

# Envirothon NB 2022

## Waste to Resources

Department of Environment and Local Government

April 6, 2022



## Presentation Overview

- Why should we make our waste into resources?
- Key Drivers
- Solid Waste Management in New Brunswick
  - Prior to 1985
  - Current Practices
    - A) Collection
    - B) Diversion
    - C) Disposal
  - Regulatory Tools
- Waste to Resources
- Next Steps

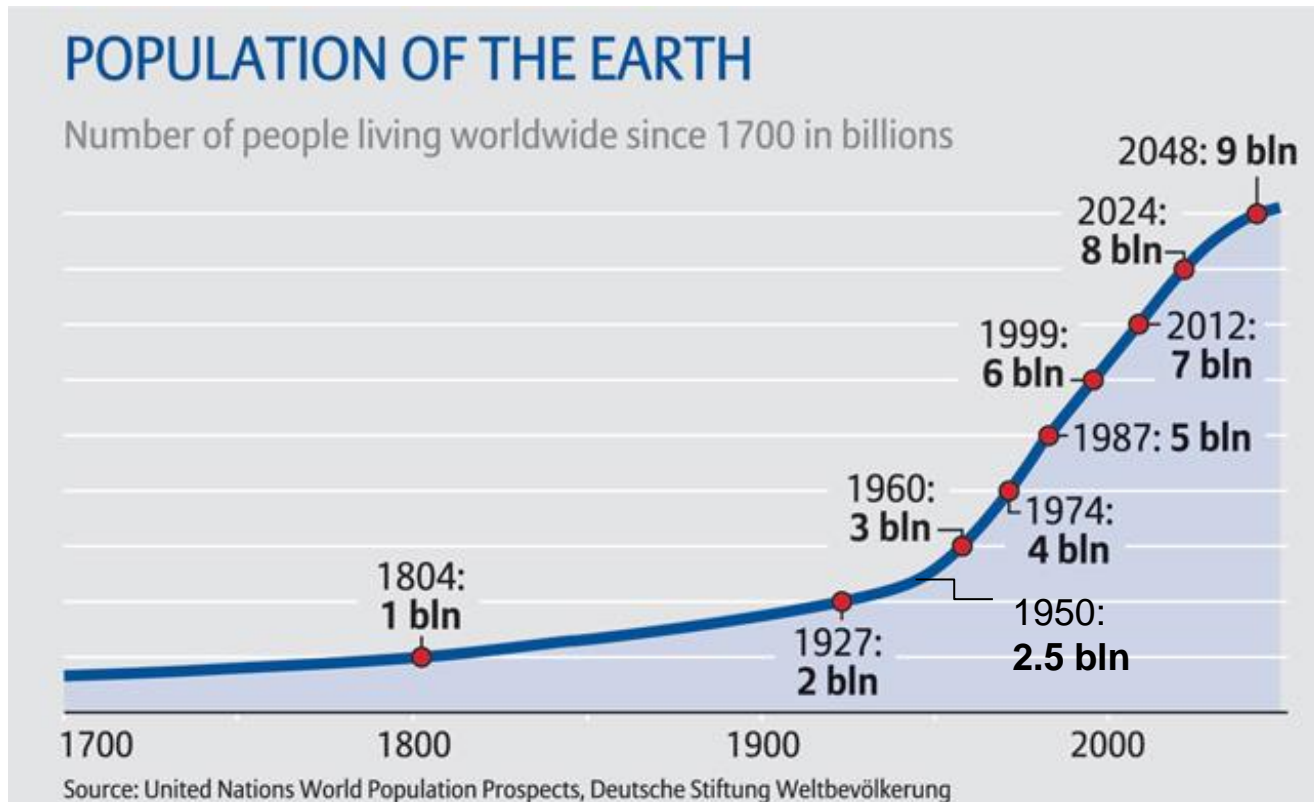
## Why do we need to reduce our waste?

- What's the problem?
- Why do we need to reduce the amount we dispose of in the landfill ?
  - Mismanaged waste impacts aesthetics, terrestrial and aquatic life, habitat, and human health and safety.
  - Organic material degradation produces landfill gas, 95% being methane ( $\text{CH}_4$ ) and carbon dioxide ( $\text{CO}_2$ ). Both are green house gases (GHG), with methane potency 25-27x more that of carbon dioxide.
  - Landfill sites have a large footprint and are becoming closer to residential neighbourhoods as communities grow. Engineered landfill cells are expensive to build, diversion results in extension of operational life.
  - However, what we call “waste”, often has value from its potential to:
    - 1) be reintroduced into the economy
    - 2) replace virgin material from being mined or harvested, reducing monetary and environmental costs.

