The Conversion of a Municipal Solid Waste Boiler Plant to Burn Alternate Fuels

by

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Background

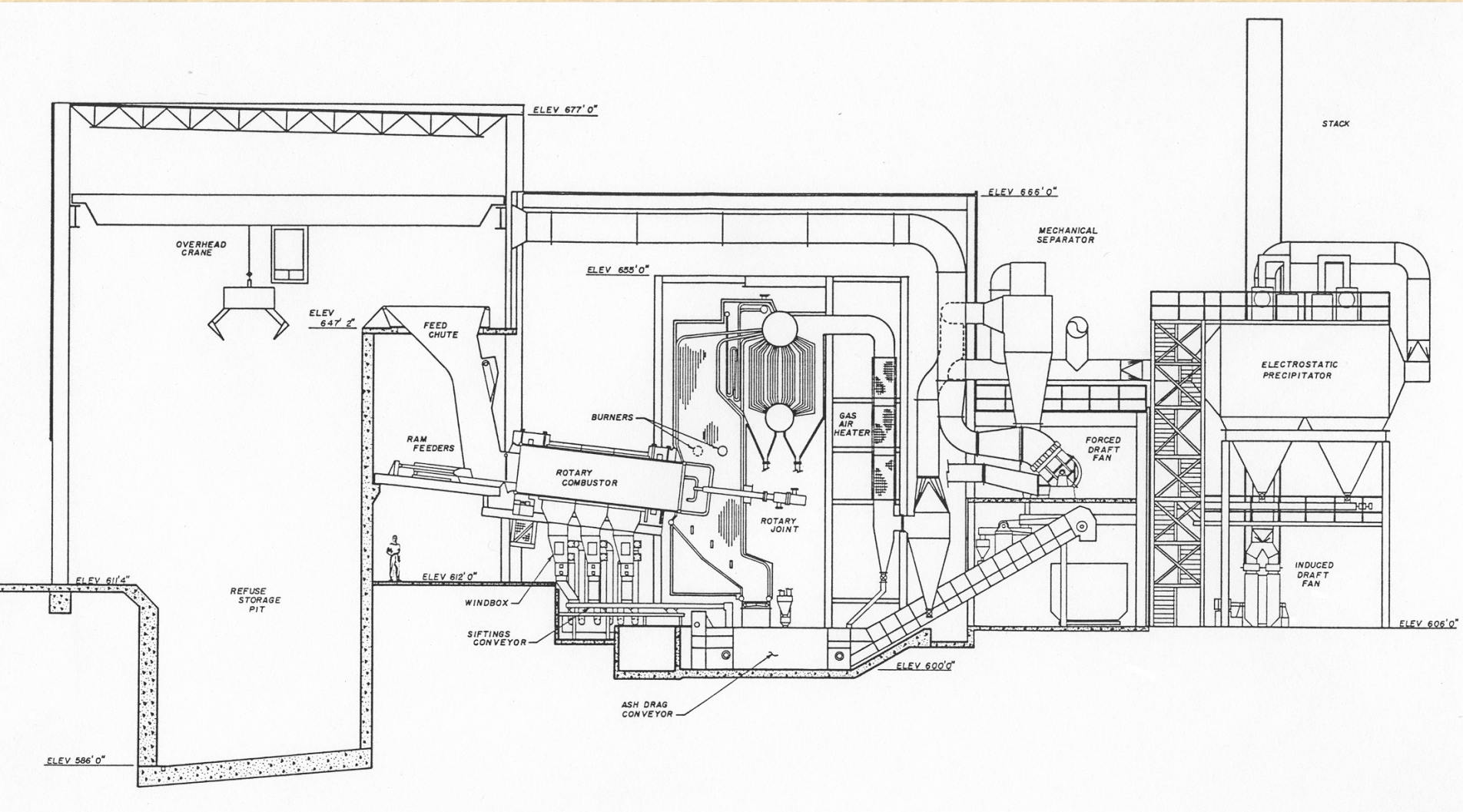
- 200 ton per day waste-to-energy plant located in Gallatin, Tennessee
- Construction completed in late 1981
- Start-up & commissioning took place in February 1982
- Serves all of Sumner County, Tennessee
- Owned & managed by the Resource Authority in Sumner County

