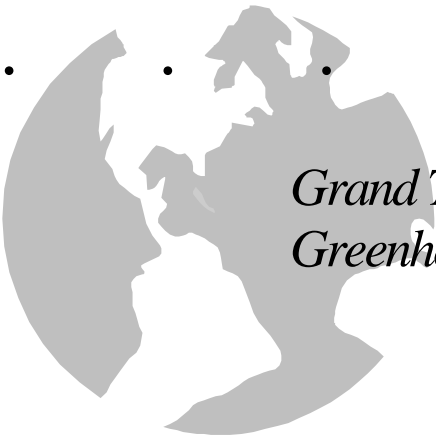
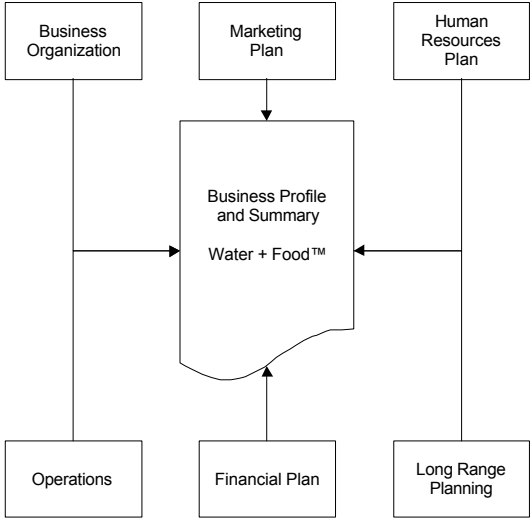


Batavia Greenhouse Builders Ltd.

Financial & Commercial Viability Study



*Grand Turk Solar Desalination
Greenhouse for Water + Food™*



Abstract

This Financial and Commercial Viability Study is 'Deliverable 2' of the Grand Turk Solar Desalination Greenhouse (SDG) Viability Study. It is addressed to the supporting agency, CIDA INC; people and government of Turks and Caicos Islands (TCI); suppliers and advisors to the project, and potential investors and financiers.

A customized financial model is the core of a Business Plan that allows us to simulate and analyze a business producing fresh water and food crops in Grand Turk (GT).

Selected aspects of the economy are reviewed. TCI (population 25, 000) has an economy based on tourism, offshore finance, and fishing. Imports exceed exports and there is a need to improve the balance of trade. Tourism visits exceed 165,000 annually and are growing at a 10% rate. Agriculture is limited. Electric power is provided by diesel-fueled generating plants. TCI has constrained fresh water resources, especially on Grand Turk. Airfreight is the main mode of transporting goods within TCI. Marine container services are adequate to Providenciales.

Primary data from a survey of TCI businesses handling produce and/or water was collected during September 2002 fieldwork. The data provides a means of initializing the model so it represents a greenhouse growing a realistic crop mix. The data allows us to assess imported food quality, food/bottled water distribution, delivery preferences, cool storage capacity, and tourist demand for produce.

Our Business Plan reviews required financing and sources. About USD 3.5 million is required to establish the business. The plan suggests a business organization for the 3500 m² greenhouse. Production planning focuses on common imports. These are commodity produce (tomatoes, sweet peppers, and lettuces) and produce considered as specialty due to high import cost and/or poor shelf life (cucumbers, eggplants, green beans, culinary herbs, strawberries, and cut flowers). Fresh water sales are modeled as being to a mix of greenhouse crop irrigation, a community standpipe, co-operative garden plots, the government water utility, tanker trucks, and a bottled water plant.

Volume of sales of water and produce by the third year of operation is projected to be USD 4.75 million. A selling price model is presented. Competition in the produce and water sectors is analyzed. Constraints such as energy costs, transportation costs, human resources, and the small regional economy are discussed. Marketing of greenhouse products as a *case lot operation* is discussed in terms of production, handling, transport, pricing, and selling.

Input costs in our financial model are discussed. Quality assurance is essential to realize the modeled production levels. The Grand Turk SDG will be the first commercial enterprise to achieve temperate-climate conditions at a subtropical site while producing 200,000 litres/day of surplus fresh water. Grade-making targets, tailored to TCI are suggested.

