

# IMPACT OF THE RECESSION AND RECYCLING ON SOLID WASTE PROCESSING FACILITIES IN NEW ENGLAND

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## ABSTRACT

Solid waste professionals in Connecticut have recently had to deal with two landmark events. A severe recession, coupled with the implementation of mandatory curbside and business recycling programs, has had a dramatic effect on the municipal solid waste stream.

A great majority of Connecticut communities have entered into put or pay contracts with both Waste To Energy plants (WTE) and Intermediate Processing Centers (IPCs). Balancing the tonnage requirements of these solid waste facilities was relatively straightforward until one tried to consider the impact of the recession and new recycling programs on waste stream generation rates. In addition, while most recyclables pulled from the residential waste stream are easily tracked, a significant portion of the waste stream has been diverted via new commercial and industrial recycling efforts. Commercial recyclables are not easily tracked.

This paper will analyze the recession and recycling and how these two factors impact a representative portion of Connecticut's population. Once the analysis is presented, it will be clear how a decrease in the different components of the waste stream can be analyzed to make critical decisions such as:

- (a) Is spare capacity temporary or permanent?
- (b) When the economy rebounds, what can we expect to see happen regarding waste generation rates?

While the paper will focus on Connecticut, conclusions can be extended to other parts of the country

where mandatory recycling, put or pay contracts to IPCs and/or WTEs, and the possibility of an economic downturn exist. No place in the country is immune from economic downturns. Passage of a new RCRA bill will also more than likely increase the number of communities nationwide contracting with IPCs and WTEs.

## INTRODUCTION

Throughout the Northeast, significant decreases have been experienced in the amount of municipal solid waste delivered to waste to energy facilities. It is frequently stated that the reason for the decrease is a combination of the economy and new recycling programs. For environmental and economic reasons, Waste to Energy plants should be operated at design capacity.

Waste to Energy plants typically service a specific group of towns or counties or combinations thereof. If the waste required to operate the plant at design capacity is not available within the service area for any reason (seasonal fluctuations, economic changes, population growth, or unanticipated recycling activities), additional waste must be obtained. This additional waste is called spot market waste. In the densely populated Northeast, and in particular Connecticut, Massachusetts and New York, there are sufficient waste to energy

plants in operation [1] such that competition for spot market waste is fierce. At times, spare capacity can not be filled on a short term basis. In addition, spot waste in the Northeast frequently flows across state lines [2]. Legislation is pending on the federal level that would restrict interstate flows.

In order to avoid the uncertainties of the spot market, public officials responsible for supplying waste to the WTEs prefer to keep the plant supplied with as much waste as is possible on long term contracts. This usually means expanding the service territory and making 20-year commitments.

Clearly, it is imperative to know how much spare capacity a WTE has not only presently, but also in the future. Without knowledge of future capacity, one would only be able to fill the plant with short term spot market. As stated earlier, short term spot market waste is increasingly more difficult to obtain due to competition and interstate waste restrictions.

In order for decision makers to make critical decisions that will affect potentially hundreds of thousands of people, one must know whether spare capacity today will be there tomorrow.

While the data presented will be from a region in Connecticut, the assumptions and calculations used in this paper could be applied to any area of the country where a change in recycling occurs either in the residential or commercial sector or there is a significant change in the economy. Throughout the life cycle of solid waste projects such as Waste to Energy plants, landfills or Intermediate Processing Centers (IPCs), it is expected that every part of the country will experience either economic or recycling changes over the life of the project (20–30 years).

## BACKGROUND DATA

There has been a significant drop in tonnage delivered to Waste to Energy plants and landfills in the Northeast and particularly New England. It is widely accepted that the decrease is due to some combination of the economic misfortunes of the region and the implementation of new recycling programs. This paper will focus on one disposal site in Connecticut, representative of much of the service areas in the Northeast served by Waste to Energy plants and/or landfills.

The Bristol Resource Recovery Facility Operating Committee (BRRFOC) is made up of a group of 14 Connecticut towns comprised of 300,000 citizens, working together as a region to solve their solid waste

disposal problems (Fig. 1). Presently, the BRRFOC is a working financial and operational mechanism between 14 towns. The BRRFOC handles all financial, administrative, and technical duties with regards to solid waste disposal for its member towns. The BRRFOC also sets policy for the region with regard to solid waste issues.

The BRRFOC was formed voluntarily by communities whose elected officials belong to different political parties. Furthermore, the chief elected official and/or the town manager participate directly in the BRRFOC. The chief elected officials of the participating towns have a direct say in tipping fees and any other issues relating to the plant. Connecticut's "home rule" philosophy and the absence of a county form of government make the BRRFOC especially unique in Connecticut. Multi-community projects are the exception, rather than the rule, in an area of the country where town meetings are still prevalent.

