A PERSPECTIVE OF MSW ENERGY RECOVERY IN QUEBEC

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OF MUNICIPAL SOLID WASTE TO ENERGY

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1) WASTE MANAGEMENT IN QUEBEC

The recent policy on waste management in Quebec has established the five elements of the government's integrated waste management strategy:

1) waste reduction (overwraping)
2) re-use of goods (bottles and containers)
3) recycling (paper and metals)
4) recovery (incineration, RDF, pyrolysis, compost and methane production)
5) final disposal

Element 4) is the target of this paper.

Municipal solid waste quantities amount to 2.18 million metric tons/year, while total waste, including commercial, institutional, industrial, demolition waste and treatment plant sludge, total 7.268 million tons. The composition of MSW is:

Paper/cardboard:	28,5%
glass:	10,9%
ferrous metal:	5,6%
non ferrous metal:	1,1%
plastics:	10,3%

food and yard wastes:	29,1%
wood:	2,4%
others:	12,1% (1)

MSW is currently disposed of through incineration (10% of the tonnage) or burying in various types of sites. Besides, 348 000 tons of paper and 30 000 tons of glass are recycled.

In Quebec, the total budget for MSW management is 139,183,000 CAN$ (1986), which gives a per capita cost of 21,38 CAN$ average. It is 17,60 $ in Hull, 20,91 $ in Montreal, 40,52 $ in Quebec City, and 63,20 $ in Westmount (2). The economics of waste recovery are dominated by the fact that the cost of disposal in most of the existing sanitary landfills is still 1.5 to 6 times smaller than the cost of any existing recovery technique (3) thus creating a situation where the benefit of recovery is outbalanced by the increased cost of disposal. On the other hand, this situation will admittedly be short-lived, since landfill costs are expected to raise significantly, due to the increasing difficulty in creating new sites. Quebec City and Montreal have already reached that point, and those

municipalities are exploiting incinerators equiped for heat recovery. In 1985, the steam produced was sold 7,20 $/ton in Quebec City and 25,00 $/ton in Montreal, which gives revenues of 18,00 and 62,50 $/ton of waste respectively (4). the provincial average waste management cost is 66,81 $/ton (including landfill sites).

The most important economical constraints encountered in Quebec by the various recovery techniques are:

- **Vapor production:** The customers must be located close to the burning unit, and the supply - and demand - must be constant. The competition from other energy sources is meaningless as long as you consider the deal simply as a way to decrease waste disposal costs.

- **Electicity production:** This market does not exist in Quebec.

- **Methane production:** Metropolitan Gaz holds a monopoly on gaz distribution, and the products must meet MG's price and quality requirements.

- **RDF**: With the exception of large boilers in the pulp and paper industry, very few installations can use RDF as replacement fuel.

- **Compost**: The presence of heavy metals is an obstacle in the production of a quality compost.

The environmental constraints include:

- **Air pollution**: from incineration or RDF burning.

- **Water pollution**: from incinerator ash cooling and methane disgestion.

- **Ground contamination**: from heavy metals and unburned organics in incinerator ash.

- **Noise** odor and explosion risks.

In order to reach practical results, the search for alternatives in MSW disposal must be analysed in the global context of social, industrial and economic activities. An overview of

Quebec's specific energy supply situation is therefore essential, particularly if we consider recovery from an energy point of view, in order to properly evaluate the possibilities of cooperation in R&D efforts.

2) THE ENERGY CONTEXT

In the populated part of the province of Quebec, the consumer, either residential, commercial, institutional or industrial, is offered a choice of three well-supplied sources: electricity, gaz and petroleum distillates. Wood residues and coal are also used by a specific industrial clientele.

While the cost of petrol depends on the international market, that of electricity is fixed in Quebec, since all of the electricity is home-produced from hydro power, and production far exceeds requirements. Natural gaz also benefits from an excellent distribution network, with customers mostly in the industrial or institutional segments of the market, and prices are related to the cost of the two previous sources. Those three markets are consequently strongly interconnected, especially since electricity is used for thermal needs as well as electromotive power.

Major obstacles to the value of energy recovery from waste are the good availability and the reasonable pricing policies applied to traditional forms of energy. State-owned Hydro-Quebec Society, the sole electricity supplier in the province, has a production capacity of 28,323 MW for a population of six million and earlier projections were for an expansion of 26,900 more MW between 1987 and 1996. This figure has been brought back to 5 300 MW because, since 1984, H-Q has to promote programs of thermal consumption to absorb an excess production of 3,207 MW (5). This program has a limited duration though, and is essentially aimed at industrial consumers.

