment of a 230 kV transmission link between Amaila and Georgetown will provide the first part of a national 230kV interconnected grid (this is not necessarily related to or part of any larger scheme to export power to neighbouring countries although inevitably interconnections would be developed).

The project developers have submitted a Feasibility Study Report and a Final Environmental Impact Assessment Report which are the subject of this review, and a revised application for issue of an Interim Licence under the Hydro-Electric Power Regulations.

There are several areas where additional input and investigation are required to properly define the project. They include:

1. Hydrology. The developers have based the project viability mostly on data collected in an adjacent water shed (Kaieteur) and the Amaila/Kuribrong River basin hydrology has been inferred from this. At no stage have concurrent hydrological data been collected to verify the relationship between the two water basins. This review recommends that additional stream flow data be collected at the base of the Amaila Falls for at least a sufficient period to confirm the relationship to Kaieteur. Also, a detailed topographical survey of the reservoir should be carried out to confirm its containment volume. This is a critical design prerequisite to ensure that an acceptable flow of water is available during the dry seasons when the amount of storage will determine the amount of "firm" power which can be contracted to customers in the various Power Purchase Agreements (PPAs). It also verifies the height and size of the required dams and therefore the cost.

2. Cost. Capital costs must be reviewed further, particularly with respect to infrastructure costs such as access to the site, clearing and preparation of the flooded area, dam construction costs, civil costs generally including the water conductor tunnel, surge shaft and penstock, unit concrete costs and transmission line costs including route selection, surveying, clearing, land compensation and acquisition costs. Also, operating costs must be reviewed to ensure that the project has the necessary staff and equipment to deal with routine maintenance as well as emergencies should they occur.

3. Market. The energy market which the developers plan to capture appears to have been overstated in the early years of the project.

   The Omai Gold Mine, to which it was proposed to sell an initial 223 GWhrs of "secondary" energy annually (decreasing to 63 GWhrs per year by 2011), will have closed by the time the project is operating unless the results of ongoing exploration are positive. This load has therefore been excluded from projected markets in this review.

   The Linden load is significantly smaller than the amount envisaged; currently about 6 MW rather than the 15 MW assumed in the Feasibility Study Report. This translates to an available annual energy market of about 50 GWhrs in 2007. This compares with an estimated annual market of 114 GWhrs assumed in the Feasibility Study Report.

The Guyana Power & Light (GPL) load, which provides the cornerstone of the project's likely energy market, cannot be fully supplied by Amaila due to the project's distance from the GPL load. Synergy has indicated that GPL will have to continue to operate end-of-line diesel generation for voltage and frequency support and to provide back-up generating capacity in case of outages on the Amaila supply system. In the absence of firm design calculations from either Synergy/Harza or GPL, we have estimated that approximately 480 GWhrs will be available to Amaila in 2007 (approximately 75% of GPL's expected total gross generation).

In summary, and according to the calculations included in Appendix E, it will be 2016 before Amaila Falls has an energy market of 775 GWhrs available to supply, if it relies solely on the GPL and Linden loads. This means that the rate of 7 US cents per kWhr proposed will not be sufficient to generate the returns envisaged, especially in the early years of operation, without additional support from government or third party funding agencies.

4. Technical. There are several significant design issues which will need further investigation as the project progresses but the most important matter is whether Amaila will be able to deliver supply to GPL in a quantity, of a quality and availability and at a price that will be attractive to GPL and which will be of benefit to GPL's customers who eventually will be the consumers of power produced at Amaila. The definitive answer to this question remains outstanding pending completion of technical evaluations between GPL and Synergy/Harza engineers.

Amaila Falls (or a similar hydro project) will be built sooner or later. For the project to succeed it must have a reliable and accurately defined water supply, an accurate estimate of total development costs and operating costs, a proven design and a sustainable energy market. Synergy should be actively encouraged to pursue the issues which currently need attention and to produce a "bankable" feasibility study. Given the present load scenario, it is unlikely that the project will be able to sell 100% of its planned annual output until about 2016. It is possible that Government assistance will be needed to make up this revenue shortfall.

This review recommends that the project be pursued with the ongoing collection of data and supporting information. GPL has indicated a willingness to work with Synergy to assess the effect of the project on the GPL system and to work towards developing a PPA with Synergy. Linden Power Company (LPC) has indicated that it will be in a position to discuss a PPA with Synergy after agreement with GPL has been reached. As mentioned, the length and cost of transmission for the size of the generation and the load makes the project a challenge. The project will come closer to financial

sustainability with the passage of time and as loads grow to better support the project. The length of transmission will remain a significant obstacle unless a substantial load can be developed closer to the site.

Specifically, it is recommended that the following areas be pursued on an ongoing basis:

1. Confirm that the site has the water flow profile to support the project and that the reservoir has sufficient capacity to allow "firm" output throughout the dry seasons.

2. Confirm energy markets available to the project. This will be a dynamic situation but will determine the net cost of supply from Amaila over time.

3. Confirm capital and operating costs. In view of the plan to award one large EPC contract, solicit expressions of interest from suitably qualified international contractors and budget proposals from a "short list" of suitable bidders.

4. Confirm the project's ability to supply GPL by continuing the load flow evaluations that GPL and Synergy/Harza have begun.

5. Continue dialogue with the potential energy customers leading to expressions of interest and signed Power Purchase Agreements.

6. Continue to pursue access to possible financial support for the project from international financial institutions (IFIs) via programs such as the Global Environmental Facility, Clean Development Mechanism, the proposed BioCarbon Fund and others.

1. INTRODUCTION

This review has been conducted by Kaehne Consulting Ltd. (KCL), of Vancouver, BC, Canada at the request of the Government of Guyana, Office of the Prime Minister. The review is based on the Amaila Falls Hydroelectric Project Feasibility Study Report prepared for the project developers, Synergy Holdings Inc. (Synergy) and Harza International Development Company LLC (Harza) by Montgomery Watson Harza (MWH). The objective of the report as defined in KCL's Terms of Reference is "to provide the Government with an assessment on whether the project is technically, economically, environmentally and financially viable and to act as facilitator between Synergy, Guyana Power & Light Inc. (GPL) and other prospective purchasers to develop principal terms for Power Purchase Agreement(s), depending on the findings. The Consultant is also required to make recommendations on how any shortfall in revenue could be covered to assure the sustainability of the project". The full Terms of Reference are included in Appendix A.

2. HISTORY

Amaila Falls was identified along with several other projects as a potential hydroelectric development site during studies carried out around 1975. In the intervening years various studies have been carried out to more accurately define the project potential and over recent years, the Guyana Energy Agency has confirmed the priority of the top six projects based on a combination of factors including social, economic, environmental and technical. The Amaila Falls project is favoured by the GEA as the first project to develop based on its overall risk/benefit evaluation.

In 1998, Synergy/Harza was given the exclusive right to investigate the project with a view to ultimate development, subject to meeting certain prior requirements. As part of these requirements, Synergy has recently submitted a Feasibility Report and a Final Environmental Impact Assessment which are addressed by this review.

