



G. A. (Sandy) Constable, P.Eng.

B.A.Sc., Industrial Engineering, University of Toronto, 1965

M.Sc., Mathematics, University of Waterloo, 1966

M.A., Economics, Simon Fraser University, 1972

Professional Background

Mr. Constable is a resource economist with over thirty years of experience in energy and environmental issues. His academic studies include engineering, mathematics and economics. In 1972, he was a founding partner of Canadian Resourcecon Limited, a consulting firm that focused on providing economic analysis of energy, natural resources and environmental topics. Mr. Constable is experienced with respect to technology development and technology assessment – from 1988 to 1991, he was Vice President of Finance and Marketing for a small R&D company seeking to commercialize on-site natural gas liquefiers to fuel commercial transportation vehicles. As well, from 2001 to 2003, he managed the energy and environmental planning for a biomass power generation project. Mr. Constable has international project experience in Chile, Australia, Malaysia and elsewhere. Since 1991, he has operated Constable Associates Consulting Inc. Mr. Constable and Gryphon Resources have collaborated on a number of projects over the last thirty years.

Areas of Specialization

- Energy Economics and Greenhouse Gas Issues
- Renewable Energy
- Environmental Economics
- Business Planning
- Technology Assessment/ R&D
- Market Assessment and Market Development

Selected Experience

Energy Economics and Greenhouse Gas

- ◆ In a consulting capacity, Mr. Constable has worked on a variety of Greenhouse Gas (GHG) issues.
 - Developed the requirements for a pilot trading program for greenhouse gas offsets in British

Columbia. This pilot program operated for four years – 1998 to 2001.

- Working with Powerex, B.C. Hydro's export marketing subsidiary, created GHG credits and established the trading transaction around those credits.
- Prepared a report for B.C Hydro identifying the GHG credit opportunities in British Columbia for the utility to pursue.
- Investigated the possibility of creating GHG credits around improved growth rates and added carbon sequestration attributable to superior genetic forest seedlings. The forest biotechnology company (Cellfor Inc.) sought to separate the incremental carbon sequestration that results from its superior seedling stock and to attribute GHG credits to that increment. Concept appears feasible but has not been implemented to date.
 - ◆ On behalf of private and public sector clients, performed analysis on a wide range of energy policies and energy developments:
 - Energy demand forecasting, for both regulatory purposes and for specific energy development projects (e.g. the Vancouver Island natural gas pipeline).
 - Environmental and socio-economic planning for energy projects (e.g. hydro-electric dam projects and liquefied natural gas projects).
 - Benefit-cost and financial analysis for energy projects (e.g. hydro-electric dams and thermal electric projects).
 - ◆ Energy policy studies, including energy R&D policies, air emission issues related to regulatory choices, trade policies related to exporting energy technology, and many others.



Renewable Energy

- ◆ Responsible for the energy planning and environmental assessment for a biomass power generation project in British Columbia. Project proposed to generate 25 MWs from sawmill waste at a northern interior location in B.C., with electricity sales to B.C. Hydro. Project was selected in a competitive review to go to tender.
- ◆ Led project to study the feasibility of establishing a biomass fired thermal-electric power station in Chiloé Island, Chile -- for Fundación Chile/Sociedad Austral de Electricidad S.A.
- ◆ Conducted numerous studies of alternative transportation fuels and their applications – alternative fuel types include natural gas for vehicles, propane, methanol, ethanol and hybrid-electric drive trains.

Environmental Economics

- ◆ Prepared a review of future industrial and energy sector output, and the consequences for air emissions and air quality in the Georgia Basin – Puget Sound area for Environment Canada as part of the Canada-US International Air Strategy for this region. See www.ec.gc.ca
- ◆ Provided analysis and advice to Natural Resources Canada on alternative transportation fuels (ATF) and related air emission issues in British Columbia. Organised and acted as secretariat for air emissions monitoring committee for ATF demonstration programs in B.C.
- ◆ Prepared resource use and environmental valuations for energy development project – hydro-electric dams, petrochemical plants, natural gas pipelines, and other energy developments.
- ◆ Participated with others in an assessment of the role of alternative transportation fuels in reducing GHG in Canada. Specific task was the heavy-duty vehicle portion of the analysis.

Business Planning

- ◆ Responsible for corporate and project finance and marketing for a R&D company seeking to

manufacture skid-mounted natural gas liquefiers to provide fuel for commercial vehicles in remote locations. Cryogas Engineering Ltd. promoted projects in Canada, Australia, New Zealand, Russia, Argentina, Chile and elsewhere.