The BRRFOC area, like the rest of Connecticut and much of New England, is in a severe recession. Economic indicators show that Connecticut's economy started declining in February, 1989. The recession has deepened throughout 1990 and into 1991. Non-agricultural employment in Connecticut has decreased by 85,000 (5%) between January 1990 to August 1991 according to the Connecticut Labor Department. Seasonally adjusted manufacturing output declined by over 11% from January 1990 to August 1991.

The Bristol Resource Recovery Facility has been processing waste from the original 11 member towns since January, 1988. Calendar Year 1989 was the peak year for deliveries. While the BRRFOC is presently comprised of 14 towns (Fig. 1), this paper deals with only the 11 members delivering waste since start up. There is insufficient data from the three new towns to include them in this study. During 1989, the 11 communities delivered 198,600 tons.

For 1991, the projection is that the BRRFOC communities will deliver 20% less municipal solid waste to the plant than in 1989! Depending on Btu value of the waste, somewhere between 192,000 and 200,000 tons is required to supply the plant to keep it running at full capacity. The question is how much of this 20% drop will be permanent, i.e., 20 years, and how much of the spare capacity is temporary?

The Ogden Martin facility has a processing guarantee of 82.5% of design capacity, or 195,725 tons on an annual reference waste basis. The facility has two 325 tpd boilers. The 195,725 tons is based on a Higher Heating Value of 4500 Btu/lb. A discussion of how Btu/lb might impact the results of the study can be found later in this paper. However, the guarantee is