During 2001, field crews carried out drilling and related geotechnical investigations on the site, environmental reviews and further hydrological data collection. This included 8 months of measuring water levels at the base of the Amaila Falls and 2 months of measuring water flows. This led to the submission by Synergy in December 2001 of the Feasibility Study report and the Draft Environmental Impact Assessment report. The draft EIA was replaced in April

2002 by a Final Draft version, containing responses to comments received from the EPA and others on the draft, and then by a Final issue dated May 2002.

3. SCOPE OF PROJECT

The Amaila Falls project consists of a reservoir of approximately 180 million cubic metres capacity, two dams of maximum height 30.5 metres, a water conductor consisting of an underground tunnel, a vertical surge shaft and surface penstock to a powerhouse containing four 25 MW Francis hydraulic turbines and electric generators and a tail race for water discharge back to the Kuribrong River. The power generated is fed to a nearby substation and subsequently via a 296 km double circuit 230 kV overhead transmission line to connect to the existing GPL system at Sophia Substation. Other proposed or possible connections are to the future Tumatumari hydroelectric project (45 MW), the Omai gold mine and the Linden region including Linden Mining Enterprise Limited (Linmine), the bauxite operation at Linden. The project would be accessed by a new road from Pamela Landing, approximately 40.6 km in length. An airstrip is also planned for the site. The project has an initial rated output capacity of 100 MW and an estimated annual energy output, after allowing for station and transmission losses, of 775 GWhrs (firm and non-firm).

Amaila Falls is to be developed as a private sector project. Government may request that the project be structured as a Build-Own-Operate-Transfer project with a degree of flexibility on the "transfer" aspect. Similarly, the project should be identified and licenced in two parts; namely, the generation portion and the transmission portion. The Amaila selling price of energy should also be stated in two parts to allow separate accounting of generation and transmission components. Government is also supporting the project by investigating availability of carbon credits through initiatives such as the Global Environment Facility and the Kyoto Protocol Clean Development Mechanism.

The project includes delivery of power to its prospective customers at utilization voltages, i.e. customer substations for Omai, Linden and GPL have been included in the overall project costs (69 kV for GPL, 13.8 kV or 69 kV for Linden and 4.16 kV for Omai). Right-of way (ROW) costs including land compensation and acquisition, clearing and substation costs are included.

4. TOTAL GREENHOUSE GAS EMISSIONS –AMAILA VS. DIESEL

For purposes of understanding the difference in overall greenhouse gas emissions from the Amaila project versus the option of continuing with diesel in the long run, this section examines in a general way the long term effect that the Amaila project would have on reducing greenhouse gas emissions.

It has been assumed that the total life span of the Amaila project would be 100 years and that the average output would remain at 775 GWhrs per year throughout its life. The diesel alternative assumes that an equivalent amount of energy is generated using current diesel technology and efficiencies over the 100 year period. It could be argued that diesel combustion technology and therefore efficiencies will improve over time and the ability to reduce emissions will also improve. However, this comparison compares best available current technology on the basis that this state exists and is proven.

It has further been assumed that the diesel alternative achieves operating efficiencies considered acceptable in modern utilities and that these efficiencies are maintained throughout the study period. Total GHG emissions from the diesel alternative are given in Appendix I.

In the case of the Amaila project, allowance has been made for the net permanent loss of carbon sink due to construction of 40 km of access road to the site, flooding of 26.5 square kilometers of cleared land for the reservoir, clearing of the water collection and generating site, construction and operation of the water collection and generating facilities, clearing for, and construction and operation of 296 km of transmission line. The loss of carbon sink based on the project's total cleared area and Guyana's total forested area is approximately 0.2%. It has been assumed that there will be no long term increase in methane or CO_2 emissions from the reservoir due to the elimination of vegetation prior to flooding.

Construction of the Amaila project is estimated to produce about 367,000 tonnes of GHGs including burning off the reservoir area. Operation is estimated to produce about 4900 tonnes per year or about 490,000 tonnes over the life of the plant, resulting in an approximate total production of 857,000 tonnes of GHGs over the life of the project. In addition, the loss of approximately 42 square kilometers of forest results in a loss of carbon sink of approximately 1.78 million tonnes GHG equivalent. The total net effect on GHGs of the Amaila project is therefore about 2.6 million tonnes. This compares with approximately 13 million tonnes total for the equivalent diesel generation.

In summary, it can be seen that the net reduction of GHGs over the life of the Amaila project is approximately 10.4 million tonnes or about 80% reduction over the diesel option. It is anticipated that this element of the project will help qualify for GEF and/or CDM credits.

5. TOTAL PROJECT LIFE CYCLE COST – AMAILA VS. DIESEL

In order to properly evaluate the overall benefit of the Amaila project to Guyana, a comparison of life cycle costs has been prepared. Life cycle costs include the entire financial commitment to a project from its inception and planning, to its construction and commissioning, through its operating life with repairs and maintenance, finally to its decommissioning and rehabilitation. For the purposes of this comparison, the life span of the Amaila Falls project is assumed to be 100 years at an average annual output of 775 GWhrs.

The equivalent diesel plant is assumed to be best available current technology in 2002 and also to be producing 775 GWhrs per year at optimal utilization factors and operating efficiencies. Fuel is assumed to be No. 6 low sulphur low vanadium and is assumed to cost a constant USD 20.50/barrel in 2002 dollars. A discount rate of 5% has been assumed to determine the NPV of operating costs.

The full calculation appears in Appendix J, however in summary it can be seen that the approximate comparable life cycle costs are USD 446 million for Amaila and USD 625 million for the diesel equivalent.

6. LICENCING OF THE AMAILA FALLS PROJECT

Amaila Falls is the first of several potential large scale hydroelectric developments in Guyana which could materialize over the next few years. Given the significant distance between Amaila and its intended primary market (i.e. GPL) it is important to be able to separately evaluate the generation and transmission components of the project. It is suggested that the project be developed under separate licences for generation and transmission and that the capital and operating cost of each component be kept separate for recording purposes. Each portion of the project should be approached as a Build-Own-Operate-Transfer (BOOT) project, with the generating portion accessible for purchase or transfer after say 20 years and the transmission portion available for purchase or transfer at any time. This is to allow possible development of a Transmission System Owner/Operator at any time in the future it becomes appropriate. If other Independent Power Producer (IPP) projects develop

quickly, this timing could even be before Amaila is complete. In any case, the transfer cost would be at the depreciated or book value.

In the same vein, the Amaila selling price for energy should always be expressed in two components, the generation and transmission components. This review suggests that a ratio of 70/30 should be used for generation/transmission respectively, based on the estimated net present value of the life cycle cost of each of the components. This results in a split of Amaila's 7 US cent/kWhr selling price into 4.9 cents for generation and 2.1 cents for transmission. Calculations are included in Appendix K.

7. ENERGY MARKET

The Amaila Falls project anticipates supplying energy to three main customers, namely Guyana Power & Light (GPL), Linden Power Company (LPC) and Omai Gold Mines Limited (Omai). The Feasibility Study Report envisages initially delivering approximately 438 GWhrs of "firm" energy annually to GPL, 114 GWhrs of "firm" energy to LPC and 223 GWhrs of "secondary" or "non-firm" energy to Omai.