# Key Drivers

# Key Drivers

## 1) Population Growth



**Figure 1:** Global population 1700-2020 projected to 2048

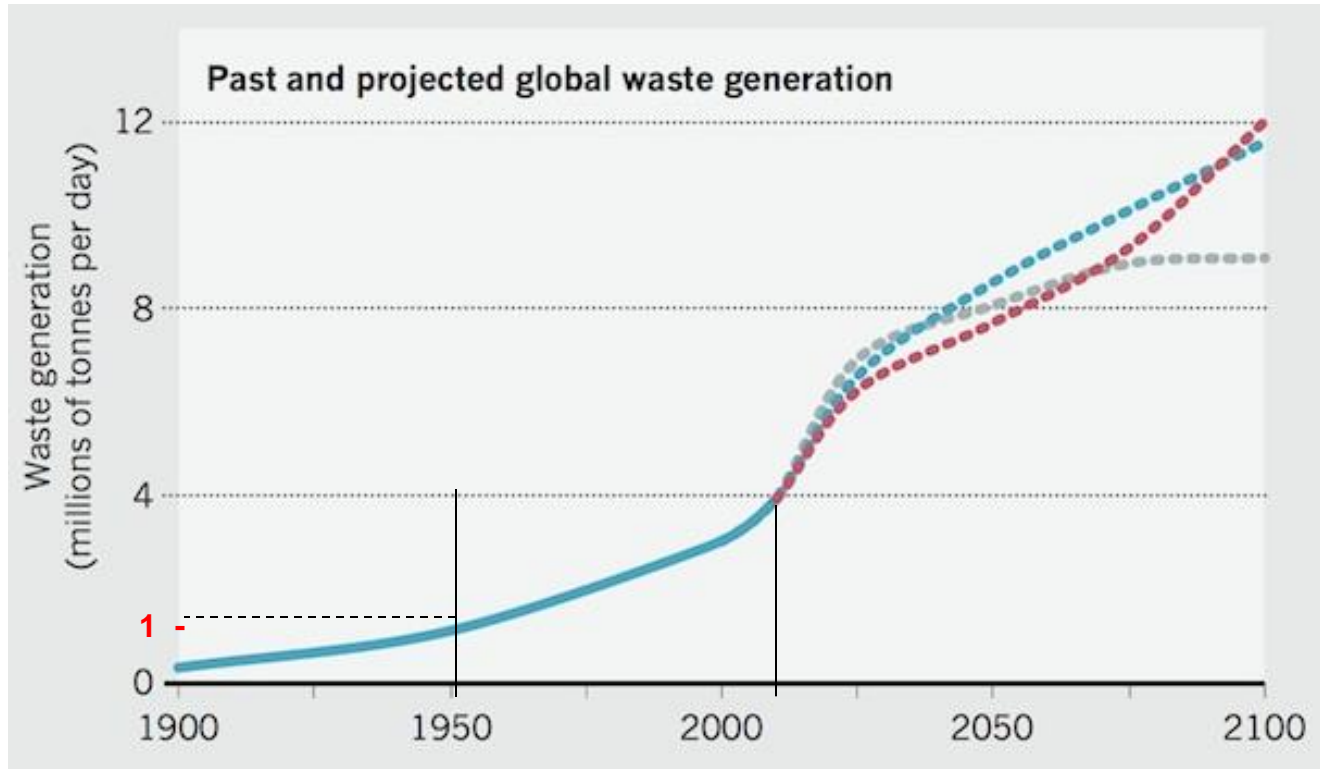
### Population increase Examples

$$1950-2010 = (6.8 / 2.5) \times 100 = 272\% \text{ or } 2.7X$$

$$1972-2022 = (7.8 / 3.8) \times 100 = 205\% \text{ or } 2X$$

# Key Drivers

## 2) Waste Generation



**Figure 2:** Waste generation 1900-2010 and projected to 2100 with 3 scenarios. (Stromberg 2013)

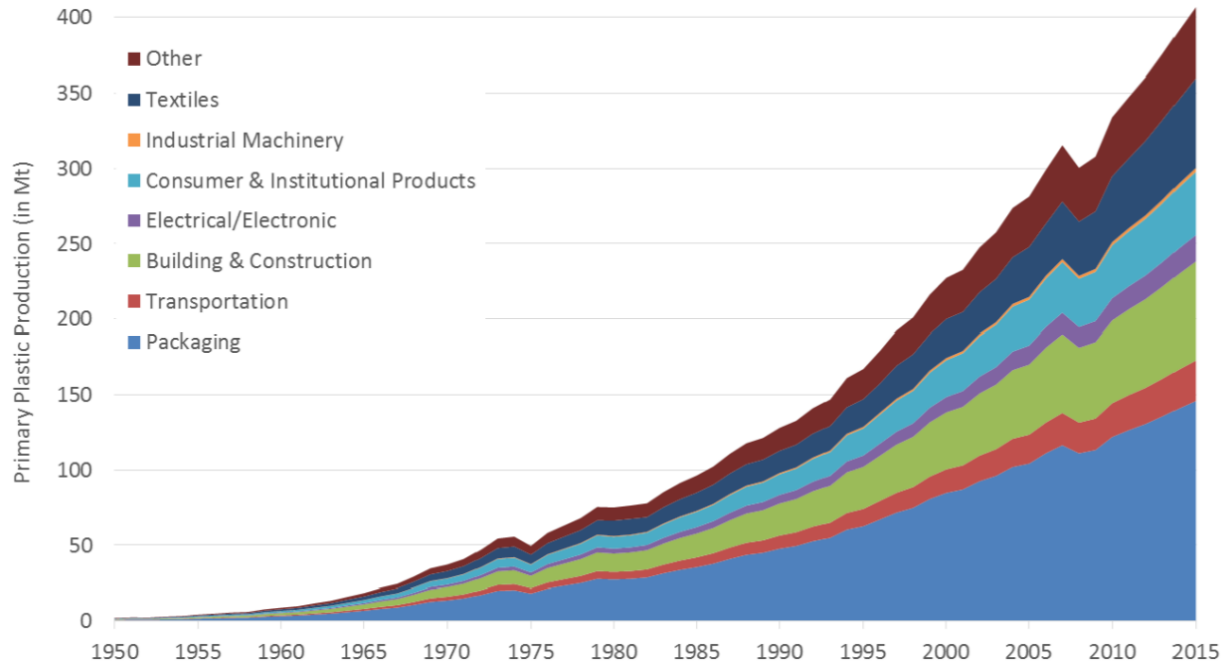
**Blue line:** No change in behaviour with current population growth rate

**Red Line:** No change in behaviour with increasing population growth rate

**Grey line:** Behaviour change with reduced population growth rate

# Key Drivers

## 2) Waste Generation (continued)



**Figure 3:** Primary plastic production 1950-2015 (Geyer et. al 2017, “Production, use, and fate of all plastics ever made”, Science Advances, [Production, use, and fate of all plastics ever made \(science.org\)](https://www.science.org)).

### 2010

350 million tonnes/year  $\approx$  960,000 kg/day or 0.96 million tonnes/day

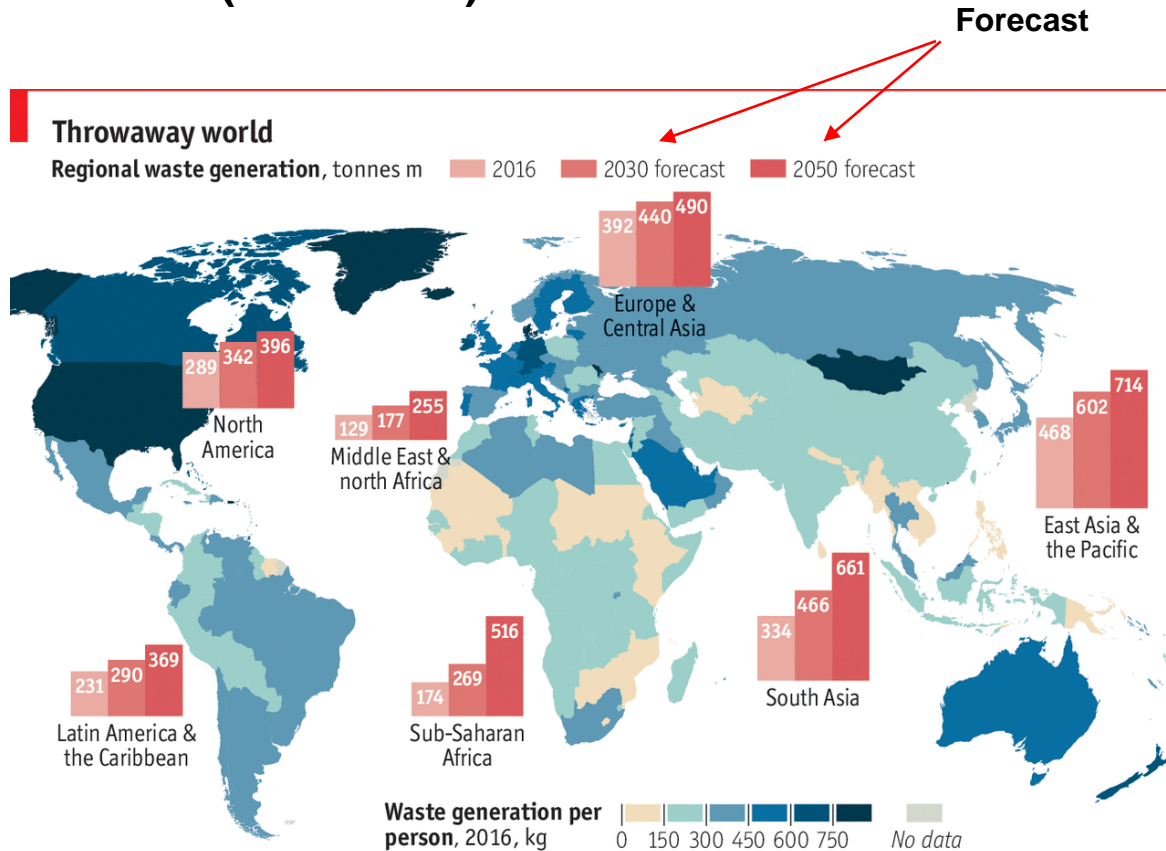
**From previous slide:** Increase in waste generation since 1950  
 $\approx$  3 million tonnes/day