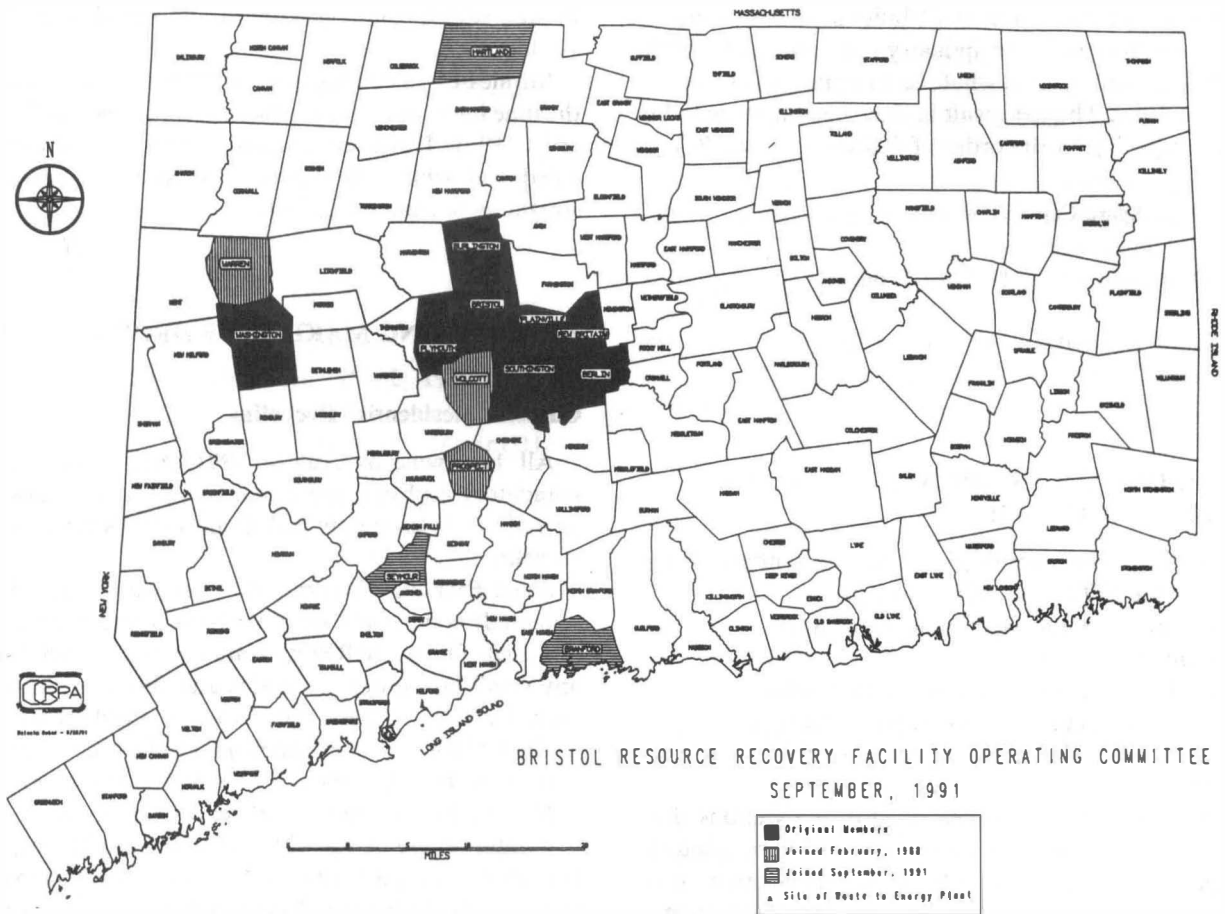


FIGURE 1

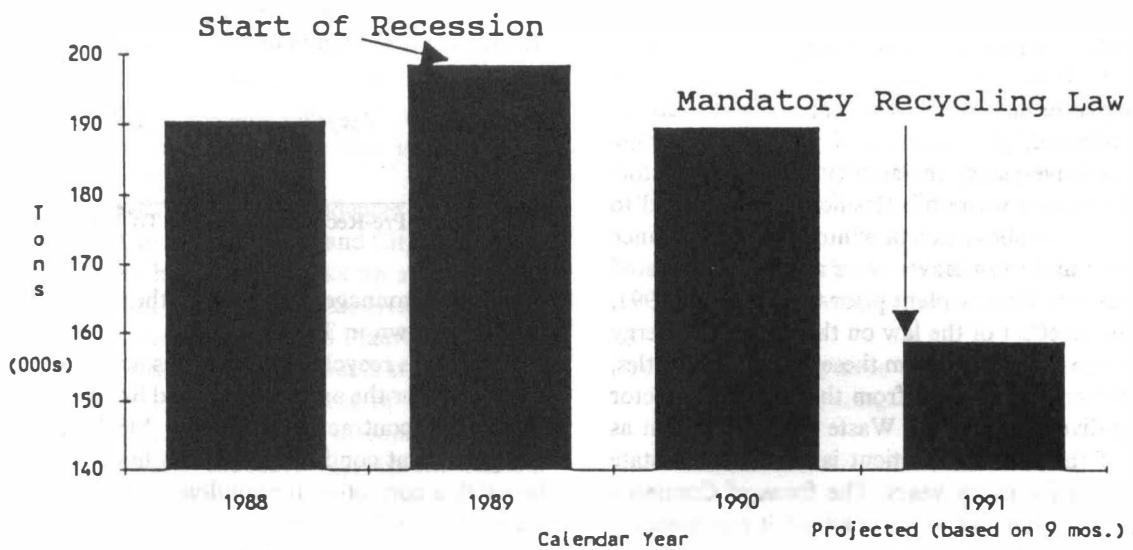


FIG. 2 ANNUAL BRRFOC TONNAGE

based on a relatively low availability of 82.5%. A more typical guarantee in the industry today would be 84% (198,000 tons). This is what the 11 communities delivered in 1989. The net result is that there appears to be spare capacity on the order of 40,000 tons for 1991.

$$\text{Spare Capacity} = \text{Processing Guarantee}$$

$$- 11 \text{ Town Tonnage}$$

$$40,000 = 198,000 - 158,000 \quad (1)$$

### COMPONENTS OF DROP IN TONNAGE FROM 1989 TO 1991

The four components of the drop in tonnage delivered to the WTE that will be analyzed are:

- (a) Implementation of new mandatory residential recycling programs.
- (b) The effect of the recession on residents.
- (c) Commercial decrease due to recession.
- (d) Commercial diversion due to mandatory recycling law.

Each of these will be described in the sections that follow. Changes in the waste stream due to mandatory recycling laws can be expected to be permanent or long term. Changes in waste generation due to economic factors are transient. That is, when the economy rebounds, these generation rates may be reversed.

In planning for use of spare capacity, it is imperative that one be able to determine how much of the waste reduction is due to permanent and temporary factors, respectively.

Connecticut's mandatory recycling law took effect January 1, 1991 [3]. Businesses were mandated to source separate nine items: newspaper (ONP); corrugated cardboard; glass and metal food and beverage containers; leaves; scrap metal; white office paper; storage batteries; and waste oil. Residents are required to recycle all of the above except white office paper. Since scrap metal and most leaves were not being delivered to the Waste to Energy plant prior to January 1, 1991, no noticeable effect of the law on the Waste to Energy plan tonnage is expected from these two items. Bottles, cans, ONP and corrugated from the residential sector are being diverted from the Waste to Energy plant as a result of the law. Connecticut is a Bottle Bill state and has been for many years. The focus of Connecticut's new recycling law is on nondeposit containers.

Curbside recycling programs for the BRRFOC residents did not start until July, 1991. The exception is in

Bristol, which commenced curbside recycling in May 1991.

Businesses, of course, were in theory recycling all of the nine items that made economic sense prior to January 1, 1991. However, a significant amount of corrugated and white office paper was still in the waste stream as of January 1, 1991.

### DETERMINING MAKEUP OF DROP IN TONNAGE

#### Curbside Residential Recycling

All 11 towns, by August 1991, had implemented mandatory curbside residential recycling programs as part of efforts to comply with Connecticut's mandatory recycling law.