Background (continued)

- $10.2 million construction cost
- Plant supplies steam to area industries
- 550 kW turbine generator for sale of electricity to the Tennessee Valley Authority

Plant Equipment

- Fuel storage pit with an overhead crane
- Two combustion trains
  - Rotary waterwall combustor
  - Waterwall boiler rated at 27,000 lb/hr @ 525°F/425 psig
  - Forced draft fan
  - Induced draft fan
  - Cyclone separator
  - Electrostatic Precipitator
  - Stack


ELEV 677'0"
OVERHEAD CRANE
ELEV 647'2"
FEED CHUTE
ELEV 655'0"
ELEV 666'0"
MECHANICAL SEPARATOR
STACK
ELECTROSTATIC PRECIPITATOR
BURNERS
RAM FEEDERS
ROTARY COMBUSTOR
GAS AIR HEATER
FORCED DRAFT FAN
ROTARY JOINT
INDUCED DRAFT FAN
ELEV 611'4"
REFUSE STORAGE PIT
ELEV 612'0"
WINDBOX
SIFTINGS CONVEYOR
ELEV 600'0"
ELEV 606'0"
ASH DRAG CONVEYOR
ELEV 586'0"

Waste-to-Energy Operations

- Consistent operations since Feb. 1982
  - exception of maintenance/inspections
  - two pit fires
- EPA promulgated revised air regulations for waste-to-energy plants with a compliance date of May 2005 for the Gallatin facility
- To meet acid gas emissions, new regulations would require:
  - New wet or dry scrubbers
  - New baghouses

Waste-to-Energy Operations (continued)

- Based on:
  - potential capital expenses
  - current operation costs vs. landfilling
- Resource Authority made decision to cease waste-to-energy operations

Operations Changes Hands

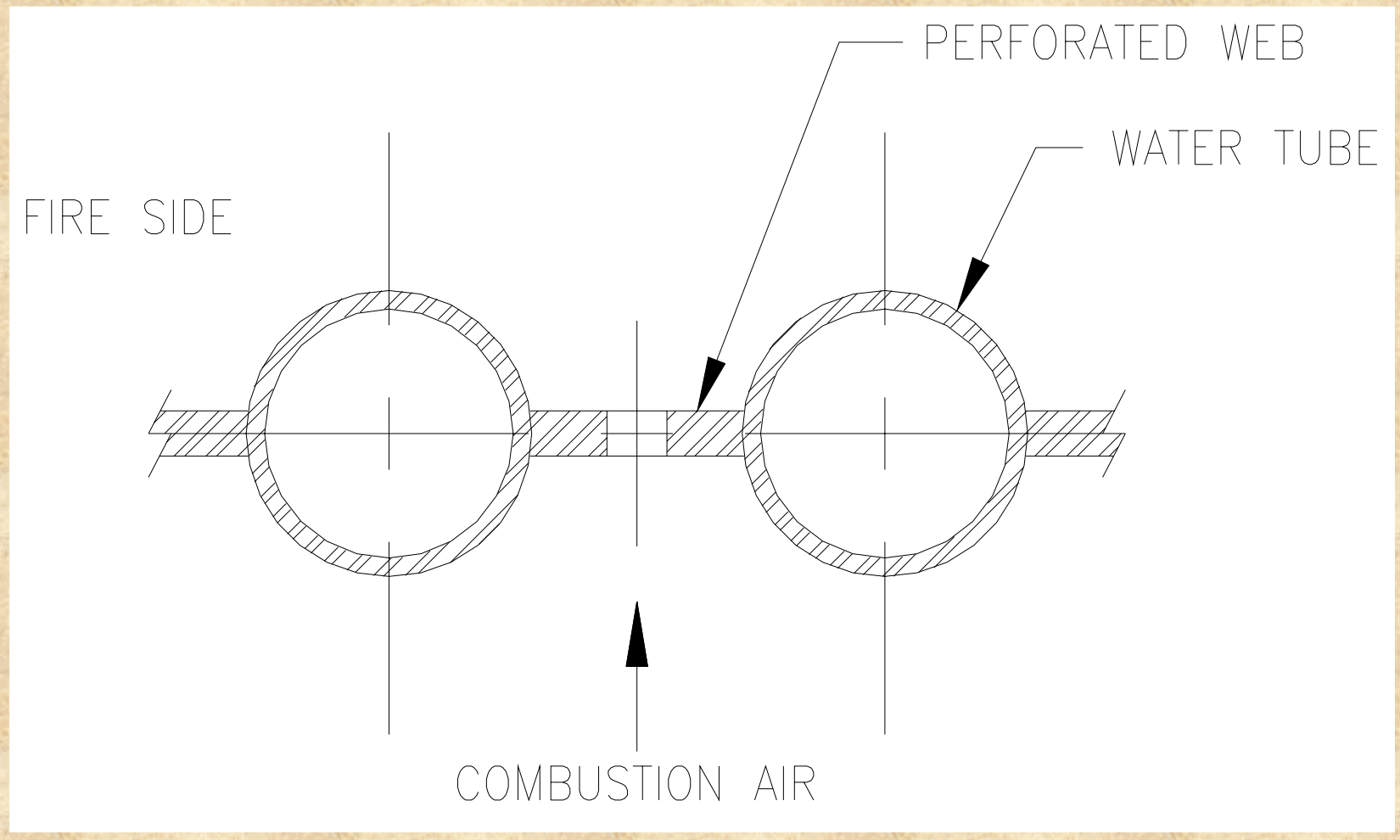
- Resource Authority approached by TVI of Youngstown, Ohio
  - Lease the plant
  - Assume operations on wood fuel
- Preliminary discussions between TVI, Resource Authority and steam customers
- Temporary, short term agreement reached