**Increase due to plastic** =  $(0.96 \text{ MT} / 3 \text{ MT}) \times 100$   
= 32 % or about 1/3

**Increased population 1950-2010:**  $\approx$  2.7X

# Key Drivers

## 2) Waste Generation (continued)



Source: World Bank

The Economist

**Figure 4:** Global and per capita waste generation  
([Global waste generation will nearly double by 2050 | The Economist](#) )



However, the size of Planet has remained the same.

**Thus:** Population density has increased, which has resulted in a need to reduce the amount of waste generated by each of its inhabitants.

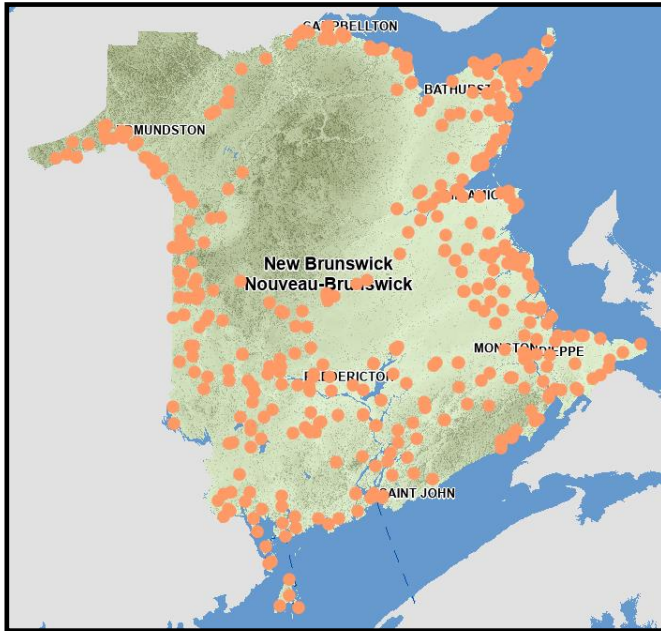


# Solid Waste Management in New Brunswick

# Solid Waste Management in New Brunswick

## 1) Solid Waste Management in New Brunswick Before 1985

- Municipalities responsible
- Province responsible for solid waste disposal in the unincorporated areas
- No organized solid waste collection for unincorporated areas
- Over 300 open pit dumpsites



# Solid Waste Management in New Brunswick

## 2) Current Waste Management Practices in New Brunswick

The management of solid waste in the province consists of **collection**, **diversion**, and **disposal** activities.

### A) Collection

Service for Residential and Industrial Commercial & Institutional (ICI) waste provided by:

- 1) Local Governments (cities, towns, villages, LSD's)
- 2) Regional Service Commissions (RSC),
- 3) Private sector.

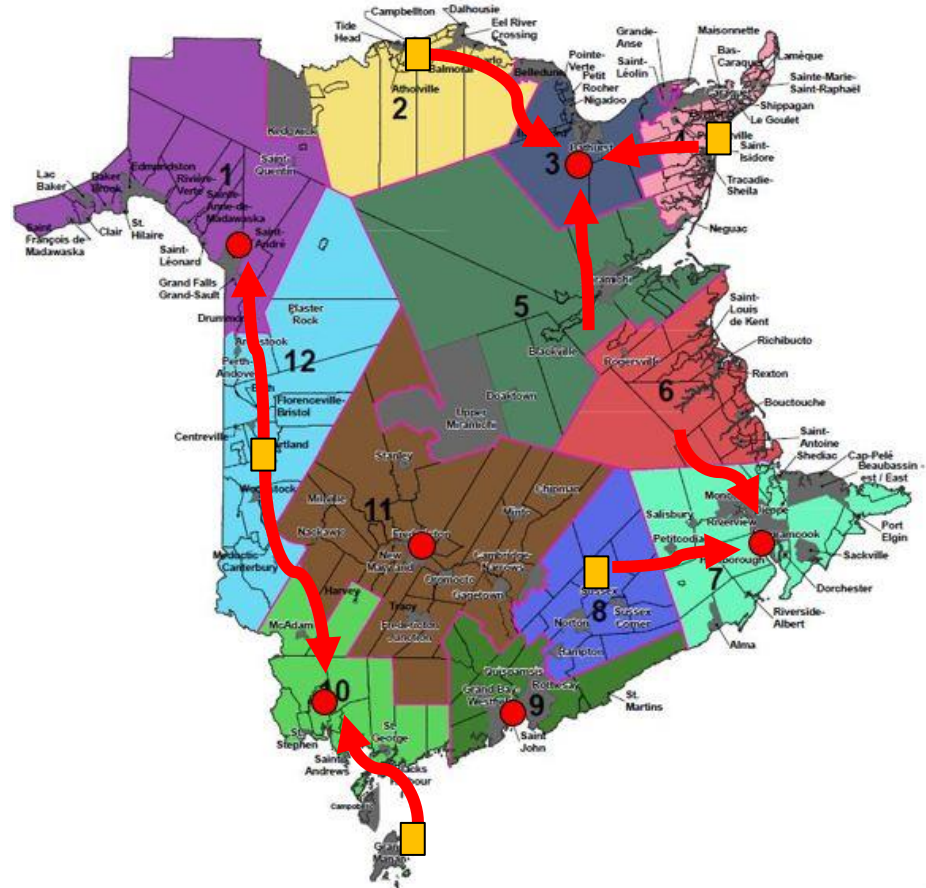
Differences exist between regions with respect to frequency (weekly, bi-weekly), form (cart/bag), as well as who offers and how it is delivered.

# Solid Waste Management in New Brunswick

## 2) Current Waste Management Practices in New Brunswick

### A) Collection (Continued)

Waste is transported directly to landfill within RSC, a neighbouring RSC's landfill or to RSC transfer station then to landfill within RSC (i.e. RSC 10) or within another region.