Some BRRFOC communities defined "residential" to include condos and small businesses with residences attached. Other BRRFOC communities do not have any small businesses or condos and therefore did not even have to address this issue. A third group of BRRFOC communities had condos but did not include condos in their definition of residential recyclables.

Nonetheless, all residential recyclables from the 11 communities are being delivered to the same place, an IPC in Berlin, Connecticut. Therefore, it is relatively easy to obtain residential recyclable tonnage from the towns by using the IPC scalehouse records. The residential waste streams of Bristol and Plainville were analyzed. These two towns were selected because one needs to isolate the residential waste stream from the rest of the tonnage to do comparisons. In both Bristol and Plainville, it is possible to determine what the residential waste stream is before and after recycling.

Recycling Component Drop

$$= \frac{\text{IPC Tonnage}}{\text{Pre-Recycling Tonnage To WTE}} \quad (2)$$

Residential tonnage delivered to the IPC by the two towns is shown in Tables 1 and 2.

Plainville's recycling tonnage has not been corrected to account for the amount delivered by condominiums. Plainville's contracted residential MSW hauler does not pick up at condos. In order to have Eq. (2) above be valid, a correction for condominiums was required. Plainville has 839 condo units and 5600 single family homes. Industry practice is to assume that, per unit, condos will generate 60% of the recyclables of a single

TABLE 1 TONNAGE TO IPC, 1991

	Bristol	Plainville
July	299	84
August	302	107
September	303	101
October	323	123
November	283	86

\*no deduction for condos

TABLE 2 TONNAGE TO IPC, 1991

	Bristol	Plainville
July	299	77
August	302	98
September	303	93
October	323	113
November	283	79

\*deduction for condos taken

family home. This difference is due primarily to population density. For Plainville,

$$\frac{839 \text{ Condos}}{6400 \text{ Units}} = 13\% \text{ Condo} \times 0.6 = 8\% \text{ of All Residential Recyclables From Condos} \quad (3)$$

Now, to determine the impact this residential recycling tonnage had on the town's total tonnage, the residential MSW had to be examined. Most BRRFOC towns use multiple haulers for residences. Even if one hauler is used for all residences in the town, that same hauler usually will pick up commercial accounts as well. It is difficult, if not impossible, in these cases to determine exactly what the residential waste stream is. For Bristol and Plainville, we are able to isolate the purely residential waste stream.

Bristol was used because all residences (no condos) are collected by City owned trucks and City employees. Plainville has one hauler who picks up all residences and also does not have any commercial accounts. Therefore, in the case of Bristol and Plainville it is easy to determine the residential only waste stream.

In order to determine the impact of recycling on the MSW delivered, one only has to compare similar months before and after the recycling programs started.

The following is the average monthly impact of recycling on the residential waste stream only:

- (a) Bristol (15%)
- (b) Plainville (14%)

The first of the four components, i.e., Residential Recycling, is now determined. There has been a 15% drop in the residential waste stream due to recycling. Now, one can determine the second component, i.e., Residential Recession.

For the entire BRRFOC region, a study was done in 1988 to determine the makeup of the region as far as commercial and residential waste is concerned [4]. For the region, 60% of MSW is residential and 40% of MSW is commercial [5].

If one assumes that the 60/40 residential/commercial split did not change from 1989-1991, then one can conclude that there was a 20% drop in residential tonnage delivered to the IPC. This is the same percentage drop for the waste stream as a whole.

$$0.60 \times \text{Tonnage 1989} = 119,200 \text{ Residential Tonnage 1989}$$

$$0.60 \times \text{Tonnage 1991} = 94,800 \text{ Residential Tonnage 1991}$$

$$\text{Total Drop} = 20\% \text{ Total} = 24,400 \text{ Residential Drop in Tonnage 1989-1991} \quad (4)$$

If 15% is due to recycling, 5% is due to residential recession.

A 15% drop in residential waste is equal to approximately 18,000 tons. Approximately 6,000 tons of the total waste stream drop is due to the impact of the economy on the residential waste stream.

The recycling portion of calculation can be checked on a regionwide basis as follows: Over a 17 week period from August 5 until December 1, the 11 communities delivered, on average, 354 tons to the IPC while 3055 tons was delivered to the WTE. Therefore, as a region, residential recyclables resulted in:

$$\frac{354}{(3055 + 354)} \times 100 = 10\% \text{ Drop of the Total Waste Stream} \quad (5)$$

A 15% drop in the residential waste stream equals a 9% drop in the total waste stream.

$$\text{Total Waste Stream Drop} = \text{Residential Drop} \times \text{Percentage Factor}$$

$$9\% = 15\% \times 0.6 \quad (6)$$

Because the results of Eq. (5) and Eq. (6) are very close, one can have a lot of confidence in the residential components of the waste stream drop. The key param-