GPL currently generates all its energy from fossil fuel. The old steam plant at Kingston which is scheduled to be retired soon operates on Bunker C heavy fuel; the Wartsilas, which form the major part of the "priority dispatch" capacity, operate on a No. 6 heavy fuel oil (low sulphur, low vanadium) and the smaller units operate on No. 2 diesel fuel (or distillate). In all, GPL has an available installed generating capacity of about 100 MW to supply a peak demand load of approximately 90 MW. At present, GPL's biggest diesel generating unit capacity is 5.5 MW although plans are under way to add three new units of approximately 10 MW rating each over the next three years.

In order for GPL to cope with the loss of one machine at Amaila Falls, it will need to have approximately 25 MW of spare diesel capacity (minimum) operating and on the system to avoid having to load shed or to take a partial outage. In reality, if Amaila at the time does not have the ability to supply GPL's entire load then additional diesel will already be running to handle the load and the 25 MW of support capacity would be required in addition to the loaded diesel capacity. This could result in GPL having to run a considerable amount of diesel under less than optimal operating conditions compared to a diesel only scenario. The reason for this is GPL's ability to control dispatch and spinning reserve capacity with an all diesel scenario and its inability to control machine output characteristics at Amaila. This places a higher level of burden on GPL's

operations to ensure that its customers are not adversely affected by the introduction of the Amaila project as a source of generation.

Similarly, when GPL is able to take all Amaila's output in the future, an outage at Amaila or on the transmission link to GPL will cause a major or total outage at GPL. Unless 100% generation reserve is maintained, such an outage will continue until the problem is solved.

Based on discussions with GPL and a review of its Development and Expansion Programme 2002-2006, it was decided to model GPL's future estimated gross generation energy on a sustainable annual load growth of 4 % in each of the next 25 years. Due to the fact, however, that the Amaila project requires "end-of-line" generation by GPL to provide voltage stability, some of GPL's load will continue to be served by diesel generation. In the absence of better data from system load flow studies being carried out by GPL and Harza, it has been assumed that 25% of GPL's gross generation will continue to be provided by diesel. From the operational point of view and due to the long distance over which power must be sent from Amaila, GPL will also wish to continue to operate some diesel to avoid total blackouts if the transmission line is damaged or if one or more 25 MW generators at Amaila suffer an unscheduled shutdown. Graphs of the estimated energy available to GPL from the Amaila project over time are given in Appendix E.

The Linden Power Company (LPC) owns and operates the power generating plant at Linden which supplies both the Linden community and Linden Mining Enterprise Limited (Linmine). The LPC plant consists of 12.5 MW of diesel generation (five units of 2.5 MW capacity each) and one steam turbine with a capacity of 7.5 MW. The combined peak load of Linden and Linmine is approximately 12 MW although Linmine's dragline which causes about a 4 MW swing load is about to be retired.

LPC currently generates and sells about 4.4 GWhrs per month. It has been assumed that long term growth will also be around 4%. Plans are underway to encourage industrial and commercial growth in Linden as it becomes a hub for transportation to the interior, a staging centre for timber traveling to the coast for export and service industries related to these activities. The Linden regional load has been plotted in Appendix E.

For the purposes of this review, the Omai load has been deleted. Omai's management has advised that, based on current gold prices and ore reserves, the mine will close in 2005. The company is conducting ongoing exploration on an

accelerated scale and is hopeful of discovering more ore to feed the existing mill. To date, results have been negative.

In order to model the likely revenue stream to the Amaila project, it has been assumed that the project can be commissioned by Jan 1, 2007 with 100 MW of generating capacity available and sufficient stored water to permit normal operation through the two dry periods in 2007 (February – April, September – November). This date is taken from the Final draft EIA dated April 2002.

Mention is made in the Feasibility Study report of Amaila possibly supplying power to towns and villages in the project vicinity. Given the small loads likely from these communities, supply from the 230 kV transmission line is impractical. If supply to these communities becomes an issue, consideration could be given to extending a supply from the station service bus at Amaila, probably stepped up from the generation voltage of 13.8 kV to 35 kV or so.

8. SYSTEM LOAD FLOW

As an Independent Power Producer (IPP) with one major customer (GPL – the Linden load accounts for only about 10% of the GPL load), Amaila will strive to sell all its available output to that customer. The ability of the IPP to supply the load will be constrained by the amount of water available either in the catchment area or stored in the reservoir, the rating of the generating equipment and the transmission system and finally by the size of the load itself. There will also be secondary constraints such as scheduled and unscheduled outages. As long as the flow of water into the reservoir is equal to or greater than the flow required to produce enough electricity to handle the load, the plant operation at rated output is assured. However, when the flow of water required to the generators is greater than the amount of water flowing into the reservoir, the plant is then exhibiting a dependency on stored water. This dependency reaches 100% when there is no flow of water into the reservoir. In this situation, management of the available water becomes critical to ensure that it can be used to maximum benefit in the generators to suit the load. By matching water flow through the generators (and therefore the power output) to the available load, plant utilization can be kept as high as possible throughout the dry seasons.

There will, however, naturally be periods where GPL's load is smaller than the available water flow and Amaila will then be able to either store the water for future use, or spill it (when the reservoir is full) and lose the future opportunity to generate power and revenue from it. Conversely, there will be periods where GPL's load will be larger than Amaila's output (for example, during dry seasons

when water inflow to the reservoir will be less than the required flow to the generators and the volume of water stored in the reservoir is insufficient to make up the difference) and require that GPL therefore generate from other sources, assumed to be its existing diesel generating capacity (or part thereof).

The long transmission distance from Amaila to GPL's system at Sophia introduces two concerns:

8.1 Losses which occur during the transportation of energy from place to place, and

8.2 Voltage and frequency instability between no load and full load and during transient conditions such as switching and block load addition or rejection (such as when a fault occurs and when load is reapplied). Synergy/Harza has indicated that Amaila will require "voltage support" at Sophia in order to maintain acceptable voltage regulation to the GPL system and customers. This could be in the form of a shunt reactor or automatic voltage regulation via a regulator or on-load tap-changer on the main power transformers at Sophia or a combination of these.

Losses have been addressed by Synergy in its proposal by specifying a double circuit line with Drake conductor, which has a combined design capacity approximately four times the initial intended load of 100 MW. Losses are indicated in various references to be between 2 and 5%. This means that 2-5% of the energy generated at Amaila never reaches the load at Sophia. This is normal and reasonable for a line of this length.

The voltage and frequency instability concern is more significant and to date it has not been possible to quantify this problem. Further discussion is required with Harza and with GPL and its engineers at ESBI in Dublin, Ireland. The effect of the voltage issue is that GPL will (may) have to continue to use its own diesel generators to supply part of its load, therefore further limiting the ability of Amaila to maximize its energy output. For the purposes of this review, it has been assumed that Amaila is able to provide 75% of GPL's annual gross generation energy requirements and 90% of the Linden load. The assumptions are based on the assumed levels of difficulty each customer would have integrating the Amaila supply. As the GPL and Linden loads grow over time, the combined energy requirements will exceed Amaila's ability to supply. At that stage, it can be determined whether to share available supply between the customers or to provide more to one customer at the expense of the other. Based on transmission distances and losses, it would probably make most sense to supply as much of the Linden load as possible, cutting back accordingly on the

GPL supply. This split will, however, be determined by the PPAs which are agreed between Synergy and its customers.