### RSC Operated

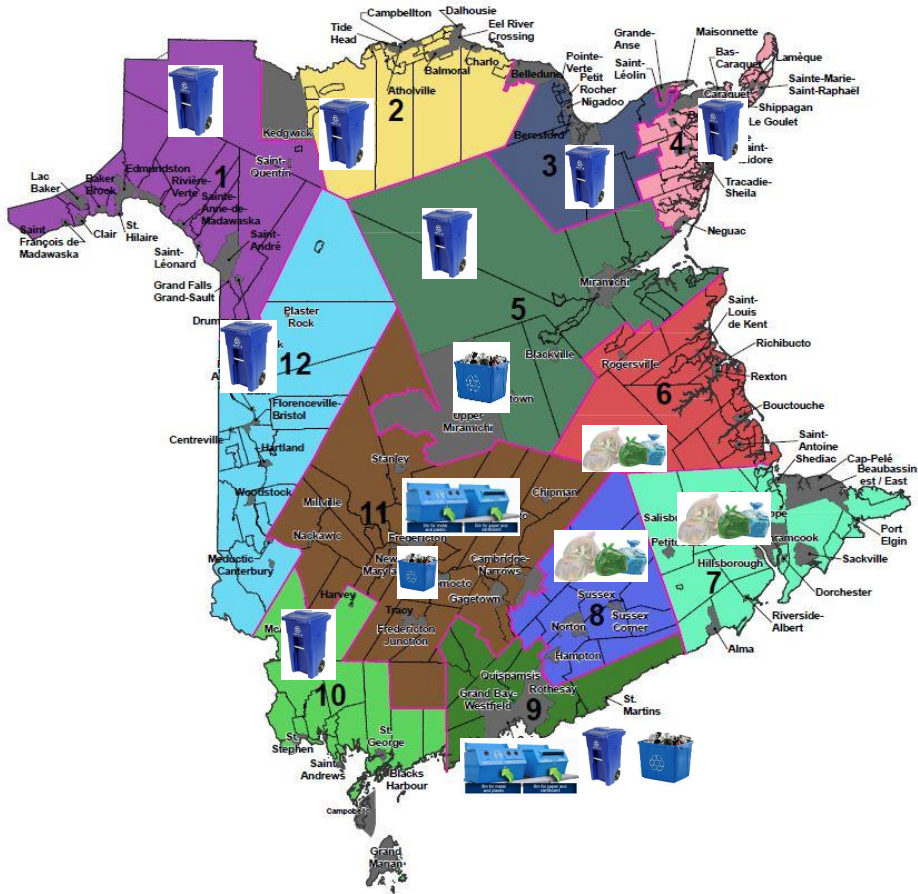
Landfills ●

Transfer stations ■

# Solid Waste Management in New Brunswick

## 2) Current Waste Management Practices in New Brunswick

### A) Collection Continued (Recycling)



Blue/Grey



Cart



Three bag



Depot

# Solid Waste Management in New Brunswick

## 2) Current Waste Management Practices in New Brunswick

### B) Diversion

#### 1) Voluntary Province Wide programs

##### A) Industry-led Initiatives

Cleanfarms

- Plastic pesticide container recycling



Atlantic Dairy Council

- Milk packaging
  - Cartons
  - Bags



Call2Recycle

- Household batteries



Canadian Batteries Association

- Lead Acid Batteries



# Solid Waste Management in New Brunswick

## 2) Current Waste Management Practices in New Brunswick

### B) Diversion (continued)

#### 1) Voluntary Province wide programs (Continued)

##### B) Regional Service Commission Initiatives:

Services offered often differ between regions.

##### Paper, Plastic, Metals

Blue box, cart or depot



##### Hazardous waste

On site or Mobile Collection



##### Organics

Backyard Composting (All RSC's)

Curbside (4/12 RSC's)



##### Other services offered by some regions

– Examples: White goods, tires, wood, mobile depot.





# Solid Waste Management in New Brunswick

## 2) Current Waste Management Practices in New Brunswick

### B) Diversion (continued)

#### 2) Province wide Regulated Diversion Programs

- Beverage Containers Program 
- Tire Stewardship Program 
- Extended Producer Responsibility (EPR) Programs
  - Designated Materials Regulation
  - Tire Stewardship managed and EPR Program oversight by Recycle NB
- Current EPR materials:
  - Paint
  - Used Oil & Glycol
  - Electronics
  - Paper Products and Packaging (2023)



# Solid Waste Management in New Brunswick

## 2) Current Waste Management Practices in New Brunswick (Continued)

### C) Disposal

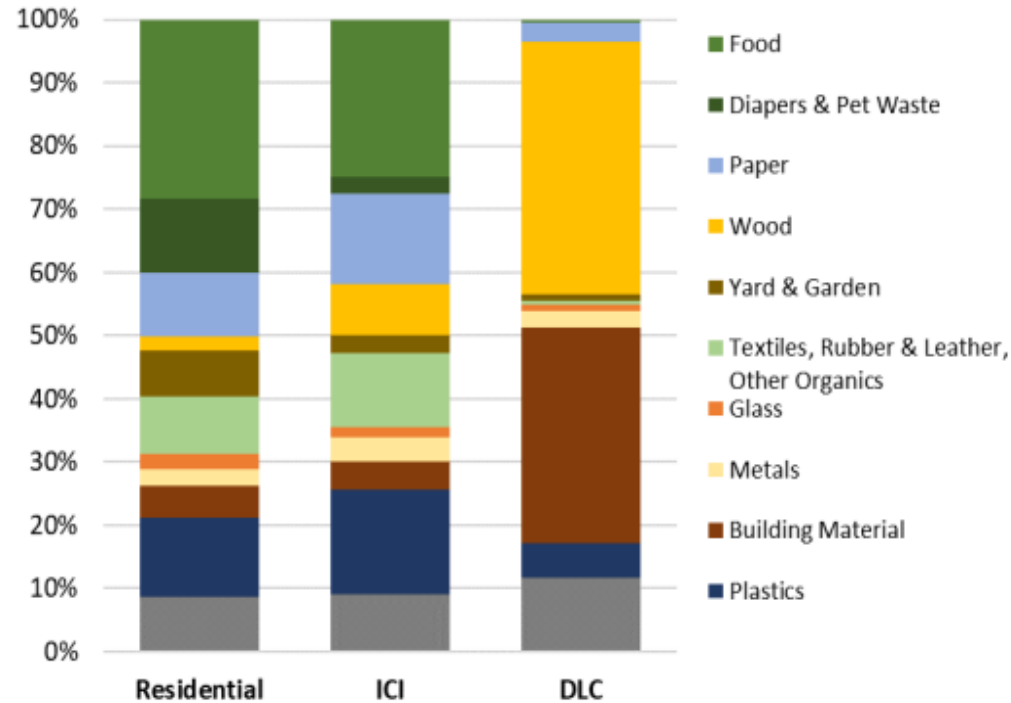
#### Municipal Solid Waste

##### Residential and ICI

- Predominantly composed of organics

##### Construction Renovation Demolition

- Predominately composed of building materials and wood.