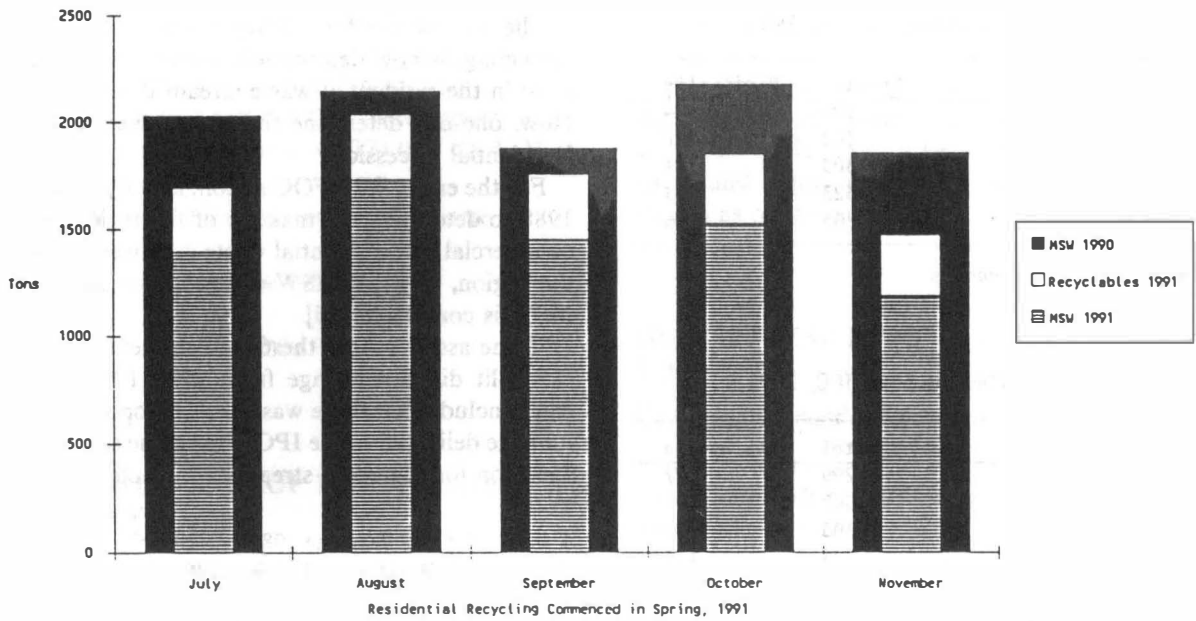


FIG. 3 CITY OF BRISTOL RESIDENTIAL TONNAGES 1990-1991

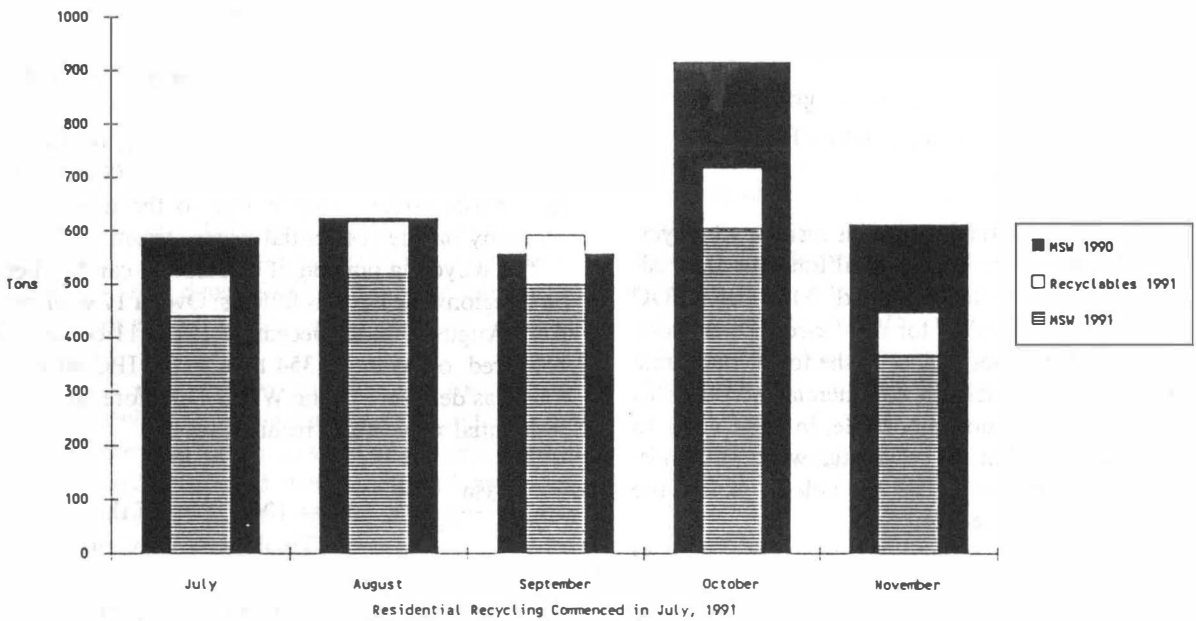


FIG. 4 TOWN OF PLAINVILLE RESIDENTIAL TONNAGES 1990-1991

ter is the drop in tonnage due to residential recycling. Residential recycling tonnage and its impact on the residential waste stream is easily calculated. Any additional changes in residential waste generation drop

from those presented in this paper can be distributed accurately by calculating the residential recycling component of the drop first. The balance of the decrease would then be due to other factors such as recession.

