Chapter 19
When Low-Carbon means Low-Cost:
Putting Lessons from Nature to work in our Cities

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ABSTRACT

Ecology is often discussed as a matter of balance, in which environmental protection must be affordable and not interfere with jobs or the economy. At the same time, the economy is based on wastefulness. It has been estimated that the embodied energy in wasted food in the United States is greater than the energy available from the production of ethanol and from the annual yield from petroleum drilling in the outer continental shelf (Cuéllar & Webber, 2010). In addition, rising demand for fossil fuels is being met by sources that bring increasing environmental risk. This paper summarizes the industrial ecology aspects of a 2010 study completed by a cross-functional team of specialists in ecology, engineering, economics, and governance in Vancouver, Canada. The Integrated Resource Recovery Study, Metro Vancouver North Shore Communities (the North Shore Study) modeled the value of producing reclaimed water, electricity, and heat from wastewater, clean organic wood waste, and waste heat from industry simultaneously. The results suggest that this integrated approach could yield significant ecological benefits, and reduce the community's greenhouse gas emissions by 25%. In addition, revenues from sales of recovered heat, water, greenhouse gas credits, and fertilizer could significantly reduce the cost of municipal waste management to taxpayers.

DOI: 10.4018/978-1-4666-3613-2.ch019

INTRODUCTION

Water, energy, food, and climate change are inextricably linked. Cleaning and moving water through cities consumes energy, producing energy consumes water, food production requires both energy and water, energy production and food production both generate greenhouse gases, and climate change is affecting the availability of water and the economics of food production.

In most cases, these areas are managed by separate "silos" in government, industry, and the consulting community, and the collective challenges they present can appear to be overwhelming. Recovering resources from waste tends to mimic nature's closed ecological cycles however, and an integrated approach that spans the silos can help address many of these interconnected issues at the same time.

In 2010 Metro Vancouver commissioned the study, *Integrated Resource Recovery Study, Metro Vancouver North Shore Communities* to evaluate the costs and benefits of an integrated approach to recovering resources from liquid and solid waste. The study involved four communities - the District of West Vancouver, the City of North Vancouver, the District of North Vancouver, and First Nations - collectively referred to here as the North Shore Communities.

The North Shore Communities face several challenges. First, the local wastewater treatment plant must be upgraded to meet new Federal standards. Second, the capacity of landfills to accept solid waste from the growing population is limited. Finally, the capacity of senior governments and individual taxpayers to finance upgrades to municipal infrastructure is increasingly strained. At the same time, the Province of British Columbia has established objectives to conserve potable water, generate energy from sustainable sources, and to reduce greenhouse gas emissions. Because of the high density of resource consumption of cities, it is clear that much of the responsibility for meeting these goals will fall to municipalities.

The highest density of industrial, commercial, and residential development on Vancouver's North Shore lies in a narrow band in the southernmost region. This concentration of demand for heating and water had a strong influence on the resource recovery decisions described in this paper. The North Shore Communities are also fortunate to have access to multiple modes of transportation along the shore (e.g., rail, barge, road), and to shipping terminals capable of handling wood residue and other solids.

METHODOLOGY

Sources of Waste

In order to model the resource recovery options as realistically as possible, an inventory of solid waste, liquid waste, and waste energy was developed through questionnaires and interviews with representatives of local governments, industrial, and commercial organizations. Potential sources of waste were also identified through Environment Canada's National Pollutant Release Inventory, municipal reports and data, and field trips.

Potential Markets for Recovered Resources

Two hundred and eighty-six buildings in the North Shore Communities were identified as potential candidates for connection to a district energy system. These buildings were chosen because they operate large hydronic heating systems that could be served by district energy, and are located within a reasonable distance of sources of heat (please refer to the Distribution of Energy and Water section).

The economics of providing heating and cooling to buildings through a district energy system depend on both the quantity of energy required, and when the energy is required. If a building consumes all of its energy in the winter months,