**Figure 5:** Composition of Municipal (Residential + ICI) and Construction Renovation and Demolition waste. (ECCC 2018)

# Solid Waste Management in New Brunswick

## 2) Current Waste Management Practices in New Brunswick

### C) Disposal (continued):

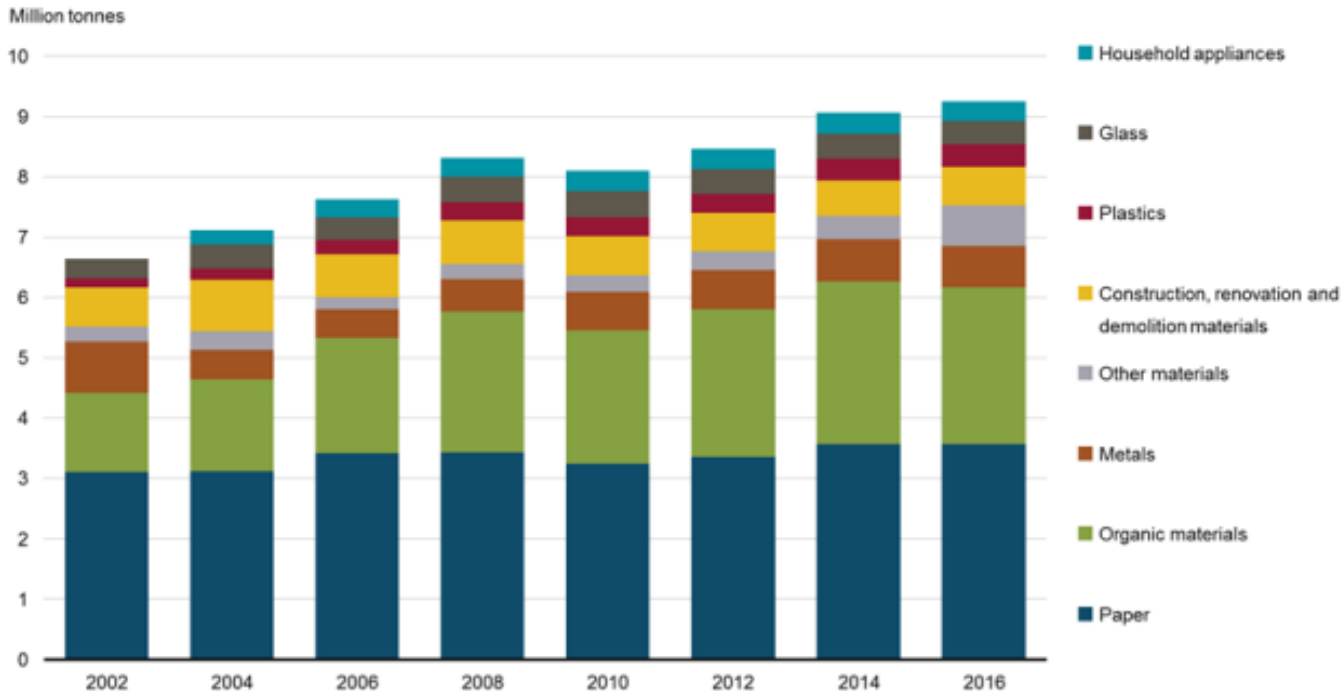


Figure 6: Composition of municipal solid waste (2002-2016) (ECCC 2018)

# Solid Waste Management in New Brunswick

## 2) Current Waste Management Practices in New Brunswick

### C) Disposal (Continued)

#### Waste to Energy

- Wastes or emissions from wastes burned to produce energy.
- There are no facilities in the NB that burn municipal waste for energy.
- Wood biomass facilities do exist (e.g. Fraser mill Edmundston, UNB Fredericton 30-60% biomass).
- Biogas: Five of six RSC landfills in the province, one pulp mill, and one dairy farm produce electricity from landfill methane. Cavendish Farms presentation last week.

#### Landfilling

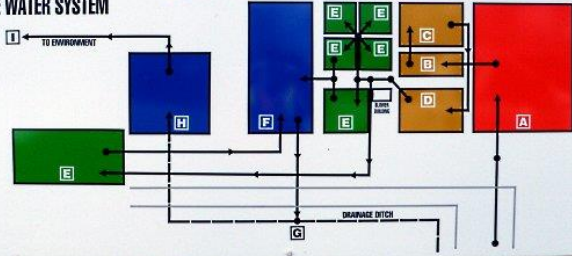
- Engineered Landfill
- Clay lined with geo membrane base and cap (bottom and top).
- Leachate Collection and Treatment
- Groundwater and gas monitoring wells
- Landfill Gas Management Systems
  - gas collection and treatment by flaring ( $\text{CH}_4$  to  $\text{CO}_2$ ) or gas ( $\text{CH}_4$ ) to energy

# Typical Modern Landfill Cross Section



# LEACHATE TREATMENT

- A** SURGE POND
- B** PRIMARY SETTLING & AERATION
- C** SECONDARY SETTLING & AERATION
- D** STORAGE POND WITH AERATION
- E** SAND FILTERS
- F** TREATED LEACHATE HOLDING POND
- G** DISCHARGE POINT TO SURFACE WATER SYSTEM
- H** SEDIMENTATION POND
- I** OUTFALL CORRIDOR TO ENVIRONMENT