Operations Changes Hands (continued)

- TVI brought in TTI Technologies of Omaha, Nebraska as equity partner
- Gallatin Thermal, LLC formed
- Revised air permit submitted
- TTI Technologies assumed sole ownership of Gallatin Thermal, LLC

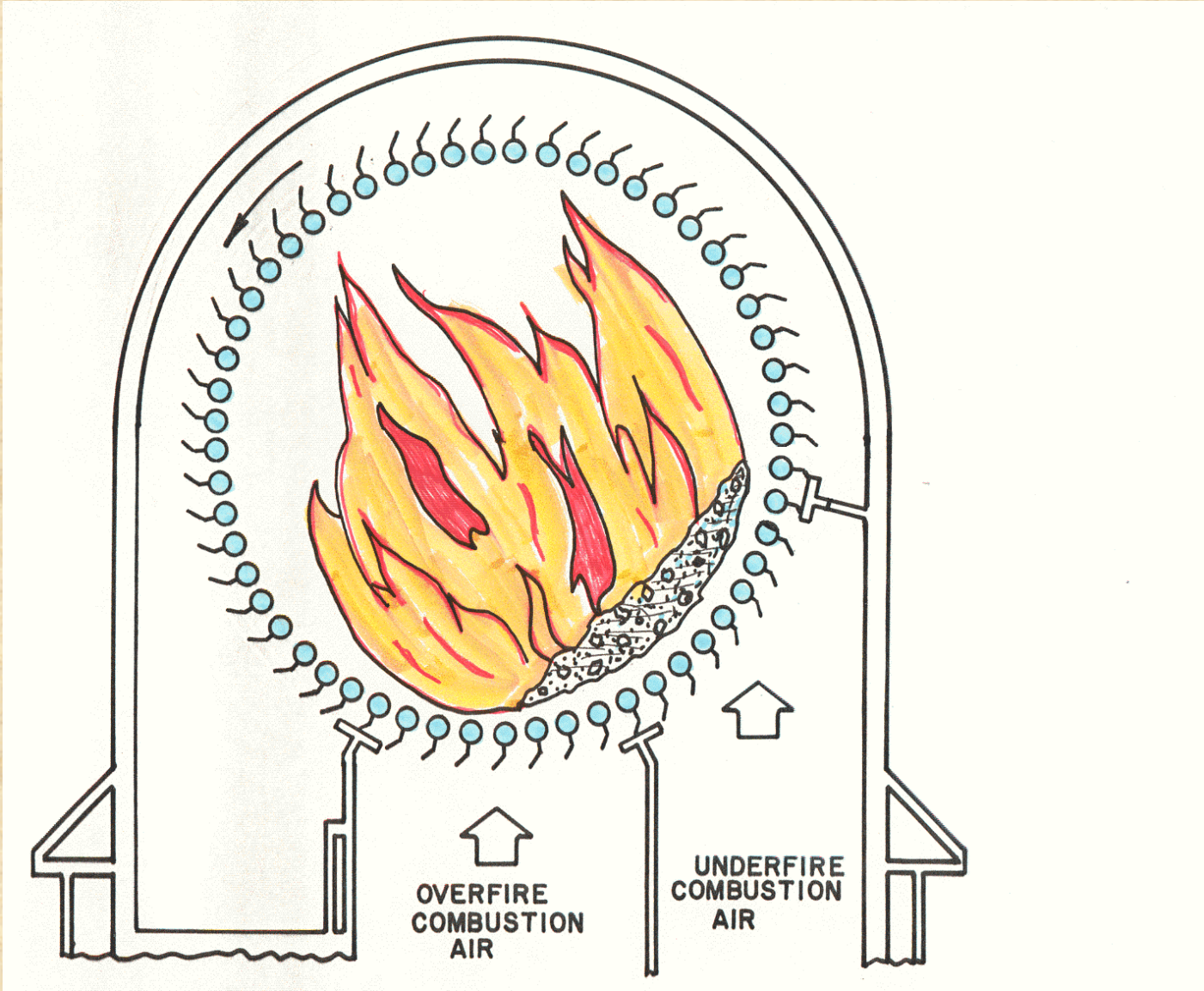
Wood Fuel Process Changes

- Rotary combustor:
  - Unique technology
  - 80” diameter cylinder x ~15 Ft long
  - Constructed of alternating water tubes and perforated webbing
  - Water is circulated through combustor tubes
  - Combustor tubes connected to the boiler water circuit
  - Combustor accounts for ~ 20% of total unit steam production


PERFORATED WEB
WATER TUBE
FIRE SIDE
COMBUSTION AIR

Wood Fuel Process Changes (continued)

- Rotary Combustor (continued)
  - Rotates @ 1/6 rpm
  - Sloped at 6° from horizontal
  - Combustion air is split into separate, controlled air zones
    - transverse controlled underfire & overfire areas
    - longitudinal areas along fuel path


OVERFIRE
COMBUSTION
AIR
UNDERFIRE
COMBUSTION
AIR

Wood Fuel Process Changes (continued)

- No equipment changes required
- Some repairs/maintenance required
  - Air heater
  - Seals

Wood Fuel Air Permit Changes

- Rotary combustor is unique technology
- Rotary combustors exist in U.S. and worldwide in limited numbers
- No basis established for emissions from wood combustion in rotary combustor
- Tennessee Dept. of Environment and Conservation (TDEC) granted a limited permit
- Emissions testing required before issuance of final operating permit

Existing Temporary Air Permit

- Items which <u>can</u> be burned:
  - Yard waste & clean wood:
    - Grass, grass clippings, bushes, shrubs
  - Untreated clean wood:
    - Lumber, tree stumps, tree limbs
  - Pallets made from untreated, clean wood

Existing Temporary Air Permit (continued)

- Items which can not be burned:
  - MSW or municipal type solid wastes
    - Defined as materials discarded by households, commercial/retail establishments or institutions
  - Refuse-derived fuels
  - Used oil
  - Sewage sludge
  - Demolition wastes
  - Treated or painted wood
  - Any wood containing glues (plywood, pressboard)