Net farm income is projected to be USD 755,161 in the third year. Return on investment is expected to be 18% in year 3. Sensitivity analyses show that the financial success of the proposed business is tied to energy, employee compensation, financing, and water bottling costs. A 40% wind / 60% diesel option as the autonomous energy source for the business is examined for viability. The analysis revealed that grid energy costs for a large development (currently USD 0.17/kWh) would have to rise above USD 0.23/kWh to effect payback periods of less than 10 years.

Our financial model and Business Plan demonstrates that the GT SDG is financially viable because capital costs, financing costs, and operating costs are all in satisfactory relationships to projected revenue. Commercial viability seems assured from analyses of our primary data

and numerous discussions with entrepreneurs and government officials, all stressing the strong demand for locally produced food and for alternative sources of potable water.

Bottled water sales have a dramatic impact on the revenues possible for the operation, although water bottling might consume only 4%–18% of the fresh water produced by the greenhouse system. The attractiveness of the SDG technology may depend as much on water bottling expertise as horticultural expertise. The partnership that forms around this project should not forego an immediate diversification into water bottling—the case is compelling.

We conclude with a 'next steps' approach to further research and joint venture formation.

Delivered to CIDA INC November 13, 2002. Financial and Commercial Viability Study Team: Bob Crocker, Site Specific Structures, 3785 - 202 Street, Langley, BC, V3A 1R9 and Roland V. Wahlgren*, Atmoswater Research, 2116 Grand Boulevard, North Vancouver, BC, V7L 3Y7.

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Financial & Commercial Viability Study

Grand Turk Solar Desalination Greenhouse for Water + Food™

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Financial & Commercial Viability Study

Grand Turk Solar Desalination Greenhouse for Water + Food™

1 Description

This report is addressed to the Canadian International Development Agency Industrial Cooperation Program (CIDA INC) as *Deliverable 2 of the Contribution Agreement E4936-K060831 with Batavia Greenhouse Builders Ltd. for the Viability Study — Solar Desalination Greenhouse — Turks and Caicos Islands.*

A Solar Desalination Greenhouse (SDG, Fig. 1-1) comprises a system of producing fresh water and food along arid subtropical or tropical coastlines by:

1. Bringing ocean water into a greenhouse and encouraging evaporation of pure water molecules into the air inside the building;
2. Cooling the greenhouse space by evaporative cooling;
3. Condensing pure fresh water out of the greenhouse air by means of a condenser array cooled by a flow of cold ocean water pumped from depths of 100's of metres; and
4. Irrigating the greenhouse crop with condensed fresh water.