9. ACCESS

The project is currently accessed by water via the Kuribrong River (3 or 4 portages are required), an all terrain vehicle track from Pamela Landing, a trail from Kaieteur Falls or helicopter from either Kaieteur Falls, Mahdia or an airstrip at Maple Creek. Before construction can commence, a new road must be constructed from Pamela Landing to the site, a distance of 41 kilometres. This road must be of sufficient load capacity and width to allow the transportation of the major earthmoving equipment required to develop the site and the installed equipment, the heaviest item of which will be the transformers at approximately 100 tonnes each. Normal road weight limit is 18,000 lbs per axle and minimum road width is 22 feet. One new bridge is required and several culverts will be needed to ensure adequate drainage. The Ministry of Public Works will determine road design and ensure adequate protection and drainage of water courses, erosion control, camber, grades, bend radii and signage.

Road access to the site also involves ferry crossings at Mango Landing and Pamela Landing, both on the Potaro River. Synergy has advised that the existing pontoon (ferry) at Mango Landing is adequate to transport the loads required, but that the pontoon at Pamela Landing is inadequate and will require replacement with a bigger unit. The remainder of the road from Pamela Landing to Georgetown is in good condition and will not require further upgrade.

In addition to the proposed access road which is to be located along the top of the two dams, it is recommended that alternative road access to the powerhouse be provided via a new road along the bottom of the escarpment and a bridge across the Kuribrong River. This route would provide continued access to the power house in the event that the dam were breached and access along the crest of the dams were lost.

The developers have also advised that a permanent airstrip will be built at Amaila. This will be essential once construction begins for ferrying the supervisory and senior labour force to and from site and for carrying out medical emergency evacuations should that be necessary. The airstrip must meet statutory requirements and the developers must obtain all relevant permits and approvals to construct and operate the facility.

10. HYDROLOGY

The project hydrology was first developed from data which was collected on the Potaro River over a 40-year period from 1950 to 1991. This data was used to infer the project water shed hydrology on the basis of an assumed flow ratio of between 0.24 and 0.40, which has been averaged to 0.30. This method of data transfer introduces potential inaccuracy into the project data, although Hydromet supports this type of statistical analysis as reasonable. Further sporadic stream flow analysis was carried out on the Potaro River downstream of the project at Portage Falls between 1975 and 1980, however the applicability of this data to the project may be limited as the water catchment area there is three times the size of the project water catchment area. Given the severe changes in global climatic cycles over the past decade, and the possible significant errors in using inferred data, further hydrological studies should be carried out.

The Government Chief Hydrometeorological Officer has advised that average annual rainfall has not changed significantly over the past 10 years or so. The most significant change is the rainfall pattern which tends to be more spread out across the seasons and occurs in more severe specific rainfall events. The spreading of rainfall through the seasons should be an advantage to Amaila in that the effect of the dry season should be less. The severe rainfall events however could lead to higher rates of silting and could require larger spill capacity to prevent dam overtopping.

The position taken by the developers is that because inferred average flows at Amaila Falls are 64 m^3/sec and the project at 100 MW needs only an average of 33.5 m^3/sec, there is sufficient safety tolerance in the figures to be reasonably sure that a plant capacity of 100 MW can be supported. The planned expansion (to 165 MW) would require a significantly larger reservoir to maintain plant output during the dry seasons.

11. RESERVOIR

The reservoir volume has been estimated to contain 180 million cubic metres with the dams currently envisaged. The active (or recoverable) volume is 146 million cubic metres. The estimate is based on scaling from 1:50000 scale topographical maps with 50 foot contours. The Final Environmental Impact Assessment Report advises that the assumed area could be out by plus or minus 13%. If this tolerance is assumed to carry over to volume (i.e. assume no difference in average water depth), then the contained volume could be between

157 and 203 million cubic metres. This level of accuracy must be improved before a construction decision is taken.

Clearing of the inundated area has been recommended in the environmental report to eliminate or minimize the resulting formation of gases such as CO_2 and methane. It was thought by Synergy that this work could be carried out at no net cost to the project as timber licences could be granted with the value of harvested timber offsetting the cost of recovery. It is now believed that this is not the case due to the long haulage distance and that there will be a net cost to the project of some USD 3 to 5 million to achieve a properly cleared and burned reservoir area. This cost has been included as an additional capital cost in this review.

In discussions with Forestry Commission personnel, we were advised that, while the usual government cutting fees would be waived for timber cleared for the overall project, the cut timber would be given to the local population.

12. DAMS

Two dams are to be built, one across the Kuribrong River and one across the Amaila River. The dams are to be built from local metamorphous rock and faced on the reservoir side with concrete or asphalt. Although the Kuribrong dam is located on top of a significant fault line, Synergy's geologist has determined that the fault can be grouted and sealed and that no unusual risk results.

A significant concern when building dams in areas of severe rainfall, is the possibility of the dam being overtopped. Extreme rainfall events appear to be increasing in frequency and magnitude and need to be addressed in designing and sizing the dams. Although beyond the scope of this review, it will be essential to carry out independent review of the dam and spill-gate design to ensure that the statistical 1000 year rain event is considered in their design. Similarly, the intake structure should be designed to permit easy access and clearing during a flood event and to withstand damage from large floating objects.

13. TUNNEL

The proposed water conductor (the tunnel from the reservoir intake to the top of the Falls) passes through an area thought to contain several geological fault lines. Due to the stability of the subsurface structure in the area and the low incidence of seismic activity, it is felt that these faults can be crossed without introducing

major additional expense to construction or risk to the reliability of the project in the long term. EPC bidders will note that geological drilling to date has determined that the local rock is very hard and very abrasive. This will no doubt impact on the cost of installing the tunnel and surge shaft.

14. PENSTOCK

The penstock which carries water to the power house from the vicinity of the Falls passes through an area of 'house-size' boulders which have been acknowledged to present a significant construction challenge. (Refer to the MWH Geology report page 31). This is an area for further research prior to making a construction decision as the cost and risk could be sizeable.

As proposed the penstock is of sufficient size for the 100 MW plant rating. Synergy proposes either to increase the size of the single penstock to accommodate the future plant rating of 165 MW or to allow the future addition of a second penstock if and when the plant is expanded. The intention is to request alternate pricing from the EPC bidders.

15. POWERHOUSE

The powerhouse is of a conventional design and will consist of four 25 MW Francis turbines in a concrete and structural steel building with one end wall removable for future expansion. The powerhouse is said to be located on solid bed-rock and is far enough away from the Kuribrong River to avoid flooding in the event that a 1000 year flood is experienced.

It is understood that Harza may be reviewing the optimal generator rating and may be considering five units of 20 MW unit rating rather than four 25 MW units. The smaller units may be more suitable to the intended market and may not result in significant additional capital cost.