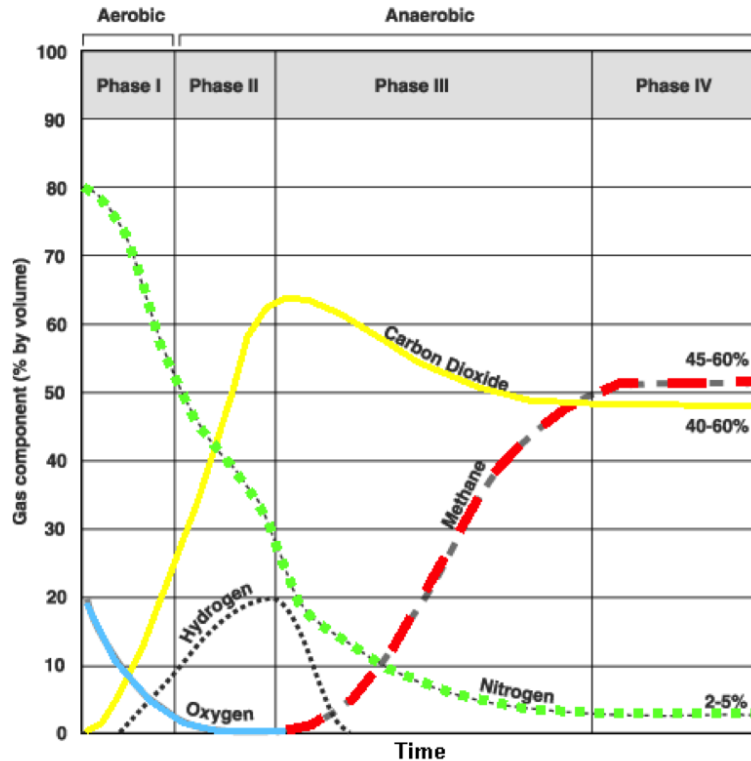


# Solid Waste Management in New Brunswick

## 2) Current Waste Management Practices in New Brunswick

### C) Disposal (Continued)

#### Landfill Gas Generation and composition



Source: EPA 1997

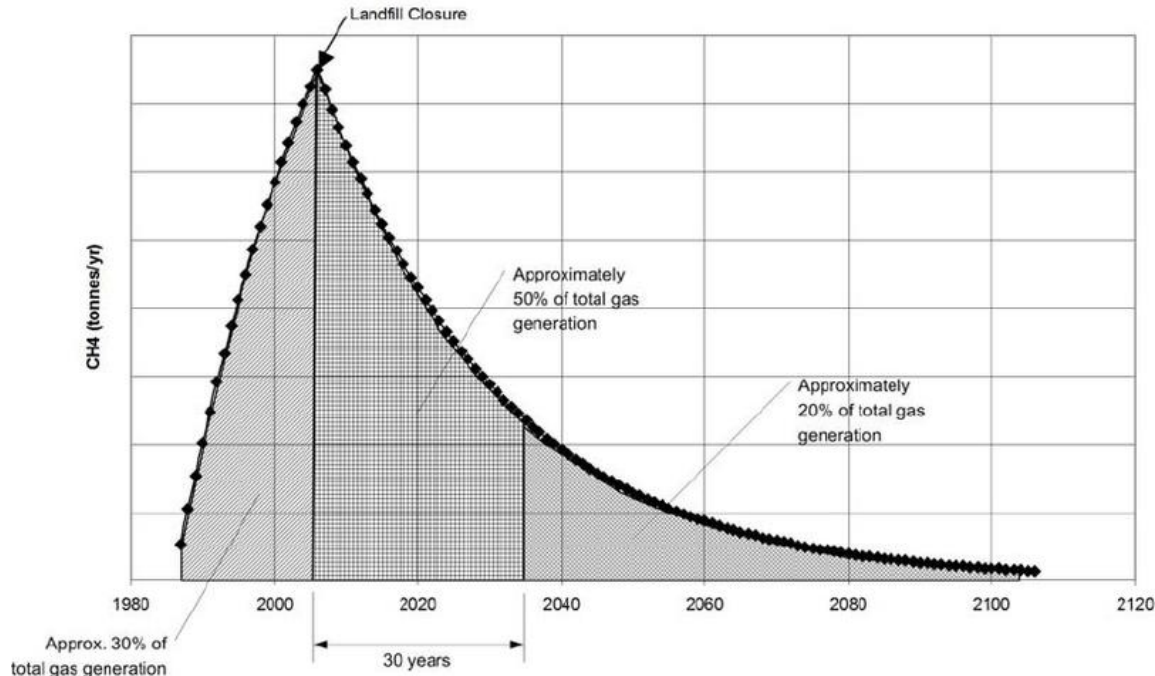
Figure 7: Gas generation during aerobic and anaerobic phases.

# Solid Waste Management in New Brunswick

## 2) Current Waste Management Practices in New Brunswick

### C) Disposal (Continued)

#### Methane Gas Generation and composition



**Figure 8:** Standard methane gas generation curve (Dever et al. 2010)  
([\(PDF\) Handbook for the design, construction, operation, monitoring and maintenance of a passive landfill gas drainage and biofiltration system \(researchgate.net\)](#) )



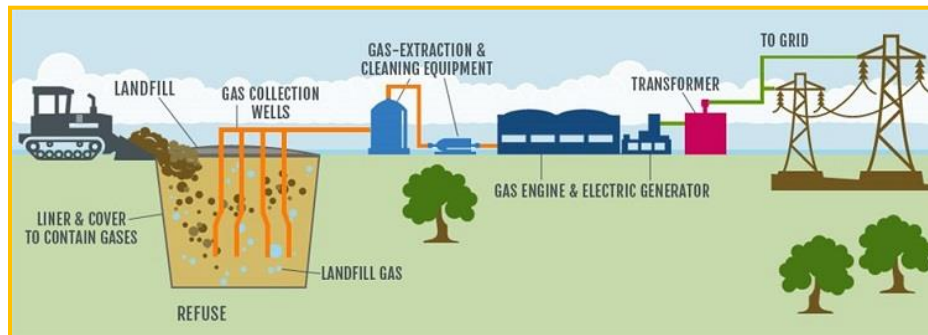
# Solid Waste Management in New Brunswick

## 2) Current Waste Management Practices in New Brunswick

### C) Disposal (Continued)

#### Landfill gas recovery

- Biogas or landfill gas generated at landfills is about 50% methane.
- Landfill gas can be recovered from the interior of a landfill using a series of extraction wells and blowers to draw the gas out.
- Once recovered, landfill gas is usually combusted, which converts the methane to carbon dioxide – significantly reducing GHG emissions.
- Landfill gas can be combusted directly (with minimal treatment) in a landfill gas flare, a boiler or an electrical generator, or it can be upgraded to remove impurities which allow use as renewable natural gas or compressed renewable natural gas.



**Figure 9:** Landfill gas recovery and electricity generation  
([Landfill Gas - A Small Benefit to a Very Dire Problem? \(theearthproject.com\)](http://theearthproject.com) )

# Solid Waste Management in New Brunswick

## 2) Current Waste Management Practices in New Brunswick

### C) Disposal (Continued)

#### Construction Renovation and Demolition

Waste obtained during the construction, renovation or demolition of a building or structure.

**Permitted materials:** untreated wood, concrete, brick, broken and aged asphalt, siding, ceiling tile, wall board (Gyproc), insulation, asbestos (non friable), asphalt shingles, glass from doors and windows, metal, wood and durable plastic structural materials from demolition projects, wiring and incandescent light fixtures, toilets, bathtubs, wash basins, plumbing fixtures and floor coverings attached to a building during demolition.



# Solid Waste Management in New Brunswick

## 2) Current Waste Management Practices in New Brunswick

### C) Disposal (continued)

#### Hazardous wastes

- Hazardous wastes cannot be disposed of in the municipal solid waste system or C&D sites.
- Required to be collected and transported to an approved disposal location or transfer station to prepare for final disposal. Hazardous wastes can only be transported by approved carriers.
- There are several large carriers in the province that collect and transport all classes of hazardous waste. They often are taken to a transfer station first (Moncton, Saint John, Sussex) to re-package in bulk and then sent to the appropriate disposal location for that type of waste. Often in Quebec or Ontario.

#### **Biomedical Waste**

- YELLOW BAG (needles etc.) sterilized through an autoclave system and then landfilled.
- RED BAG (blood, body parts) incinerated out of province



# Solid Waste Management in New Brunswick

## 2) Current Waste Management Practices in New Brunswick

### C) Disposal (Continued)

#### Hazardous wastes (continued):

##### **Pharmaceutical Waste**

- Often recycled and/or disposed of out of province. Many companies have their own stewardship programs for these wastes.