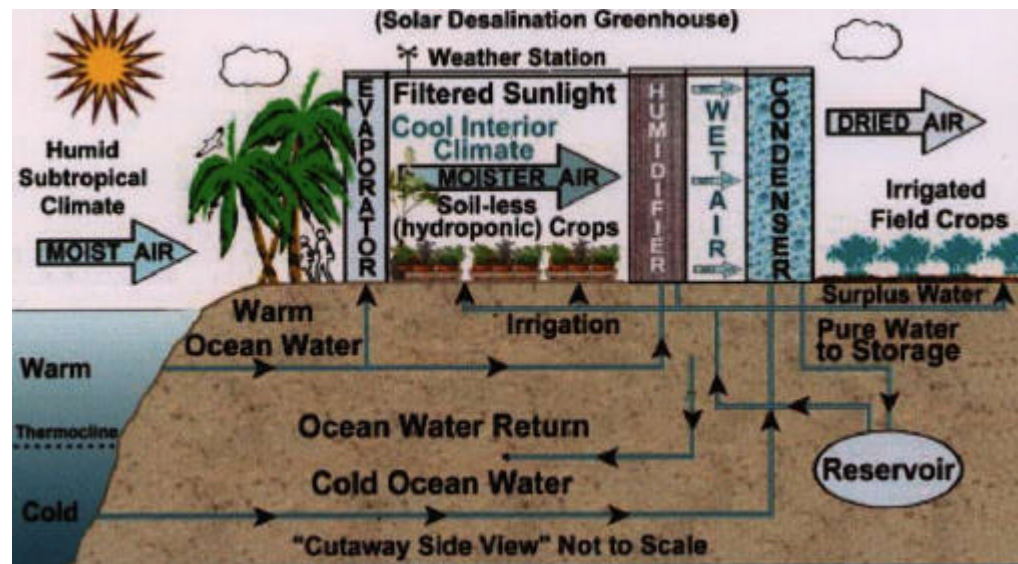


Fig. 1-1. Components of a solar desalination greenhouse.

The *Technical Feasibility Study* report described the historical development of solar desalination greenhouse technology and presented details of our proposed site on Grand Turk. It discussed the functioning of our thermodynamic simulation model, forecasts and crop models. A design for the greenhouse was presented along with the rationale for optimizing performance. The results of the study included water production and greenhouse climate values, outline drawings, equipment requirements, energy consumption estimates, and approximate capital cost. The co-authors of the present report built on this information to analyze the financial and commercial viability of the Solar Desalination Greenhouse in the context of Grand Turk.

1.1 Financial viability

Our products will be

- Pure fresh water;
- Fresh temperate-climate vegetables and herbs; and
- Fresh temperate-climate cut flowers and potted flowering plants.

The financial viability study addressed

- Market conditions in the British Overseas Territory of Turks and Caicos Islands (population circa 25,000), with emphasis on the two most populated islands of Providenciales (18,000 people) and Grand Turk (3,700 people);
- Human resources for a proposed operating company, including organization of responsibilities and duties, compensation and benefits, and training goals;
- Operations, including: the construction phase and commissioning; level of investment in land; buildings, site improvements, and equipment; supply chain management; crop selection; and production strategies;
- Financial Plan, including spreadsheets and financial indicators; and
- Long range planning

1.2 Commercial viability (market study)

Commercial viability exists in two contexts:

1. Grand Turk (island with 3,700 people);
2. Turks and Caicos Islands (territory with circa 25,000 people and 165,000 tourist visits annually);

The market study was aimed at refining revenue expectations. We interviewed business people on the islands of Providenciales and Grand Turk. Businesses in the following categories were surveyed:

- Florists
- Food Wholesalers and Importers
- Restaurants
- Supermarkets
- Water—Bottled and Bulk

Quantitative and qualitative survey information collected in September 2002 allowed us to assess the commercial viability of the proposed Greenhouse enterprise.

1.3 Study team

Bob Crocker, Site Specific Structures, and Roland Wahlgren, Atmoswater Research, have refined continually the information in the financial model first presented to CIDA in May 2001. They met regularly with Aar Koeman, Managing Director, Batavia Greenhouse Builders Ltd. and Terrence Nylander, our advisor for Business and Corporate Development. A major milestone was the ability to integrate results from the Technical Feasibility Study completed in June 2002. Further refinements were possible after they visited Providenciales and Grand Turk in September 2002. This resulted in obtaining food consumption data for the two islands for selected fruits and vegetables. This information was essential for demonstrating that the Greenhouse would indeed be a viable commercial enterprise with sales of fresh water, vegetables, fruits, and fresh cut flowers resulting in a long-term return on investment projected to be at least 15%.

2 Methodology

Weekly meetings were held throughout the study period July through October 2002. These were generally two hours in the boardroom of Batavia Greenhouse Builders Ltd. The meetings addressed:

