Environmental Symposium

Alternative Fuels in Cement Plants

August 23, 2013

Jacksonville, Florida

“Safety is a Constant State of Mind”
Who is Titan?
Who is Titan?

CSR @ TITAN: *do less harm; do more good; WIN-WIN*

... a long-term commitment to continuous self-improvement through sharing, learning and partnership building...
### Why Use AF?

**Society Concerns**

- Economic growth leads to over consumption, increasing waste volumes for final disposal
- Urbanization brings together millions, creating need of mass waste disposal
- Human activity destroys the natural environment (i.e. global warming / CO₂)
- Green movement asserts new agenda
- Energy & mineral resources are limited
- Economic costs increase
- Landfill space is very limited
- Not in my back yard (NIMBY) mentality
- Society seeks sustainable solutions

**Cement Industry Response**

- Fuel costs multiply in the 1970’s
- Need to diversify energy resources identified – experiments take place
- Waste & by-products are energy & raw materials that remain un-utilized
- Technology developed to consume alternative fuels with success
- Cement kilns offer perfect solution for all: full energy recovery of the waste, total absorption of ash in clinker & no negative impact on emissions
- Industry receptive to stricter regulation
- WIN-WIN solution provided
- Stakeholders engagement guarantees cooperation & agreement
Why Use AF?

How the Alternative Fuels Business was created

• In mature markets (like the US & EU) Waste Producers are under very strict regulations to dispose of their waste in an environmentally friendly manner and pay the full cost of their removal/transport/treatment/disposal services.

• These regulations have been the outcome of pressures coming from the people themselves since the early 1970’s in order to better manage their living environment and stop / reverse the trend of environmental degradation in their respective societies, including the minimization of landfills, reducing global warming, etc.

• Indicative such behaviors & practices concern:
  • Reducing (demand/consumption), Reusing & Recycling (products & waste)
  • Separating waste at source (in households, public sector & business)
  • Managing waste streams to create both environmental & economic value
  • Co-operating with industry to provide solutions, like co-processing in cement kilns
Why Use AF in FL?

- Essentially best use of discarded materials that cannot be recycled: the “low-hanging fruit” of alternative fuel options

- Local fuels compared to traditional fossil fuels not available in Florida, avoid mining, refining, pipelines, trucking, barges, rail, etc., so lower cost and lower GHG/carbon footprint

- Abundant supply of feedstock materials: 17 million TPY of municipal and commercial waste landfilled in Florida last year

- 3.5 million TPY landfilled in Dade and Broward Counties last year

- Approximately 30% is being recycled in Florida (75% Goal by 2020)

- Approximately 2-3 million TPY should be available for combustion
Why Use AF?

- (do not throw away)
- (use less resources)
- (compost, separate)
- (paper, glass, plastics, etc.)
- (RDF & other AF)
- (bury it in Landfills)

Direct land-filling is today illegal in Germany, Austria & other EU countries
What are AF?

Alternative Fuels

- Liquid
  - Non-Hazardous
  - Sewage Sludge
  - „Bio- Solids“

- Solid
  - Biomass
    - Wood
    - Rice Husks
    - Olive Kernel
    - Coconut Shells
    - Peanut Shells
    - Citrus Peel
  - Refuse Derived Fuel (RDF)
    - Municipal Solid Waste (MSW)
    - Commercial Waste
What are AF?

Example of Refuse Derived Fuel
<table>
<thead>
<tr>
<th>What are AF?</th>
</tr>
</thead>
<tbody>
<tr>
<td>CARSCHREDDER</td>
</tr>
<tr>
<td>RICESTRAW/HUSK</td>
</tr>
<tr>
<td>ANIMAL MEAL</td>
</tr>
<tr>
<td>IMPREGNATED SAWDUST</td>
</tr>
</tbody>
</table>
Using Alternative Fuels in a Cement Kiln is safer than in your house

Q: How does combustion in a cement kiln differ from other types of combustion, for example having a fire in my backyard or in the fireplace?

A: There are several differences:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Cement Kiln</th>
<th>Backyard Fire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>&gt;1450°C &amp; stable/constant</td>
<td>Low and variable</td>
</tr>
<tr>
<td>Combustion</td>
<td>Complete</td>
<td>Incomplete</td>
</tr>
<tr>
<td>Oxygen Levels</td>
<td>Excess oxygen</td>
<td>Lack of oxygen</td>
</tr>
<tr>
<td>Pollution Control</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

The key for controlling emissions and preventing against pollutants [i.e. such as dioxins] is good combustion practice which is fundamental to the cement plant and takes place continuously.
**Pennsuco Type Kiln**

- **840 F**
- **1210 F**
- **1480 F**
- **1610 F**
- **1800 F**
- **3000 F**

**Kiln Temperature Zones**

- Gas Temperature
- Raw Materials Temperature

**Retention Time**

- **PREHEATER**: 1 min
- **CALCINER**: 30 min
- **ROTARY KILN**: 30 min
- **COOLER**: 1 sec