##### **Used Paint**

- NB Stewardship Recycle Program – collection and re-use program in Bouctouche.

##### **Used Oil**

- Recycle/Reuse programs throughout the province. Impurities removed and able to re-use.

##### **Old chemicals (e.g. labs)**

- Stored in drums for safety and disposed of out of province.



# Solid Waste Management in New Brunswick

## Regulatory Tools:

<b><u>Municipal</u></b> (i.e. cities, towns, villages)	
Collection	Municipal bylaws
Distribution bans (e.g. SUP bags)	
<b><u>Provincial</u></b>	
RSC MSW Landfills and CRD sites	Approvals issued under the authority of the <i>Water Quality Regulation</i> within the <i>Clean Environment Act</i> and <i>the Clean Air Regulation</i> within the <i>Clean Air Act</i> .
Private CRD facilities RSC and municipal transfer stations	Approvals issued under the authority of the <i>Water Quality Regulation</i> within the <i>Clean Environment Act</i>
Provincial Regulated Diversion programs - Stewardship - Extended Producer Responsibility	<i>Designated Materials Regulation</i> of the <i>Clean Environment Act</i> . <i>Beverage Container Act</i> . General Regulation
Illegal Dumping and Littering	<i>Clean Environment Act</i> .

# Solid Waste Management in New Brunswick

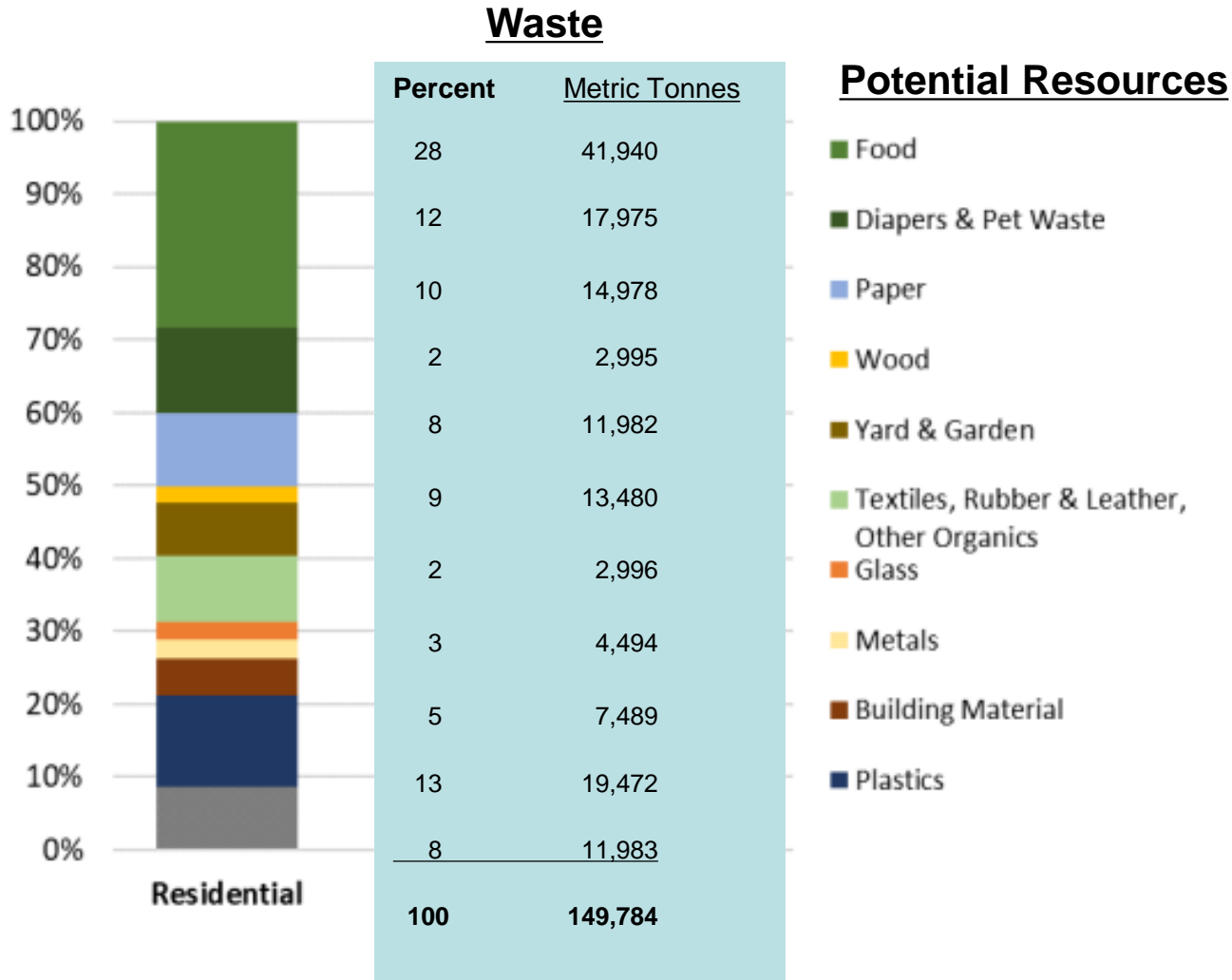
## Regulatory tools (continued):

### Federal

- Plastics and methane regulated by the Canadian Environmental Protection Act (CEPA) which enables the publication of regulations under Section 93 of the Act.
- Draft Regulations on six types of single use plastics to be finalized as early as the end of 2022:
  - checkout bags
  - ring carriers
  - cutlery
  - foodservice ware made from polystyrene foam (Styrofoam), polyvinyl chloride (PVC) and carbon black or oxo-degradable plastic
  - straws
  - stir sticks
- *Canadian Net-Zero Emissions Accountability Act 2021*  
Enshrines in legislation the federal governments commitment to achieve a 40-45 % reduction in green house gas emissions by 2030 and net-zero by 2050.

# Waste to Resources

# Waste to Resources



**Figure 10:** Composition of Municipal Solid Waste and potential resources within waste  
(Sources: ECCC 2018 and Dillon Consulting 2020)

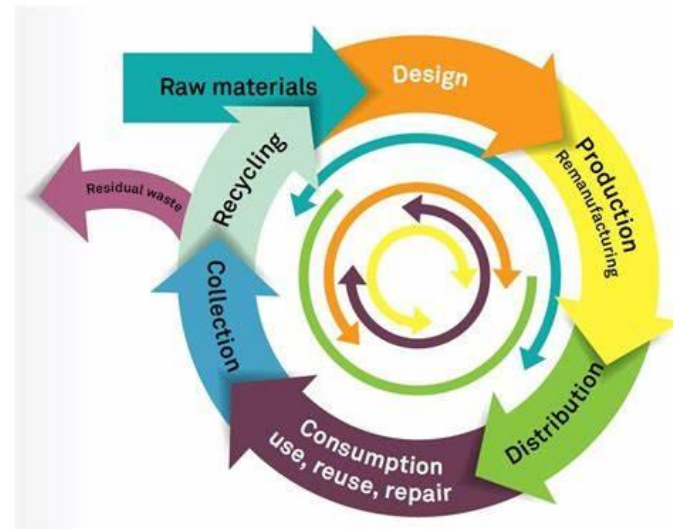


# Waste to Resources

## Circular Economy

An economy that retains and recovers as much value as possible from resources used to produce products and materials within the marketplace by reusing, repairing, refurbishing, remanufacturing, repurposing, or recycling products and materials.