TABLE 3 RESIDENTIAL TONNAGE TO WTE AND IPC, 1991

	MSW		Plainville			MSW		Bristol		Bristol		Bristol
	Plainville Pre-Recycling 1990	Plainville Recycling 1991	Recyclables 1991	Total Drop 90-91	Total MSW Drop 90-91	Pre-Recycling 1990	Recycling 1991	Recyclables 1991	Total Drop 90-91	Total MSW Drop 90-91	Drop Due To Recyclables	
July	587	439	77	25%	13%	2030	1393	299	31%	15%		
August	624	518	98	17%	16%	2145	1730	302	19%	14%		
September	557	499	93	10%	17%	1878	1451	303	23%	16%		
October	917	604	113	34%	12%	2179	1525	323	30%	15%		
November	612	367	79	40%	13%	1858	1189	283	36%	15%		
			Average:		14%			Average:		15%		

Commercial Recession and Recycling

One can assume that the impact of the recession on waste generation affects the residential and commercial sector in the same fashion.

Then, let us say that for the purpose of calculation, the residential economic drop is 5% of the residential waste stream.

If the commercial economic drop is 5% of the commercial waste stream, one can calculate a commercial recycling rate.

Assume 40% of the waste stream was commercial in 1989 and remains in 1991.

$$0.40 \times 1989 \text{ Total} = 80,000 \text{ Commercial Tonnage } 1989$$

$$0.40 \times 1991 \text{ Total} = 64,000 \text{ Commercial Tonnage } 1991$$

Total Commercial Drop is 16,000 tons

$$5\% * 80,000 = 4000 \text{ Commercial Tonnage Decrease Due to Recession } (7)$$

This means that the commercial drop due to recycling is 12,000 tons. Is this reasonable?

One of the most difficult numbers to obtain is a commercial recycling rate. In Connecticut, in particular, the public sector has no ability to get involved in commercial recycling activities [6]. Commercial recycling is handled exclusively by the private sector; haulers; entrepreneurs; and other businesses.

What we do know, however, is the quantity of recyclables being delivered to the Waste to Energy plant by virtue of having trucks inspected on the tipping floor. Since May, 1988, the WTE has had a vigorous inspection program. Prior to the start of Connecticut's mandatory recycling law, inspections for recyclable materials was not required.

Inspections of waste for significant quantities of commercial corrugated cardboard commenced at the WTE in January, 1991 per the requirements of Connecticut's

TABLE 4 INSPECTION DATA FOR 1991

	Number Inspected	Commercial Inspected	# Loads > 80 % Corrugated	Percent
January	303	121	24	20%
February	492	197	30	15%
March	638	255	18	7%
April	549	220	15	7%
May	508	203	5	2%
June	205	82	3	4%
July	231	92	6	6%
August	284	114	8	7%

recycling law. Based on the visual observations of the inspectors, we assumed that the majority of recyclables that would be removed from the commercial sector would be corrugated. Inspection records and observations verified this fact.

Inspector reports at the WTE plant were used to check if commercial recycling activities in 1991 could result in a 12,000 tonnage drop.

From inspection records and observations, it was not until March of 1991 that the impact of Connecticut's mandatory recycling law on businesses took hold.

Using inspection records to quantify the amount of corrugated removed from the waste stream can be difficult due to the fact that 100% of the trucks are not inspected and the amount of corrugated in the load is eyeballed (not scientifically weighed). Nonetheless, the fact that the same individuals were working as inspectors throughout the period and the fact that there is a logical consistent trend with regard to the corrugated delivered lends credence to the calculations. Despite confidence in the calculations of corrugated removed based on inspector records, a cross check is important and is provided.

It is clear that additional significant commercial recycling did not take place during January and February.

For January and February, 17.5% of the commercial loads, on average, had significant quantities of cardboard. Since March the average is 5.5%. What does this mean? Can this account for 12,000 tons annually?