Existing Temporary Air Permit (continued)

- Items which can not be burned: (continued)
  - No paper products, cardboard or newspapers
  - Plastics, synthetic materials, vinyl
  - Roofing materials
  - Paints
  - Chemicals

Wood Operational Changes

- Fuel Throughput
  - MSW BTU rating: 4,500 Btu/Lb (nominal)
  - Wood BTU rating: 4,500 Btu/Lb based on wet, green wood
  - Throughput should remain relatively unchanged
- Wood must be shredded or chipped due to retention time and resulting burn-out

Wood Operational Changes (continued)

- Fuel Source
  - Initially from Resource Authority yard waste operations
    - Poor quality due to moisture, decomposition and inerts
  - Wood fuel suppliers (interim)
  - Gallatin Thermal Operations
    - Private county haulers and City of Gallatin
    - Require shredder

Wood Operational Changes (continued)

- Gallatin Thermal purchased & installed a used shredder
  - Two, 200 hp electric motors
  - associated conveyors


JOHN DEERE


DANGER
ROTATING
MACHINERY

Wood Summary

- Since August of 2005, Gallatin Thermal has received ~ 30,000 tons of wood at a cost of ~$276,000
- Equates to:
  - $9.20/ton
  - $1/mmbtu @ 4500 Btu/Lb
- Cost includes purchased wood, however current costs are lower than this

Wood Summary (continued)

- Gallatin Thermal plans on structuring the wood shredding operations with a nominal tipping fee to result in a zero net fuel cost

Future Fuels

- Tire-Derived Fuel (TDF)
  - Currently being pursued by Gallatin Thermal
  - High BTU, low moisture fuel source
  - BTU content ~15,500 Btu/Lb based on information from the Rubber Manufacturers Association, Scrap Tire Management Council

Future Fuels (continued)

- Tire-Derived Fuel (continued)
  - Minimal research exists on burning TDF with wood
  - Two studies:
    - Air Emissions from Scrap Tire Combustion; October 1997
    - Burning Tires for Fuel and Tire Pyrolysis: Air Implications; December 1991
  - Both studies conducted for the EPA

Future Fuels (continued)

- Tire-Derived Fuel (continued)
  - Overall, the EPA studies concluded favorable results to combining TDF with other fuels as long as the combustion took place in a controlled environment and high efficiency air pollution control equipment is employed (i.e., a baghouse or electrostatic precipitator)
  - However, very little of the data can be correlated to the % of TDF burned and resulting emissions rates
  - Some criteria pollutants not tested or not tested for all percentages of TDF

Future Fuels (continued)

- Air Permit Challenges
  - No reliable emission rate data available, therefore estimated emissions have to be developed for permit submission
    - Some emissions taken from facilities cited in two EPA reports
    - Other emissions based on calculations
  - Are tires defined as a “municipal” waste?

Future Fuels (continued)

- Permit changes to allow burning of TDF submitted & currently under review by TDEC

Future Fuels (continued)

Proposed Wood & TDF Mixture per Unit

	Btu/Lb	Mixture, % by BTU content	Equiv. Heat Input, mmbtuh	Equiv. Mass Input, Lb/Hr	% by weight	Equiv. Mass Input, Ton/Yr	Equiv. Btu/Lb
TDF	15,500	18.8	7.08	456.6	6.3	2,000.0	----
Wood	4,500	81.2	30.52	6,782.7	93.7	29,708.4	----
TOTAL		100.0	37.6	7,239.4	100.0	31,708.4	5,194

Other Alternate Fuels

- Long Term Goal: investigate other potential alternate fuels
  - On-spec used oil
  - Asphalt shingles & roofing materials
  - Treated wood & wood containing glues
  - Sawdust
  - Automobile fluff

Summary

- Conversion from MSW to wood successful
- Conversion from wood to wood + TDF underway and expected to be successful
- Other alternate fuels will be explored but will have to provide an economic and environmental benefit

Thank You for Your Time & Attention