Applying circular principles reduces impacts on resources and reduces waste which avoids the generation of greenhouse gas emissions during extraction of resources and the management of waste.



# Waste to Resources

## Construction Renovation Demolition

- Halifax C&D presentation
- Sort and recycle wood, metals, plastics, tires, glass, metals, shingles etc.
- May be made refurbished or made into numerous products depending on material type.








## Plastics

- Not all plastics are the same, many types, some more recyclable than others.
- Depending on type, can be recycled into building materials, clothing, bottles, auto parts etc.

# Waste to Resources

## Plastics (continued)

**Table 1:** Common sources and recycled products from plastic resins.

 <b>PETE</b>	 <b>HDPE</b>	 <b>PVC</b>	 <b>LDPE</b>	 <b>PP</b>	 <b>PS</b>	 <b>Other</b>
Polyethylene Terephthalate	High-Density Polyethylene	Polyvinyl Chloride	Low-Density Polyethylene	Polypropylene	Polystyrene	Other
<b>Common Sources</b>						
Beverage containers, cups, jars, trays, clamshells.	Milk jugs, detergent & shampoo bottles, flower pots, grocery bags	Cleaning supply jugs, pool liners, twine, pipe, automotive product bottles	Bread bags, product wrap, squeeze bottles, trash bags, six pack rings.	Yogurt tubes, cups, juice bottles, straws, hangers, sand and shipping bags.	Take out containers hot cups, CD cases, shipping material, food trays	Nylon, safety glasses, CD's, headlight lenses.
<b>Recycled Products</b>						
Clothing, carpet, clamshells. Beverage containers.	Detergent bottles, flower pots, crates, pipe, decking.	Pipe, siding, binders, carpet backing, flooring.	Trash bags, plastic lumber, furniture, shipping envelopes, compost bins	Paint cans, speed bumps, auto parts, food containers, hangers, plant pots.	Picture frames, crown molding, flower pots, toys, tape dispensers.	Electronic housings, auto parts

# Waste to Resources

## Paper

- The most common sources of used paper are newsprint (old newspapers and flyers), cardboard (corrugated cardboard boxes), office paper (shredded and other), and mixed paper (coloured paper, cereal boxes, magazines, coffee cups etc.).
- Recycled paper requires less energy and water to produce than virgin paper. In addition, it generates less air pollution.

## Examples of recycled products:

Recycled paper, cardboard, boxboard, roofing felt, toilet paper, tissues, greeting cards, paper towels, napkins, paper board, (e.g. cereal and cracker boxes).



# Waste to Resources

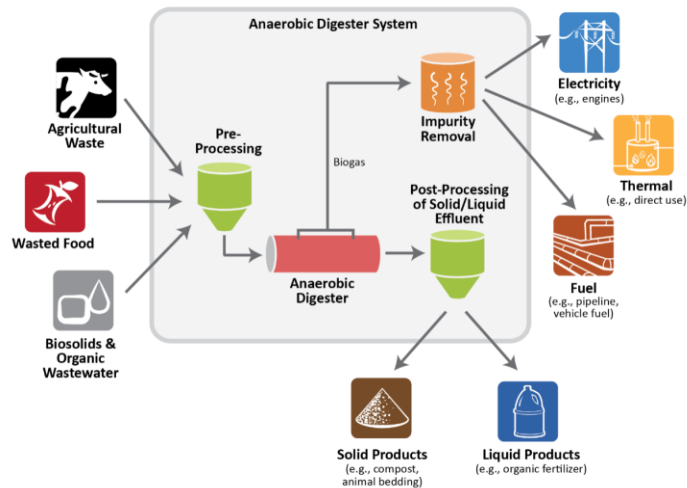
## Organics

- 23% of methane generated in Canada originates from MSW (ECCC 2022).

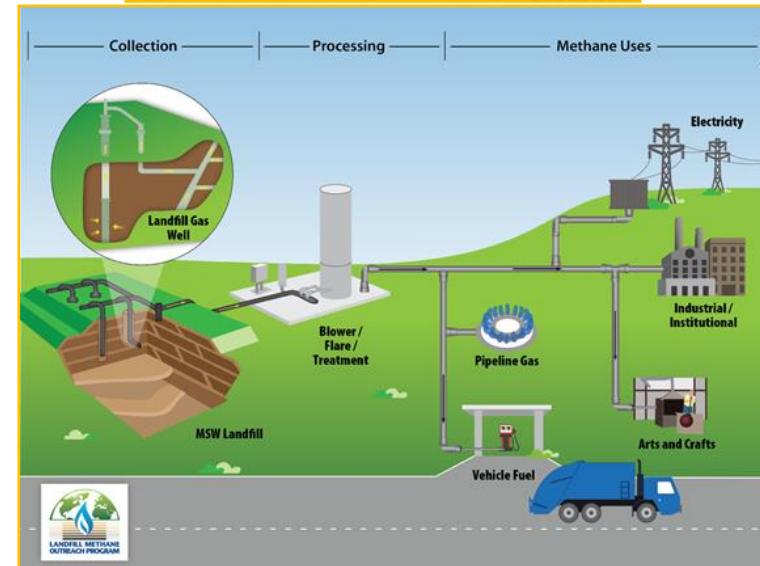
**Aerobic:** Produce compost in windrows/in vessel.  
- No CH<sub>4</sub> produced. Primarily N and CO<sub>2</sub>

**Anaerobic digestion:** No oxygen, CH<sub>4</sub> and CO<sub>2</sub> produced.

**Compost:** Addition to soil improves structure, nutrient content and moisture holding capacity.



Source: [Anaerobic Digestion \(tn.gov\)](https://www.tn.gov)



# Waste to Resources

## Emerging Technologies

**Pyrolysis:** the thermal decomposition of materials at elevated temperatures in an inert atmosphere. It involves a change of chemical composition. The word is coined from the Greek-derived elements pyro "fire", "heat", "fever" and lysis "separating".

- Produce products from municipal solid waste.
- Include biomass pellets for energy production to #1 (kerosene) and #2 (diesel) fuels derived from plastics.
- First North American facility, Sustane Technologies Inc. in Chester, Nova Scotia.  
**Link:** <https://sustanetech.com/>

## Next Steps

### For Dept Environment & Local Government

In consultation with key stakeholders and other interested parties, the department are developing a *Strategic Action Plan for Solid Waste Management in New Brunswick*. The plan will replace the Department's 2001 Waste Reduction and Diversion Action Plan.

### For you

Envirothon Competition: May 1-2, 2022