Alternative road access should be provided to the powerhouse area via a bridge over the Kuribrong River and a road along the transmission line right of way, meeting up with the main access road east of the project site.

16. AMAILA SUBSTATION

The Amaila Substation is an outdoor substation adjacent to the powerhouse. 13.8 kV three phase bus will connect each generator to two step-up transformers which provide the transmission voltage of 230 kV. At present, drawings indicate proposed 230 kV buried cable from transformers to substation. Synergy should investigate the possibility of connecting overhead to reduce the cost and improve reliability.

The two transformers are proposed to have a base rating of 37.5 MVA, or 33.75 MW at 0.9 power factor. Above this output (67.5 MW) the transformers would need to rely on forced cooling from fans or pumped oil. This is considered inadequate for the 100 MW rating which will be required more in the future as the load grows and as the reservoir and dam are possibly increased to provide better security of supply through the dry months.

17. TRANSMISSION

The transmission line proposed is significantly over-built for the initial load. Construction includes a double circuit which means that either circuit could supply the load with the other out of service, providing 100% redundant back-up. This is considered necessary due to the long transmission distance. The conductor size has been selected to minimize losses and to provide the most stable voltage supply possible. (Long transmission lines tend to exhibit large voltage spikes when they are switched on and large voltage fluctuations between light load and full load conditions).

Synergy's proposed transmission design is considered most appropriate given the plant capacity, load and length of line. It is, however, suggested that consideration be given to revising the triangular configuration of the phase conductors to provide an overall higher, narrower profile. This will minimize the required width of the right of way (ROW) and thus minimize the amount of clearing and upkeep that the ROW will require. The ROW width is proposed as 40 metres and this is considered acceptable providing that higher trees outside this width are also topped or felled if they will pose a danger to the line.

Mention has been made by developers of using the existing 69 kV ROW between Linden and Garden of Eden for the 230 kV, however this ROW should be reserved for future secondary transmission, most likely at 69 kV. The 230 kV ROW should probably be established further to the east on this section.

18. CUSTOMER SUBSTATIONS

As discussed elsewhere, this review assumes that commercial load exists only at Linden and GPL in 2007 when this project comes on line. By that time Omai's ore reserves will be depleted and there will not be a load there worth connecting (possibly 1-2 MW). It is therefore assumed that transmission from Amaila would run direct to the Linden area where the first substation would be installed to supply power into the Linden Power Company power plant. LPC would then resell Amaila energy in place of the power currently being provided from LPC's aging steam and diesel power plants. The Linden substation would step down to 69 kV through two transformers (or alternatively a bank of single phase transformers) and would be rated for a future load of about 15 MW (present load averages about 6 MW without Linmine's dragline and bucket wheel which are scheduled to be retired by July 2002). The Linden substation would contain a shunt reactor required to support voltage at Linden. Some additional form of voltage regulation (on load transformer taps or a separate voltage regulator) may also be required. It has been assumed that LPC would continue to generate about 10% of its gross generation energy requirements in order to prevent total outages if Amaila supply is lost and to provide additional voltage support.

The Amaila 230 kV double circuit transmission line would then continue on to GPL's Sophia substation where a new 230-69 kV substation would be built adjacent to GPL's existing substation. In recent meetings, Synergy and GPL discussed an alternate delivery point at Garden of Eden, based on the system support offered by the generating capacity installed there. This item is still under review. If Amaila energy is delivered to Garden of Eden, GPL's Effective Marginal Cost of generation would increase, resulting in a further discount being applied to the Amaila selling price.

The GPL substation would contain two 50 MVA step-down transformers and a shunt reactor/voltage regulator for voltage control and stability. GPL is required to maintain some diesel generating capacity also to support the Amaila voltage supply and also for its own operating security reasons. (It should be noted that GPL is committed to completing several 69 kV interties within its present supply area prior to 2007. Included is the Demerara-Berbice intertie which will ensure that Amaila supply can benefit both regions).

19. EPC CONTRACT

It has been assumed that construction of the entire Amaila Falls project would be carried out by one EPC (engineer/procure/construct) contractor. This contractor would be selected following a competitive bidding process and would then be responsible for bringing the project from feasibility to operation.

Given the intention of project developers to award virtually the entire project design, supply and construction under one super-contract, it is recommended that the inquiry and tender process be commenced soon in order to confirm project cost estimates.

20. OPERATION & MAINTENANCE

The Feasibility Study Report contains an annual operating budget of USD 4.3 million. Synergy's financial model inflates this figure at 2% per year, however because all other figures have been expressed in constant 2002 dollars, this review removes that escalator. The O&M annual estimated cost should include sufficient allowance to cover future planned major overhauls by accruing a cash fund. The annual operating budget can then be levelized over time. Synergy should confirm that sufficient allowance has been made for purchase of heavy vehicles, availability of maintenance staff for trash removal from the spill gates and the water intake, maintenance of the reservoir and the dam, patrolling the watershed, clearing and patrolling the transmission line on surface and by air, maintaining the substation equipment and maintaining access roads and the airstrip. These requirements are in addition to the usual operating staff requirements.

It should be noted that crews should be available along the transmission line route to attend to faults with a minimum of delay. This will require crews and equipment at Amaila, near Omai, at Linden and in Georgetown. Synergy have not indicated whether they have allowed for live-line maintenance of the 230 kV transmission system, the first of its class in Guyana.

21. FINANCIAL MODEL

Synergy/Harza has produced a financial model for the project which has been provided in confidence for the purposes of preparing this review. Two schedules of costs were produced, Schedule A for a completion date of Jan 2006

and Schedule B with a completion date of Jan 2007. Based on Synergy's preliminary project schedule included in Appendix D and the schedule given in the final EIA, Schedule B has been used for this review. The total projected capital cost of the project as outlined in the financial model is USD 315 million. This amount includes a contingency of USD 13 million. It must be noted that the financial model was not included in the Feasibility Study Report and is not considered to be "bankable" i.e. of sufficient detail and accuracy to allow either project financing or final statutory approval. It is likely that accurate project capital costs will not be known until EPC contract bids are received. However, in the meantime, the following areas are felt to require additional costing analysis:

21.1 Access road to the project. This road will require construction to high standards and will require significant maintenance during construction, as it will be the only access for all earthmoving and construction equipment, some of which will be sizeable. Capital costs should include some upgrade from Mahdia to Pamela Landing, a new pontoon at Pamela Landing, 41 km of main road to the site, 15 km of secondary access to the powerhouse and two bridges (one on the main road and one at the powerhouse).

21.2 Clearing of flooded area. The project design includes the need to remove all vegetation from the area to be inundated. This requires felling of all trees, removal of all vegetation (except tree stumps) and burning off of the area. Despite earlier belief that reservoir preparation would be cost-neutral based on the value of harvested timber, it now appears that due to transportation distances, there could be a net cost to the project of USD 3-5 million.

21.3 EPC costs. The project has been structured to allow one EPC contract to cover the entire project, including road, clearing and site preparation, dam, water delivery system, power plant, substations and transmission line. Thus the EPC contractor will be responsible for all the project infrastructure costs including road access, air access, construction and permanent camp, borrow pits for construction materials, crushing plant, batch plant for concrete, workshops, warehousing, communications, water supply, sewage and waste disposal, etc.