- Crop yields, spoilage factors, production costs (plant materials, horticultural supplies, labour), and pricing;
- Fresh water yield and seasonal production trends, distribution channels, storage costs, and pricing;
- Industry and market trends;
- Political and legal constraints;
- Competition in both the produce and water markets;
- Design of a quantitative and qualitative survey procedure to be used when visiting Turks and Caicos Islands during the field work component of the study;
- Customer categories and representative targets, strategies to overcome possible sales barriers, and realistic rates of market penetration;
- Promotion and advertising;
- Operating company organization, employee functions, compensation and benefits;
- Training methods for production labour (objectives, perceived barriers, indicators for successful participation and subsequent staff development);
- Land, buildings and facilities costs;
- Equipment costs;
- Production strategies for crops and fresh water;
- Construction and Production schedule;
- Sales Methods;
- Proforma Income Statement; Proforma Cash Flow Summary; Proforma Projected Assets, Liabilities, and Owner's Equity; Proforma Capital Sales and Purchases; Proforma Loan Summary; Proforma Financial Performance Indicators;
- Value added businesses that could be associated with the Greenhouse;
- Mission statement for operating company; and
- Long-range planning.

A visit to Providenciales and Grand Turk, September 16–23, 2002 by Bob Crocker and Roland Wahlgren involved the following activities directly related to this report:

- Discussions with Nicholas Turner, former manager of the hydroponics farm at Crisson Plantation in the 1980's—provided insights into the social context the Greenhouse business would operate in.
- Visit with Titus de Boer, President, Providenciales Chamber of Commerce—gave guidance on several of the more progressive importers and restaurant buyers of fresh produce and contact names;
- Personal calls to produce buyers including hotels, resorts, restaurants, grocers, florists, and institutions—obtained primary data on fresh produce imports and other qualitative information—all collected on a standard survey form;
- Conversations with the owners of the two local bottled water manufacturing firms on Providenciales—provided water related data for standard survey form;
- Dialogue with the Honorary Canadian Consul, Hugh McLean, concerning TCI regulations about inward investment into approved projects;
- Meeting with Ian Harrison, owner of Island Fresh Produce Company Ltd, the hydroponics farm in Providenciales—gave important insights into the fresh produce specialties market in TCI;
- Talks with Paul Day, Managing Director, Columbus Foods Ltd. (Batavia's host country partner for the CIDA Project)—updated on progress of Financial and Commercial Viability Study—received advice on transportation and distribution issues—preliminary discussions concerning the operating company structure;
- Round table meeting with TCI's Director of Planning, Arlene Dixon, and seven of her staff (attendees listed in *Appendix*)—preference for renewable energy sources, food security, dietary improvements, local content of business development, value added components for local entrepreneurs (secondary and tertiary businesses), need for alternate fresh water sources, sustainability of Greenhouse business, employment opportunities, how TCI might benefit in subsequent technology transfers, export potential, youth issues;
- Received population statistics from Nigel Sadler, Director, Turks and Caicos National Museum;
- Obtained tourist visits statistics from Jackie Mulligan, Turks and Caicos Tourist Board
- Presentation to Ervine M. Quelch, O.B.E., Chair of TCInvest—overview of Greenhouse project; and
- Numerous discussions with Seamus Day, our liaison on Grand Turk.

The co-authors take this opportunity to thank all of the people we met for giving generously of their time, often on short notice.

2.1 Financial viability

Our Business Plan is based on the format recommended by the Province of British Columbia Ministry of Agriculture, Fisheries, and Food (BCMAF, 1995). The resulting financial model was adapted to simulate a business using the Solar Desalination Greenhouse technology as the core of its operation, once the fresh water production volume, energy requirements, and details of internal climate were known. These variables were quantified via the work of the Technical Feasibility study team and determine effectively the climatic range for crop economic production and the volume of surplus water that can be offered for sale.

The financial model was assembled as an Excel 97 spreadsheet by Atmoswater Research. The *Business Plan* version presented in the *Appendix* has been revised to incorporate the findings from the Technical Feasibility Study and the Regulatory Framework Study. The model presented with this report has now been improved to evaluate various strategies in water distribution and crop selection.

While the level of detail remains similar to earlier business plan version, there is a new level of accuracy with construction costs ($\pm 5\%$ level) and operating costs. In contrast to a sophisticated greenhouse project in British Columbia, we generally observed a +10% logistics factor for material supply, but a -20% labour factor adjustment.