Besides, in terms of energy-valuable waste, a particular type of industrial waste holds a dominating position in the global portrait: wood residue from pulp and paper or wood processing industries. It has been estimated that 1,3 million tons of dry wood residue per year remain unused, 75% being made of bark (6). On the other hand, the pulp and paper industry produces 8 million tons of steam/year from wood residue only, and total capacity of existing installations is 14 million tons of steam /year, based on total power from both residue and complementary fossil fuel.

This situation, combined with the economical and environmental constraints mentioned earlier, creates a highly competitive market for the various technologies of MSW energy recovery to develop.

3) HISTORY OF INCINERATION IN QUEBEC

Incineration is the only MSW recovery method currently used in Quebec. Twenty-three percent of the population are served by three incinerators, which burn ten percent of total MSW. Des Carrières incinerator in Montreal and Quebec City incinerator have four furnaces each, with capacities of 270 and 225 tons/day respectively, while St-David incinerator, on the south shore of Quebec City, has one 100 ton/day furnace. Since the latter is equiped with a cooling tower and an ESP only, without an energy recovery system, it is of lesser interest for this workshop.

Because of their operational history and their similar design, and because of the many modifications required to achieve environmental acceptability for the neighboring communities, we feel that the Quebec City and Montreal incinerators can be valuable exemples that can be used in the orientation of eventual improvement programs.

The development course of these two installations origins in the intolerance of the neighboring population to a source of pollution that went against the Environmental Quality Act and the Regulation respecting the quality of the atmosphere.

When the City of Montreal undertook its incinerator's improvement program, the objective was to comply with provincial emission standards regarding particles and chlorinated inorganic gaseous compounds measured as hydrochloric acid. Quebec City, on the other hand, went after the best control technology, taking into account both the more stringent upcoming provincial regulation and the NITEP studies.

Fundamentally, the two incinerators are similar, and are mostly made of:

- a vibrating feeder hopper
- drying/burning/burn-out reciprocating grates
- lower burning zone: refractory lined
- upper burning zone: waterwalled partially lined
- heat recovery boiler with superheater & economizer
- a two stage electrostatic precipitator

The City of Montreal has replaced its two-field ESP by a three-field unit preceeded by a multicyclone designed to increase global removal efficiency, particularly for large unburned particles. For a 50% reduction of chlorinated inorganic compounds, a quantity of calcium carbonate corresponding to 0,7% of the refuse weight is added to the loading. Those modifications made it possible for the City of Montreal to comply with regulations and to solve most of the problems faced by the neighboring community.

Quebec Urban Community's first step was to proceed with the installation of an arch above the grate, in order to create two separate zones in the incinerator, thus creating a restriction for the gas flow to the secondary chamber.

Secondary air supply was modified accordingly. Results were positive, but yet failed to live up to expectations. Only after discussions with NITEP representatives did QUC start to work on a permanent solution; the resulting alterations allowed NITEP to conduct experiments while contributing to the search for a solution.

The modifications of the furnace and adjacent equipment resulting from NITEP consultation gave a much improved combustion. Later on, the walls were cooled through the use of waterwalled refractory-lined high density stud in the lower part to the

combustion zone, thus preventing fouling and diminishing requirements for excess cooling air. Net results are:

- an increased steam production;
- an amazingly improved performance of the ESP unit, which had always been overexploited;
- particulate emission rates that are well below regulatory requirements;
- a clean combustion in terms of chlorinated organic compounds, as demonstrated by NITEP.

In addition to those improvements, QUC will also install in 1989 a dry scrubbing system for chlorinated inorganic compounds, followed by a fabric filter unit for residual particles removal.

The results achieved with Montreal and Quebec City incinerators should demonstrate environmental acceptability of this particular recovery technique, thus improving the chances of using waste to produce energy, given a favorable context.

4) CONCLUSION

A score of alternatives are available in waste management. the choice must be based upon environmental acceptability as well as the perspective of recovery - related income. Accordingly, nineteen projects are currently under study in Quebec for waste recovery installations:

- 4 incinerators
- 5 compost production units
- 2 mechanical segregators
- 1 pyrolysis unit
- 2 RDF units
- 1 methane production unit
- 3 compost - RDF hydrids
- 1 compost - segregator hydrid

Four of the promotors are private. The others are municipalities. All projects are presently going through the step of feasability studies.

It should be interesting to find out which of these will emerge as dominating recovery technologies. It appears that the possiblity of using RDF in boilers also capable of burning wood residues is clearly a promising development field, considering our specific situation.

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