21.4 Substation and transmission costs. Synergy's project costs do not allow for ROW costs. However, project cost must include an Occupational Survey by Lands and Surveys, Bartica office, detailed survey of the transmission line route, ROW and substations; acquisition of land, compensation to property owners, clearing and installation of an access

trail along the entire ROW. Substation costs should be increased to include for shunt reactors, voltage regulators, on-load tap changers on main transformers, spare main transformers and a powerline carrier/SCADA system between Amaila, Linden and Sophia.

In summary, it is felt that the capital costs included in the financial model could be low by about 10% which would result in a total project cost of about USD 350 million. The main items to be added are:

a)	Access road, allow	USD 5 million
b)	Reservoir clearing, allow	USD 5 million
c)	Concrete costs	USD 15 million
d)	Transmission and substations	USD 20 million
e)	Omai interconnect, delete	(USD 10 million)
	Original total project cost	USD 315 million
	New total project cost	USD 350 million

22. AMAILA SELLING PRICE FOR ENERGY

Based on the Synergy/Harza Feasibility study, the project requires full capacity sales from the first year of operation at USD 0.07/kWhr for firm power and USD 0.055/kWhr for non-firm power to provide the necessary revenue streams to allow the project to proceed. It is suggested that this rate be maintained over the long term as, following completion of the plant, Synergy will not be subject to inflationary pressures or other cost variables other than water fees, corporate taxation and payroll costs for operations personnel. Synergy had suggested an annual escalation of 2% on selling price, however as this would have to be approved by the PUC and passed on to GPL's customers it is recommended to not allow this escalator.

One other possibility is to allow Amaila's selling price to contain a fuel adjustment clause. This would follow GPL's avoided cost based on the alternative of fossil fuel based generation and could be applied on a percentage basis, e.g. if GPL's avoided cost were to increase by USD 0.01 due to increases in the unit purchase price of fuel, then Amaila's selling rate could be altered by say half that amount or USD 0.005. Similarly, decreases in fuel prices would result in a 50% reduction of the equivalent rate to Amaila's selling price. At all times, GPL's customers would be protected from the full impact of equivalent fuel price increases and would derive some benefit from fuel price decreases.

Alternatively, the Amaila selling price could be fixed over long periods of time, thus giving the customers of GPL full protection from fuel price changes, at least for that portion of the GPL load which would be served by renewable sources. The effect of fuel price changes to GPL's cost is defined in Appendix L.

Because GPL currently purchases its fuel in US dollars (accounting for the major portion of its operating costs), and because it is protected against significant currency exchange fluctuation in its licence, it is considered reasonable to expect GPL to purchase Amaila energy in US currency.

This review assumes that Amaila energy is sold at USD 0.07/kWhr for firm power and USD 0.055/kWhr for non-firm power. In the early years when the market is insufficient to cover Amaila's output, it has been assumed that the government will cover the revenue shortfall from a bond issue or other grant or financial concession (or a combination).

Synergy will need to review its required selling price as its total project capital and operating costs become more clearly defined.

23. GPL AVOIDED COST

GPL's current operating licence requires it to enter into a power purchase agreement with the Amaila Falls developer providing that a licence to develop and operate the Amaila Falls project is granted by the Government, and that certain terms and conditions are met.

These terms and conditions include approval by the Public Utilities Commission and "the principle that the purchase price paid by the Licencee (GPL) to the independent power producer (Amaila) shall not be greater than the Licencee's marginal cost of electrical energy generation". GPL is allowed to include adjustments to reflect incremental losses and other capital and operating expenses associated with the inclusion of the independent power producer in the Licencee's system, the term of the agreement and the expected reliability of the supply from the independent power producer's facility.

In the absence of published figures for the above, GPL avoided costs have been estimated based on data contained in the 2000 Annual Report and presented in a transparent manner to allow further discussion and agreement on the final figures. As these values form the basis of the allowable maximum pricing structure for Amaila supply and will need to pass scrutiny by the PUC, the

approach taken in this review is outlined in detail. Refer to Appendix G for calculations.

Three standard terms have been used to describe GPL's avoided costs of generation:

23.1 Marginal Cost. This is the incremental cost of adding new diesel generation and is assumed to apply to plant and equipment similar to the 10 MW diesel units currently under consideration for purchase by GPL. The marginal cost is short term and covers all capital costs including EPC (engineering, procurement, construction), GPL's internal project costs, financing and insurance of new plant, fuel, parts and consumables. It does not include corporate overheads, taxation, depreciation, indirects or staffing costs as it is assumed that new plant would be operated by existing staff. Marginal costs are presented in Appendix G as "without Amaila" and "with Amaila" to identify the differing levels of operating efficiency likely under both scenarios.

23.2 Effective Marginal cost. This cost is specific to the Amaila Falls project and covers the allowances made in the GPL licence. This includes an amortized allowance for GPL's capital cost to accommodate the Amaila interconnection (substation equipment, protection and control, civil/structural works, communications systems and similar) and operating costs which include hiring of new staff, development of new operating and dispatch procedures, training and similar. Also included here is an allowance for "incremental losses". It should be noted that, if it is decided to locate the Amaila delivery point at Sophia, there will be a net decrease in GPL's system losses as the Amaila power would displace power currently generated at Garden of Eden and transmitted at 69 kV to the Georgetown region. At this point, and until such time as the delivery point is decided (Sophia or Garden of Eden), it is suggested that incremental loss adjustment be considered to be zero.

23.3 Long Run Average Cost. This is the average life cycle cost of generation brought back to a net present value and applied on a unit cost basis. This cost includes all GPL's operational costs associated with generation and includes administration, management, taxation, insurance, labour, overheads and indirects. It has been assumed that this cost will be reached in year 11 of the Amaila supply and that the initial Effective Marginal Cost will ramp up in a linear fashion to reach the Long Run Average Cost.

In estimating GPL's avoided costs it has been assumed that the most expensive and inefficient of GPL's current plant would have been replaced before Amaila supply could commence. This includes replacement of GPL's high speed Caterpillar 3500 series units and the steam units at Kingston. Further, it has been assumed that the 50 to 60 Hz conversion will be complete before Amaila begins supply and that the frequency converters at Sophia will have been retired. However, countering this likely improvement in operating efficiency, we have assumed that, with more capital investment, carrying charges and staffing costs will be higher and will offset the effect of efficiency improvement on total annual operating costs.

In assessing GPL's avoided costs it could also be argued that, with an IPP of the size of Amaila being connected there will be an aspect of temporarily stranded costs due to underutilization of recently purchased generating capacity, specifically the 30 MW of new diesel generation scheduled for installation at Garden of Eden by 2006. This aspect has been considered but at a discounted rate. Over time, near new diesel equipment will be required to operate on an increasing schedule as the GPL system load continues to grow beyond the ability of Amaila to supply it (after 2017 Amaila cannot meet 75% of GPL's energy requirements).