The resulting Business Plan is largely geared toward a prospective investor audience. Apart from the essential interrelationships with market development, there was a simultaneous effort to insert more accurate perspectives of the training plan and social analysis components in progress. Because detailed environmental assessment follows, many potential stewardship costs are approximated.

Upon publication, the Business Plan will be distributed to actively concerned persons or agencies. Further circulation will target parties capable of building momentum for financing commitment in December 2002.

2.1.1 Business Organization

The structure of the proposed operating company has been discussed. We met with Paul Day, Managing Director, Columbus Foods Ltd, (host country partner), Seamus Day (Liaison on Grand Turk), Aar Koeman, Managing Director, Batavia Greenhouse Builders Ltd., and Terrence Nylander, advisor for Business and Corporate Development. The group anticipates full continuity of the participants focusing beyond development through to the joint venture stages of the project. Major investors, particularly those with existing interests in water bottling or food distribution, may be invited to participate.

2.1.2 Marketing

2.1.2.1 Development of Commodity Sales and Prices

Miami Terminal wholesale prices for selected fresh produce, published on the United States Department of Agriculture web site for Fruit and Vegetable Market News (www.ams.usda.gov/mnreports) are used to establish base prices for horticultural products.

A method of fresh water costing recommended by the United Nations (1985) was used to estimate the cost of the fresh water produced by the Greenhouse.

2.1.2.2 Industry and Market Trends

Primary data was collected from personal interviews.

Secondary information was obtained from sources such as TCInvest, *Times of the Islands*, *2002–2003 Turks & Caicos Islands Communications and Community Services Directory*,

Turks & Caicos Islands 2002–2003 Annual Visitors Guide, Turks and Caicos Free Press, and Snapshot (The Tourist Board's Official Monthly Guide to the Tourism Industry).

2.1.2.3 Political and Legal Constraints

Information relevant to the present report was summarized from *Report on the Regulatory Environment...* by Merry (2002). TCInvest provided additional intelligence.

2.1.2.4 Competition

Primary data was collected during the survey of TCI businesses. Produce and water price ranges and supplier service satisfaction were noted.

2.1.2.5 Customer Analysis and Response

Primary data came from personal visits to TCI businesses that were surveyed.

2.1.2.6 Promotion and advertising

Ideas were generated during weekly project meetings. During our various team members' trips to Turks and Caicos Islands we collected representative weekly, monthly, and annual publications suitable for posting advertisements and submitting press releases.

2.1.3 Human Resources

The employee plan, organization chart, compensation/benefits, and labour/training goals evolved during weekly project meetings.

2.1.4 Operations (Production Plan)

Aar Koeman, Managing Director, Batavia Greenhouse Builders Ltd., and Bob Crocker, Site Specific Structures researched and provided cost information for buildings, facilities, and equipment. Materials and supplies costs came mainly from information published by the BCMAF. Production Strategies and the Construction/Production schedule have evolved through debate at weekly project meetings.

2.1.5 Financial Plan

The presentation of the financial plan in terms of an Income Statement; Cash Flow Summary; Projected Assets, Liabilities, and Owner's Equity; Capital Sales, Purchases; Loan Summary; and Financial Performance Indicators were discussed at weekly project meetings.

The Income Statement for horticultural products is the result of a particular growing area allocation. It was based initially on quantitative food consumption data provided by the survey of TCI businesses.

Recognizing that the Solar Desalination Greenhouse process of fresh water production can be described by a water for energy formula (Wahlgren, 2002, section 9.2.1), energy costs are important. Autonomous wind-diesel energy costs came from the *Technical Feasibility Study* (Lodge, 2002; Wahlgren, 2002). Local grid energy costs came from TCInvest (2002).

2.1.6 Long Range Planning

Planning for the long-term was discussed at the weekly project meetings. The current Business Plan differs from earlier versions primarily with respect to energy security (wind power advantages insufficient at present) and diversification into water bottling (moved to coincide with initial construction).