Based on the inspections, we have experienced a reduction of 12% in commercial loads due to corrugated

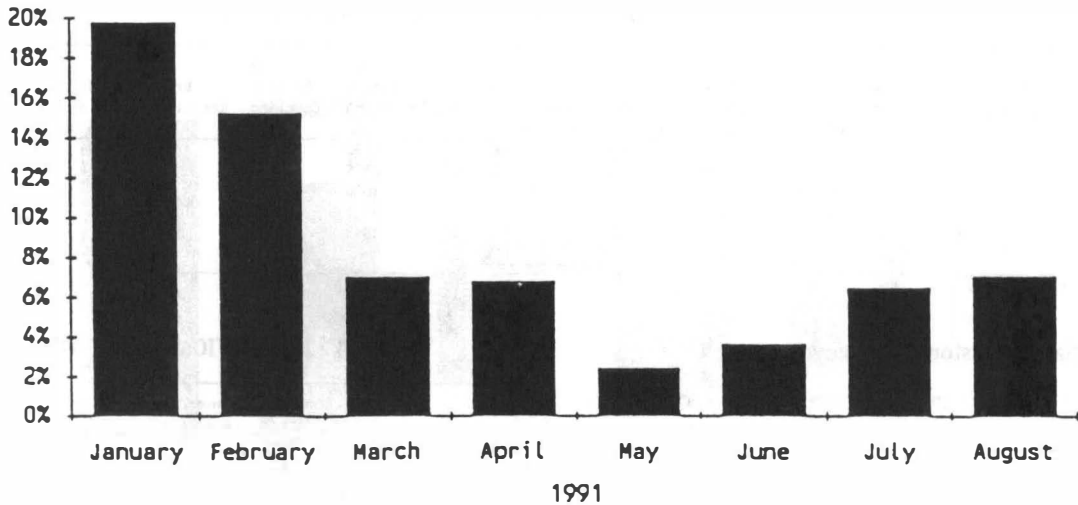


FIG. 5 PERCENT OF COMMERCIAL LOADS WITH CORRUGATED

diversion. The average weight per truck can be estimated by:

$$\frac{\# \text{ Tons Period}}{\# \text{ Trucks Period}} = \frac{\text{January-August}}{\# \text{ Trucks}}$$

$$= \frac{111,000}{17,276} = 6.4 \text{ Tons/Truck} \quad (8)$$

$$\text{On an Annual Basis } \frac{17,276 \text{ Truck}}{\# \text{ Julian Days (243)}}$$

$$= 71 \text{ Trucks/Julian Day} \quad (9)$$

$$\text{Total Trucks Per Julian Day * Factor} =$$

$$\text{Commercial Trucks/Julian Day}$$

$$71 * (0.4) = 28.4/\text{Day} \quad (10)$$

$$\text{Reduction in Commercial Tonnage} = 0.12 * 28.4$$

$$= 3.4/\text{Day} \quad (11)$$

$$3.4/\text{day} \times 365 \times 6.4 = 8000 \text{ Tons} \quad (12)$$

### Cross Check

This magnitude of a drop is verified by the inspector, who feels an 80% drop in cardboard has been seen. If one assumed the beginning level was 17.5% and an 80% reduction was experienced, then 14% of loads have been reduced and the calculation above leads to

9300 tons. This corresponds favorably to the results of a third study, an independent engineering report which showed a diversion of commercial waste on the order of 9000 tons [7].

The difference between the 8000–9000 tons of commercial waste calculated here and the 12,000 estimated previously could be due in part to other commercial recycling efforts such as office paper. More likely, however, is that the commercial drop in tonnage due to the recession is a greater percentage of the total commercial drop than assumed. In order to be conservative, assume that commercial recycling is 10,000 tons, splitting the difference between the value obtained by using residential economic data and the tonnages observed at the WTE.

Our conclusions so far state that the tonnage drop is as follows:

- (a) 18,000 tons residential recycling.
- (b) 6000 tons residential economy.
- (c) 6000 tons commercial economy.
- (d) 10,000 tons commercial recycling.

Or, more importantly, approximately 28,000 tons of spare capacity should be available on a long term basis, while 12,000 tons will only be available as long as the current economic downturn exists. For planning purposes, the numbers above would be aggressive. More cautious planning vis a vis committing spare capacity would be to assume commercial economy is greater than shown above and recycling is less. In any case, one would be safe offering 25,000 tons on long term capacity until more information became available.



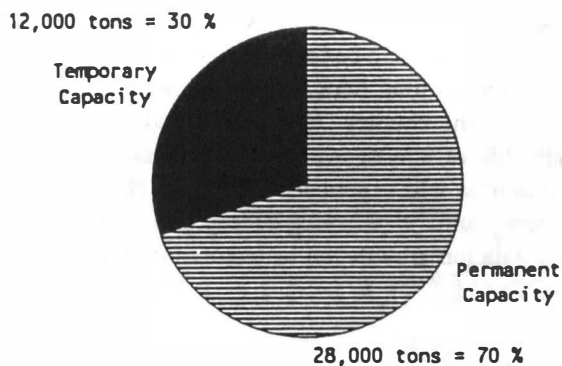


FIG. 6 COMPONENTS OF SPARE CAPACITY AT WTE IN 1991

## OTHER POTENTIAL IMPACTS

### Population

Population growth or decline could have a significant impact on the total waste stream in a given area. However, for BRRFOC, this is not an issue because the 11 communities in the BRRFOC forecast stable population through the year 2013 [8]. If an area's population was expected to change significantly, this would have to be considered.