Based on the calculations included in Appendix G, GPL's Marginal Cost of generation in constant 2002 US dollars is USD 0.073/kWhr, its Effective Marginal Cost is USD 0.072/kWhr and its Long Run Average Cost is USD 0.096/kWhr. These figures are based on an average purchase price of fuel by GPL of USD 20.50/barrel for the No. 6 low sulphur, low vanadium fuel which is assumed to account for all fuel used for generation by 2007. A sensitivity analysis of GPL's avoided cost vs. fuel is included in Appendix L.

24. REQUIRED FINANCIAL SUPPORT FOR AMAILA

Based on GPL's avoided costs and the likely revenue requirements of the Amaila project, it is apparent that there will be a revenue short fall in the first several years of operation. This short fall could be reduced by a larger than planned increase in the electrical energy market or it could be exacerbated by slower than forecast load growth. It is hoped to be able to mitigate the effects of this short fall during the ongoing development period of the project by seeking and obtaining assistance from existing and emerging support programs. These include the Global Environmental facility, the Clean Development Mechanism under the Kyoto Protocol and the proposed BioCarbon Fund. Once these sources of financial support have been applied (grants, concessionary financial,

carbon credit trading, etc) it is likely that there will remain a residual revenue short fall which the Government of Guyana may have to address. One possible mechanism for government support would be via the issue of bonds. These bonds would be issued in advance of the likely revenue shortfall (i.e. in years 1 to 10 of project operation) and would be redeemed through a surcharge on Amaila's selling price once that has been reduced following the project's repayment of debt and allowing a breathing period for equity partners to realize their required returns. This is envisaged to occur after, say, year 20 or 25.

This review models the shortfall between Amaila's rated average output of 775 GWhrs/year and the likely market during the first 10 years of operation. Based on the predictions used, the accumulative revenue shortfall to Amaila will be approximately USD 80 million starting with USD 15 million in the first year of operation and decreasing to zero after 10 years. This revenue shortfall would be paid to Amaila to top-up its required income stream and would be repaid to bond investors after 25 years from a surcharge on Amaila's energy selling price (which by that time will have dropped to USD 0.035/kWhr or so).

Alternatively, the government could borrow the capital required to build the transmission portion of the project (estimated to cost approximately USD 80 million), introduce a wheeling charge starting at zero and rising over 10 years as Amaila's revenue gap shrinks due to higher sales. The transmission loan would be repaid from wheeling charges. After 10 years, Amaila's energy selling price would be approximately USD 0.05/kWhr in 2002 dollars and the Government's wheeling charge would be about USD 0.02/kWhr, both expressed in 2002 dollars.

25. CURRENCY EXCHANGE RISK DUE TO GOVERNMENT SUPPORT

In the event that final financial evaluation confirms the need for government support to meet a revenue shortfall, the government will need to inject approximately USD 80 million over the first 10 years of operation. These funds could be provided from government bonds which would be floated in Guyanese currency and redeemed after year 25 in the same currency. These monies would require conversion to USD to meet the projects revenue requirements. Based on historical performance of the GUD compared to the USD, it is likely that the amount of funds required in GUD at the time of redemption would be GUD 70,115 million or an increase of 200% over the funds originally floated. This is based on an average annual devaluation of the Guyanese dollar compared to the US dollar of 5.4% (historical average over the past 10 years) and a bond interest rate of 8% p.a. Refer to Appendix M. The chart in Appendix N shows the

accumulating bond debt. This starts to drop in year 25 as bond repayment starts. The accumulating bond debt peaks at GUD 64,000 million.

Redemption of bonds would therefore require a surcharge on the selling price of Amaila power of approximately USD 0.02/kWhr declining over 10 years. If Amaila were to require a base selling price of USD 0.035/kWhr after year 25 in constant 2002 dollars, this would result in a continuing total selling price of approximately USD 0.07/kWhr out to year 2042. Beyond this period the net selling price could return to USD 0.035/kWhr for the remainder of the project life. This reduction could then be passed on to the retail customers of bulk purchasers like GPL.

26. STATUTORY APPROVALS

According to the final EIA, the following Government of Guyana ministries have jurisdiction over environmental compliance issues:

Ministry of Health
Ministry of Agriculture (issues water lease)
Ministry of Public Works and Communications
Ministry of Trade, Tourism and Industry
Lands & Surveys Commission
Forestry Commission
Ministry of Housing
Civil Aviation Department

The Ministry of Health has responsibility for environmental health and pollution control. The Ministry of Agriculture exercises control over state lands and surface water through the Hydrometeorological Department. The Ministry of Housing exercises control over ground water through the Guyana Water Authority. The Ministry of Public Works and Communications exercises control over the access road and telecommunications.

The Amaila project will require compliance with the following:

Environmental Protection Act
Environmental Protection Water Quality Regulations 2000
Hydroelectric Power Act and Regulations
Town and Country Planning Act
Public Health Ordinance
Occupational Safety and Health Act 1997

Forestry Act
Guyana Energy Agency Act 1997 (covers issuance of the Interim Licence)
Electricity Sector Reform Act 1999
Public Utilities Commission Act 1999

In addition to the above, the Guyana Geology and Mines Commission has issued mining concessions in the area of the project and its water shed which would be terminated. As these small concessions are renewed annually, there is sufficient time to terminate them by refusing renewal at the time of expiry. A reconnaissance concession has been granted to Migrate Mining which covers the entire project area and allows non-intrusive exploration over 4 million acres until 2004. Migrate will then be required to limit further exploration to specific sites of interest and these will be covered by smaller concessions.

See also Appendix O – Draft PPA, Schedule 3.

27. SCHEDULE

The Final Environmental Impact Assessment (EIA) contains a Section 2.2 "Project Development Process and Schedule" which is repeated below for reference:

"Because the project will likely be financed under a non-recourse project financing arrangement, it will likely be required that engineering, construction, equipment procurement, installation and testing be performed under a turnkey project delivery system where a single supplier takes all schedule and performance risks for delivery of the project and all of its components, including 296 km of 230-kV double-circuit, transmission line and related facilities. The construction contractor/equipment supplier would enter into a contract with the Developers for the project development. The terms of the contract for the construction and equipment supply would need to be structured so that most of the environmental compliance requirements during the construction phase are implemented by the construction contractor. The Developer oversees the development process, and is always the responsible party. Where necessary, the Developer brings in individuals or resources necessary to execute the requirements to comply with the environmental requirements that may result from this EIA.

Before any construction takes place, it will be necessary to secure debt financing commitments for funds to construct all features required for the successful operation of the project. Debt financing for a project like Amaila Falls would likely require involvement of large multi-lateral financing institutions with strict environmental compliance requirements. This document is intended to substantially meet the requirements of such institutions, although supplemental work may be required as some

Project elements are defined further in continuing development work (the transmission line, for example).