2.2 Commercial viability

2.2.1 Industry and market trends

The survey form provided primary information about

- Vegetables and fruits grown locally;
- Business owners' opinions on relative importance of import substitution for fruits and vegetables;
- Distribution channels for fresh produce;
- Ideal delivery frequency for fresh produce;
- Adequacy of the premises' cool storage capacity;
- Quality of imported produce;
- Cut flower demand;
- Fresh water distribution channels; and
- Relative importance of tourists to the fresh produce market;

For purposes of baseline description during the CIDA supported study, we limited our investigation to three groups:

1. Buyers from TCI-based wholesale produce distributors (all sell retail as well);
2. Restaurateurs, their chefs or their managers; and
3. Key institutions (hospitals, schools, and prisons).

Interviews with wholesale buyers and commercial kitchen operators were crucial to finding a baseline for consumption data. Participants were encouraged to offer anecdotal comments.

Several of the larger importing companies did not wish to be linked with specific information provided by them. In order to respect commercial privacy, our report generally avoids using company names during discussions about our primary data.

2.2.2 Volume of sales and selling prices

2.2.2.1 Volume of sales

Estimates of the volume of imports into Providenciales or Grand Turk for lettuce, tomatoes, cucumbers, peppers, eggplant, strawberries, beans, and herbs were made possible by adding together, in an Excel spreadsheet, the results of the business surveys. Three Providenciales importers were not available for interviews during our visit so we adjusted the 'observed' case lot combined import levels. Our perception was that these three stores between them would have case lot volumes twice that of the smaller operation we surveyed. This resulted in the following adjustment factors, applied to the 'observed' quantities, for the seven main products listed on our form: lettuce (+13%), tomatoes (+22%), cucumber (+18%), peppers (+15%), eggplant (+100%), strawberries (+5%), and beans (+100%).

Since the chain of distribution was always established, by the question asking suppliers to be identified, double counting was avoided. For example, the fresh produce tally for a restaurant was not counted if that business purchased from a wholesaler who was the importer of the produce.

There are two major all-inclusive resorts, which we believe take most of their produce and bottled water as container loads direct from mainland food service companies. We ignored this quantity as it represents only potential for future sales.

Fresh produce sales were modeled over the first three years of operation using present imports as a baseline. We cannot assume that the availability of produce from the new Greenhouse will immediately displace imports because various business considerations may result in present suppliers being maintained. For example, a wholesaler may be concerned about losing overall volume discounts from suppliers in Miami if it imports a wide range of goods.

We have identified seven channels for water distribution:

1. Greenhouse irrigation
2. Community standpipe
3. Co-operative garden plots
4. Government water utility
5. Bulk water
6. Bottled water
7. Food and beverage processing

Each has different water volume and pricing requirements. Our projected combination of sales volumes and prices has a significant influence on the blended price for the water produced by the greenhouse system. We have omitted food and beverage processing from the financial model until definite prospects arise.

2.2.2.2 Selling price

Wholesale prices for fresh produce are set to current Miami Terminal prices. This is because most of the produce imported into TCI comes from Miami.

Fresh water blended price is set to yield an overall return on investment (ROI) for the entire operation of at least 15% in Year 3. Two scenarios for cost of water production were modeled:

1. Energy provided by autonomous wind-diesel
2. Energy purchased from Turks and Caicos Utilities

2.2.3 Competition

Researching the competition for water and food products in TCI is efficient. Fact-books state simply, "Most capital goods and food for domestic consumption are imported" (CIA, 2002). Guidebooks echo flatly, "Practically all consumer goods and most foodstuffs are imported" (Cameron and Box, 1998, p.279). Observations during our survey were no different.

2.2.4 Constraints

The report on the regulatory framework of TCI (Merry, 2002), delivered to CIDA as part of the Viability Study showed that political or legal constraints to operating a business in TCI are not unusual compared to Canada or USA. Other constraints that will be discussed in Part 6 include:

- Energy costs;
- Transportation costs and availability;
- Human resources;
- Customer relations; and
- Size of market.

2.2.5 Promotion and advertising

Interviews for our survey provided valuable future sales leads and promotional insights. The entire process resulted in a valuable database.