



Turning Garbage into Electrical Energy



Project name: SEEgen – Turbogenerator installation at the GVRD Waste-to-Energy Facility

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The project is complete and as of July 2003 electricity is being sold to the BC Hydro grid.

The Greater Vancouver Regional District's (GVRD) Waste-to-Energy Facility (WTEF) is an integral part of the solid waste management system in the Lower Mainland. This facility converts garbage into steam, which is a valuable energy source, during the incineration process. An early revenue generating strategy was to sell this steam to a nearby paper recycling mill. When this mill's demand for steam declined in 1998, the right conditions were created for the next phase of eco-innovation – the installation of a turbogenerator to create electricity.

The process of installing a turbogenerator at the WTEF was named the SEEgen project, an acronym for Social, Economic and Environmental generation of electricity, which embraced the three pillars of sustainability from conception to completion. Through this project the GVRD is closing the loop by returning energy, generated from locally produced municipal solid waste, back to the community.

The SEEgen project was put through an International Standards Organization review in the initial stages of project development (the WTEF is certified to the ISO 14001 standard). During this process all aspects of construction and operation were considered, such as maintaining zero liquid discharge and recycling all waste steel.

Professional Engineers from the Pembina Institute provided assessment and training for WTEF employees. This process reinforced the principles of sustainability and ensured that these principles were taken into consideration during the design, planning and operating stages.



A key consideration in the planning stage was to minimize the impact on the natural and visual surroundings during construction and future operation. For example, in consultation with the City of Burnaby and Fraser River Estuary Management Plan (FREMP), the high voltage line adjacent to the park area was installed underground rather than overhead.

Involvement of BC Professional Engineers was integral to this project – from state of the art boiler modifications to the innovative turbogenerator design required to maximize recovered heat, increase steam quality, and meet the needs of all stakeholders. BC Engineers reached out to the global engineering community to bring leading edge technology to the project.

The economic feasibility of the turbogenerator depended on a design that could maximize electrical production under extreme variations of steam extraction to the adjacent paper recycling mill. This was achieved by designing the turbine to be flexible enough to handle varying steam loads with a wide range of controlled and uncontrolled extraction pressures while maximizing electrical output.

All aspects of design embraced sustainability. For example, the air cooled condenser (ACC) was designed to minimize natural resource usage by using considerably less process water, eliminating the need for a local heat sink, elevation of the ACC and turbine operating floor to make efficient use of the limited space available at the WTEF site, and noise reducing fan blades were specified to significantly reduce the ambient noise level in the surrounding park land. Other design innovations, including a web-based turbine efficiency monitoring system, embedded model predictive control and digital bus technology, were put in place to reduce installation costs and enable advanced equipment diagnostics and predictive maintenance programs.

The SEEgen project will produce 15 MW of electrical energy with little to no additional impact on the environment. By reducing the need for electricity from other, more polluting sources, the project will help reduce pollution in the air shed. The revenue from steam and electrical sales is used to offset the operational costs of the solid waste management system and therefore keep the solid waste tipping fees as low as possible.

Engineers are currently exploring opportunities for further eco-efficiency strategies at the WTEF made possible by the turbogenerator. One possibility is to use residual heat from the turbogenerator to heat a nearby industrial development.

Sustainability concepts featured:

- Protection of the environment was considered in all areas of the design, examples include: evaluation of the high wire installation on the ecosystem and the subsequent decision to go underground; noise and visual impact reduction measures; and, impact of the air cooled condenser operation on waterways.
- Displacement of air emissions by recovering energy from an existing source.
- Addressed community needs; revenues from this project will keep municipal solid waste disposal costs down for community, the effect of construction and operation on adjacent parkland were taken into consideration, and the turbine design incorporated the steam customer (adjacent recycling mill) needs.
- Designed for long operational life – 25 years.