**Typical boiler**

**Gas**

0
500
1000
1500
2000
2500
3000
3500
°F

0
300
600
900
1200
1500
1800
°C

**Pennsuco Type Kiln**

- **Kiln feed material**
- **Hot gases**
- Variety of alternative solid fuels including combinations of:
  - Plastics
  - Tire-derived fuel
  - Reject roofing shingles
  - Clean cellulosic biomass
  - Manufactured cellulosic biomass
  - Agricultural fibrous organic byproducts
  - Pre-consumer reject paper
  - Carpet-derived fuel
  - Engineered fuels
Equipment Installation in Pennsuco
Opportunity in Florida?

**CEMENT INDUSTRY SOLUTION TO WASTE RECYCLING**

**1. MORE CEMENT PRODUCTION & CONCRETE CONSUMPTION**
   - Highways
   - Street & local roads
   - Intersections
   - Parking lots

**FACT:**
- State ranking of Renewable Power Generation:
  - CA - #2
  - TX - #5
  - FL - #21
- Cement plants can become the new waste recycler utilizing 10% to 50% of MSW helping cities and the state to reach the 75% recycling requirement.

**2. LEADS TO MORE WASTE RECYCLING IN CEMENT KILNS:**
   - Cleaner environment
   - Meeting 75% recycling goal early
   - Easier tracking of waste disposal
   - Elimination of illegal dumping

**3. LEADS TO MORE FLORIDA JOBS**
   - Incentive for companies to relocate to Florida
   - Creates new recycle business
   - Concrete is 100% Florida made

**4. CREATES A BETTER ECONOMIC MODEL**
   - Increased local & state revenue
   - Local product drives higher revenue
   - Better built roads and intersections leads to robust interstate commerce

**TODAY**
- Florida has highest waste per person ratio
  - US - 4.4 lbs per person/per day
  - FL - 7.8 lbs per person/per day
- High levels of waste ash to landfills
- High costs to cities, counties and states
- Compare Florida waste recycling to other states: FL - 30% / CA - 40% / WA - 60%

**A BETTER TOMORROW**
A local and state waste recycling model that leverages the state cement industry which:
- Generates a more financially driven model
- Creates a cleaner environment
- Develops efficient waste recycling matching 75% requirement

**FOR MORE INFORMATION CONTACT:** MZITO@TITANAMERICA.COM
Thank You Very Much...!
AF Value Chain

**SOURCE**
Residential, commercial or industrial waste

**CEMENT PRODUCER**
Consumer of the fuels; May participate or play lead role during initial preparation and handling. Process determines the specifications for type, size and composition of fuels.

**WASTE COLLECTOR**
Collect, sort, distribute, and possibly pre-process

**DISTRIBUTOR / PROCESSOR**
Distribute waste, may also prepare to meet specifications of user. Can be separate consulting company or function performed by waste handler

**WASTE**

**COLLECTION**

**INITIAL PREP & QUALITY CONTROL**

**TRANSFER**

**FINAL PREP & QUALITY CONTROL**

**COMBUSTION**

**EMISSIONS**

**CLINKER**
Example of AF Usage

RDF Facility Process Diagram
Titan’s Zlatna Panega Plant in Bulgaria
Example of AF Usage

Raw Materials [pre-sorted] from Sofia Landfill
Titan’s Zlatna Panega Plant in Bulgaria
Example of AF Usage

Raw Material Loading
Titan’s Zlatna Panega Plant in Bulgaria
Example of AF Usage

Stage I Shredder
Titan’s Zlatna Panega Plant in Bulgaria
Example of AF Usage

Discharge Conveyor / Material Size ~300 mm
Titan’s Zlatna Panega Plant in Bulgaria
Example of AF Usage

Vibrating Screen / Magnetic Head Pulley
Titan’s Zlatna Panega Plant in Bulgaria
Example of AF Usage

Vibrating Screen
Titan’s Zlatna Panega Plant in Bulgaria
Example of AF Usage

Wind Sifter (Light Fraction Separation)
Titan’s Zlatna Panega Plant in Bulgaria
Example of AF Usage

Wind Sifter Diagram
Titan’s Zlatna Panega Plant in Bulgaria
Example of AF Usage

Discharge Conveyor to Fine Cut Shredder
Titan’s Zlatna Panega Plant in Bulgaria
Example of AF Usage

Fine Cut (secondary) Shredder
Titan’s Zlatna Panega Plant in Bulgaria
Example of AF Usage

Finished RDF ~ 25 mm
Titan’s Zlatna Panega Plant in Bulgaria
Example of AF Usage

Typical RDF
Titan’s Zlatna Panega Plant in Bulgaria