- ◆ For a forest biotechnology company (Silvagen Inc., now Cellfor Inc.), prepared a business plan for the Chilean joint-venture operations of this Vancouver-based company.
- ◆ Prepared a business plan for a company specializing in radio-frequency energy applications. Specific application was a dryer for high quality forage for export to Asian markets.
- ◆ Provided the business planning and project management for a project to develop a wellhead crude oil heater for the Alaskan North Slope. Heater was an inline microwave heater designed to raise the temperature and improve the flow characteristics a well's production.

Technology Assessment and R&D

- ◆ Interested in and active with respect to the assessment of energy and environmental technologies:
 - In charge of raising funds for the development of a heavy oil upgrading technology. Technology is a mild thermal reagent-based technology for primary upgrading of heavy crude oil to a lighter product.
 - Responsible of project management of a demonstration of an emissions reduction technology for heavy-duty on-road and off-road diesel powered vehicles and equipment.
 - Participation in the marketing of lithium-ion batteries and lithium-ion battery packs for hybrid-electric vehicles (HEVs). Lithium-ion batteries are expected to be the next generation of batteries for HEVs, replacing heavier, more bulky nickel metal hydride (NiMH) batteries.
 - Participated in technology assessment of hybrid-electric vehicles and related battery technologies for heavy-duty trucks and buses
 - Participated in a technology assessment of the role for liquefied natural gas (LNG) technology as a



- transportation fuel for heavy-duty vehicles such as highway trucks and transit buses.
- Participated in the project management and economic evaluation of a sawmill-scale cogeneration system. System generated electric energy plus heat for lumber drying utilizing sawmill's wastes.
 - Prepared a market assessment of a high-efficiency hot water boiler for residential markets.
 - ◆ Prepared a review of the R&D activities and the economic value of those activities for a natural gas utility in the context of the utility's regulatory environment.
 - ◆ Participated in a review (for the Canadian Gas Association) of the RD&D needs of the natural gas industry in Canada.

Market Assessment and Market Development

- ◆ As an energy and environmental consultant, Mr. Constable has wide experience in market assessments and development of marketing plans and strategies, including:
 - Assessment of the market for hybrid-electric medium-duty specialty vehicles for a developer of hybrid-electric and electric drive trains (Azure Dynamics Inc.). Azure customers include courier delivery vans (Canada Post and Puralator) and taxis (London Taxi International). Market assessment identified the medium-duty specialty vehicle market as a specific niche for Azure's technology.
 - Participated in a market analysis of the opportunities for the National Research Council to market their skills in combustion, fluids and thermal engineering to private sector companies.
 - Assessment of the market for propane conversion for heavy-duty diesel engines.

Government Programs and International Projects

- ◆ Familiar with and have prepared submissions for a number of Canadian Government funding programs:
 - Prepared successful applications for Technology Partnerships Canada (TCP) funding for two

- companies (Azure Dynamics and Cellfor). Each application was successful, each raising mezzanine-stage financing of \$10 million for the respective companies.
- Responsible for project management of a diesel engine emissions reduction R&D/ market introduction project. A portion of the funding is by Sustainable Development Technology Canada.
- Prepared a number of market assessment, funding in part by the Market Assessment for Research and Development (MART) of the BC and Federal Governments.
- ◆ For a Canadian Government export initiative, identified Canadian companies with natural gas industry equipment, services and technology that could be exported to the emerging natural gas sector in Malaysia.
- ◆ Prepared a review of the R&D activities and the economic value of those activities for a natural gas utility in the context of the utility's regulatory environment.

Employment History

Constable Associates Consulting Inc., Vancouver, BC, Canada.

1991 – Present. President

Greenbelt Renewable Energy Inc., Vancouver, B.C.

2001 – 2003. Vice President – Energy and Environment.

Cryogas Engineering Ltd., Vancouver, B.C

1988 – 1991. Vice President - Marketing & Finance

Canadian Resourcecon Limited, Vancouver, B.C.

1972—1988 Vice President; 1983 – 1988, President.

Simon Fraser University, Burnaby, B.C

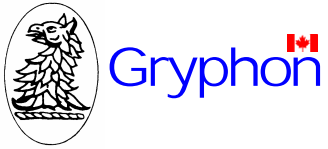
1970—1972. Graduate Student and Teaching Assistant

Hedlin, Menzies & Associates (later Acres Consulting Services), Toronto, Ontario.

1967—1970. Research Associate.

Toronto Telegram newspaper, Toronto, Ontario,

1966—1967. Computer programmer.



Professional Association

Association of Professional Engineers, B.C.

Canadian Institute of Energy (Past Chairman,
Vancouver Branch)

Independent Power Producers of British Columbia

Society of Automotive Engineers

Air and Waste Management Association