To achieve "financial closure", the Developers must work on a number of fronts to advance and complete all of the elements required for a successful project development. The Developers must negotiate financially and commercially viable energy supply contracts with potential customers for delivering the estimated 100 MW and 775 GWh of average annual energy that can be produced by the Project. The Developers must prepare technical specifications for the design and construction of the Project, obtain bids from qualified construction contractors, negotiate a financable project delivery (construction and equipment supply) contract, negotiate agreements with the Government of Guyana and its agencies with respect to: land acquisition and rights, water rights, rights to deliver and supply energy; road building permits, forestry and timber cutting, mineral rights, environmental clearances, and company formation and agreements to operate and do business in Guyana. The Developers must also arrange for financing, a large part of which is proving to the potential lenders that all other issues as mentioned above are addressed. The time required to accomplish all activities required for financial closure is estimated at 1 to 2 years. Planning and final clearances for construction of a road to the project site will require about one year, and construction of the road itself will take another year. Project construction will require a three-year period after the road is finished. The overall development process involving preconstruction activities and project construction is expected to require 4 to 5 years to complete, beginning January 1, 2002. The expected project completion date is December 31, 2006."

In accordance with the above schedule, this review assumes that revenue income from the project will commence on Jan 1, 2007 and that the major site construction will occur in the years 2004, 2005 and 2006. To date, Synergy has not produced a detailed project development schedule.

28. DEVELOPER PROFILE

The project is being promoted by the development team of Synergy Holdings Inc. (Synergy) of Pompano Beach, Florida, USA and Harza International Development Company LLC of Chicago, Illinois, USA (Harza) who presently operate under a Joint Development Agreement. Synergy is represented by its President and CEO, Mr. Makeshwar (Fip) Motilall and Harza by its Vice President of International Development, Mr. Patrick Hartel. Synergy is represented in Guyana by General Manager Mr. Patrick Ketwaru. Corporate Financial Statements for each company are included in Appendix B.

It is the intention of the present partners to form a Guyanese based project development and operating company to be known as Amaila Falls Hydroelectric Power Company, or similar. However, until such time as the Guyanese project and operating company is formed it is not known what structure this entity will take or which companies or principals may be involved. This makes it difficult for potential customers to assess the business risk of entering into legal agreements at this time. With due respect to Synergy, it is obvious that this corporate entity does not have the financial or technical capability or the project development experience to develop the Amaila project alone and this is not its intent. It is therefore important for Synergy to finalize the new corporate entity.

(Note: Synergy President, Mr. Motilall recently advised that possible development partners include Leucadia National Corp, ABB and IFC. Harza would remain as Owner's engineers. It is not known what the prospective partners' level of interest, commitment or capability is at this time).

29. POWER PURCHASE AGREEMENTS

Project developers will require some commitment from prospective customers in order to secure the necessary financing for the project. At the time of this review, it appears that two potential customers exist. The main one obviously is GPL and the second one is Linden. Omai has been dropped from the study until such time as it becomes apparent that they will still be in operation when the project comes on stream, with sufficient proven reserves to permit a commitment to a PPA.

In principle, there will be little difference between the PPA required with GPL and that required with Linden, although it is fair to say that GPL's concerns will be greater and it will be the larger and more important customer when it comes to shedding priority. Also, Amaila will likely require more voltage support from GPL, making that relationship more complex.

A draft PPA was presented by Synergy/Harza for consideration by GPL. At this stage, GPL has indicated that it is not in a position to negotiate or sign a PPA with Amaila, subject to further data being developed by the project proponents and pending evaluation of the technical issues regarding supply from Amaila. As far as it goes, the format of the draft PPA proposed by Synergy is acceptable, however it lacks certain terms and conditions which would be usual in a "take-or pay" PPA. Take or pay means just what it says – the customer agrees to take and pay for a certain amount of energy over an agreed period of time for an agreed price. What the draft lacks, however, is the offsetting requirement that the

Customer needs, namely that the IPP must guarantee the quality of energy available, the quantity (with conditions), and the availability. The last condition (availability) refers to both the amount of hours in a year which the IPP guarantees to have suitable energy available, and it also applies to the date on which energy of agreed quality and quantity will be available. This is required because as soon as the customer has agreed to take and pay for energy from the IPP, his other development plans change and he begins an increasing dependence on the IPP (along with his own customers) as he defers or cancels other orders for diesel generation, for example. It is reasonable that, in the event the IPP cannot deliver his intended energy on the agreed date, he provides energy of acceptable quality, quantity and availability from an alternate source to the customer. The IPP is responsible for this alternative source and arranges it at his own responsibility and cost and he provides it to his customer under the same technical and commercial terms as the Amaila supply.

The above suggestions have been incorporated into the draft PPA which is included as Appendix O.

30. SUMMARY & RECOMMENDATIONS

The Synergy feasibility study report states in a conclusion: "The Project appears to be an economically and technically viable project". With further work, it is hoped that all participants can endorse that opinion. Regarding Synergy's recommended course of action the following should be noted:

a) Project infrastructure costs (access road, reservoir and transmission line clearing, ROW development) must be borne by the project,

b) Financing of the transmission line must be included in the project scope,

c) The Government will not provide guarantees for project debt financing.

If the project were to proceed to completion by January 2007, it is unlikely that there would be a market for its full output. Our load projections show that, in fact, it could be 2016 before the energy market is sufficiently large to accept the rated output of 775 GWhrs of energy per year.

We believe that it will be prudent (and indeed may be a requirement to securing financing) to carry out additional hydrological data collection on the Amaila and Kuribrong Rivers at the project site. Despite appearances that a sizeable safety

margin exists, it is critical to establish minimum flows through the dry seasons to be able to better define true firm power.

Project costs are likely to exceed the figures so far projected. The isolation of the project will result in significant access and freight costs which appear to have been underestimated. Concrete costs are likely to be approximately twice what has been allowed, resulting in an additional USD 10 to 15 million in construction costs. Transmission and substation costs will likely prove to be USD 10 to 20 million higher than those included in the financial model, once ROW establishment costs and substation requirements are defined.

Due to the long distance between the project and the load (mostly GPL), reliability and stability of power is of vital concern. Synergy has stated that the project cannot supply the DBIS without diesel generation being maintained by GPL to provide voltage stability and power factor (VAR) compensation. This limits the project's ability to sell its output. The same situation applies to the Linden load. For the moment, it has been assumed that the project must proceed without the Omai load as their ore expires in 2005 unless ongoing exploration is successful.

Recommendations:

a) Proceed to collect hydrological data. A permanent station should be set up at the base of Amaila Falls and should record daily stream flow volumes from now until such time as flow is curtailed as reservoir filling occurs.

b) Proceed with a definitive system load flow study in consultation and in agreement with GPL and Linden. The object of this exercise is to maximize the amount of energy Amaila could supply to GPL and minimize the need for GPL to operate supporting diesel generating capacity.

c) Further investigate ways to "bridge the gap" between the cost of power required to fund the project and the marginal cost of power that GPL and Linden otherwise face. One suggestion has been to float government bonds which would be used to bridge the gap in the first years of operation and then could be redeemed from an energy surcharge payment once project debt has been paid.

d) Look for alternative/additional energy markets, either in the region of the project or in neighbouring Venezuela or Brazil.

e) Proceed to negotiate agreements in principle with likely major customers.

31. ACKNOWLEDGEMENTS

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The Management of Linden Power Company, Inc refused to cooperate in the development of this review.

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