### Per Capita Generation Rates

If one anticipated an increase in waste generation rates this would have to be considered. In this paper, a decrease in generation rates is calculated due to economic factors. When generation rates rebound, it is not expected that the rates will exceed prerecession levels due to source reduction efforts and increased recycling activities. Further, the Connecticut State Solid Waste Management Plan assumes that any future increase in waste generation rates will be offset by source reduction efforts [9]. Source reduction efforts in Connecticut have not yet made an impact on the waste stream. It is expected that packaging taxes will again be proposed during the General Assembly's 1992 session; however, the likelihood of adoption of such a tax is uncertain. Further, the impact of a packaging tax on solid waste generation rates is even less clear.

### Yard Waste

Connecticut's law mandates only leaf recycling, not brush or grass clippings. While the law did not take effect until January 1, 1991, in fact, most BRRFOC towns had implemented leaf composting prior to 1991,

and in most cases prior to 1989. [10]. Therefore, while leaves comprise a significant amount of the waste stream during late October and early November, separate consideration is not given in this study due to the fact that most leaves were already being removed from the waste stream prior to 1989.

### Btu

Consideration must be given to the Higher Heating Value (HHV a/k/a Btu) of the waste. The HHV of the waste determines how much refuse can be processed at the WTE plant. For the BRRFOC, estimates of Btu content of the waste has shown that the waste has exhibited a fairly constant energy content (4600–4800 Btu/#). Therefore, no adjustments were made for Btu content from 1989–1991.

If, however, one either experienced a changing Btu or expected to experience a changing Btu, this must be considered. BRRFOC's current recycling efforts of ONP and food and beverage containers is not expected to change the HHV of the waste perceptibly.

### Gypsy Waste

Some planners have speculated that a significant component of the tonnage drop is due to gypsy waste, i.e., waste that is being delivered to sites in direct violation of flow control laws. BRRFOC, while not ignoring the possibility, nevertheless does not believe that significant amounts of waste are being diverted from the service area illegally. However, if one has a high tipping fee in comparison to other local alternatives this may be a factor. BRRFOC's tipping fee of \$46.25 for fiscal year 1992 is on the low side. Furthermore, BRRFOC's tipping fee has historically been low in comparison to other projects, rising from \$37.50 in February, 1988 to \$46.35 through June, 1992. It is unlikely that a significant amount of waste is being taken out of the BRRFOC service area. Due to the prevalence of contracted haulers for residential waste, any waste that is being taken out of the waste stream would be primarily from the commercial sector. In the BRRFOC service area, diverted waste would be a part of the Commercial Economy component drop in tonnage. If the conclusions of this study were followed, spare capacity due to diverted waste would *not* be committed on a long term basis.

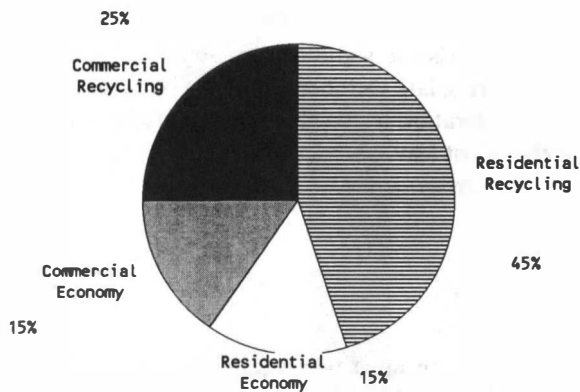


FIG. 7 COMPONENTS OF DECREASE IN WASTESTREAM, 1989-1991

## CONCLUSION

BRRFOC has experienced a significant drop in waste deliveries to the Waste to Energy plant. Similar phenomena have occurred elsewhere in the Northeast. It is imperative for financial and environmental reasons that the missing tonnage be made up. Due to potential problems with short term spot market contracts, it is desirable from an economic and public policy point of view to add additional communities to the service area.

In order to add towns and expand the service area, long term commitments must be made. Before making a long term commitment, the overseeing body must be sure that it is not oversubscribing the plant. Knowledge of the components of the tonnage drop is required.

In the BRRFOC area we have identified the following four major components of the tonnage drop and have calculated their contribution in Fig. 7.

Based on the above analysis, 25,000-30,000 tons of spare capacity could be committed on a long term basis.

The study done here can be applied to any other region in the country. It is anticipated that over the useful life of almost every waste to energy plant the service area will experience significant changes in the economy and/or recycling efforts. Other factors such as population growth can be factored into the study as needed.

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