Conyers and Augusta

Imagination at work

April 23, 2015
Expertise and innovation

Acquisition
- **1999**: Glegg Water Conditioning
- **2002**: BetzDearborn
- **2003**: Osmonics, Inc.
- **2005**: Ionics
- **2006**: ZENON Environmental

Innovation
- **2007**: GE launches TrueSense
- **2008**: GE launches GenGard
- **2009**: GE launches the Muni.Z depth filter using Z.Plex technology, PROPAK system, and ZeeWeed 1500
- **2010**: GE launches Mobile Evaporator, Mobile M-PAK, HERO and ZCore
- **2011**: GE launches LEAPmbr and SeaPAK
- **2009**: The GE/NUS Singapore Technology Center opens
- **2009**: GE opens Water & Process Technology Center in Saudi Arabia
- **2011**: Wuxi plant expansion doubles capacity of water technology manufacturing in China
- **2011-12**: Tripled capacity at Oroszlány, Hungary production site
- **2012**: Opening of new laboratory in Cotia, Brazil
- **2014**: Monsal

Built on more than 85 years of domain expertise and innovation
Power & Water diverse solutions

$25B ‘13 revenue >40,000 employees 700 locations

- Distributed Power
- Water & Process Technologies
- Nuclear
- Thermal
- Power Gen Services
- Renewables

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Monsal: Company Overview

1995 - Company formed to provide desludging, heat exchangers and wastewater aeration products to water industry

1999 - Expansion of company from products to larger process systems
- Monsal secures largest order ever – to upgrade the Mogden AD site for Thames Water
- Extensive R&D on sludge mixing technology leads to expansion of mixing product range

2001 - Established product supplier to municipal sludge market
- Developed 1st Advanced AD plant for United Utilities
- Refurbishment of largest digestion plant in the UK at Mogden completed – all Monsal AD products

2005 - 1st pilot scale facility for food waste digestion completed.
- Business makes the decision to focus only on AD technology and products after Cranfield business review.
- Rollout of multiple AAD sites

2006 - Biosolids AAD offering expanded:
- Monsal 42
- Monsal 55
- Monsal 55s
- Energy self sufficiency demonstrated at Anglian Water – a UK first
- 100s’ of sludge digester references completed
GE’s Advanced Digestion Technology

GE’s line of Monsal sludge processing systems brings Advanced Digestion Technology to municipal biosolids and organic biowaste applications.

**PRODUCTS**

1. Monsal AirLift™ System  
2. Monsal JetMix  
3. Monsal AirMix™  
4. Monsal SGM™  
5. Monsal Heating Equipment  
6. Monsal Advanced AD  
7. Monsal Pasteurisation  
8. Monsal Re:Sep  
9. Monsal HPD Process  
10. Monsal Re:AmmCycle  
11. Monsal De:Odor

**VALUE PROP**

- Optimal energy balance maximizes system yield and performance
- Mixing equipment achieves >90% active volume in sludge digesters
- Uses *Smart* heat exchangers designed for thick sludge
- Cutting-edge technology achieves pasteurization or Class A sludge processing
Projected Site Layout

- 60,000 tons per year
- 3.0 MW electrical
- Re:Sep
  - Front end processing
- HPD Process
  - Includes pasteurization
- De:Odor
  - Odor control for Re:Sep
- Amm:Cycle
  - Liquid treatment system for centrate prior to sewer discharge
Monsal Biowaste Solutions
Monsal ADT for Biowaste Processing

Overview
- 7 operational plants in the UK + 1 at detailed design
- Total treatment capacity > 250,000 tonne / year
- Commercial & Industrial Waste / Source Segregated Household Waste

Value Proposition
- RE:Sep: High Contamination, Class Leading Separation Efficiency
- HPD: Full Hygenisation, High COD/VS Conversion, Short Retention
- AmmCycle: Robust Design, Proven for High Strength Ammonia Loads
- De:Odor: Low OPEX, Fully Automated

System Components
- Monsal Re:Sep
- Monsal HPD
- Monsal Re:AmmCycle
- Monsal De:Odor
Monsal Biowaste – Typical Feed Sources

- Bread / Dough
- Prepackaged Meals
- Retail Waste
- Fish Products
- Chicken Vicera
- Expired Grocery

Note: All of the products shown above are treated at the same facility.
Monsal Biowaste – Typical Feed Sources

Source Separated Organic Waste (SSOW)
Biomass

**Value Drivers**

- High Contamination, Class Leading Separation Efficiency
- Full Hygienisation, High COD/VS Conversion, Short Retention
- Robust Design, Proven for High Strength Ammonia Loads
- Low Opex, Fully Automated
Projected Site Layout

- Liquid Reception Tanks
- Gas Holder
- Hydrolysis Buffer Tank
- Jenbachers
- Pasteurization
- De:Odor
- Re:Sep
- Chem Storage
- Effluent Buffer Tanks
- Post Digestion Tank
- Digesters with SGM™
- Dewatering
Separation technology for food waste

Food Waste  Waste pulping/screening  Digester Feed
Monsal Re:Sep

- **> 95%** Capture of Organics from variable feed sources
- **Handles** raw feeds with 30% contaminants
- **< 0.1%** contaminants in digester feed slurry
- **10% TS slurry** – perfect for contaminant & grit removal
- **< 10 kWh/tonne** energy use
Monsal Re:Sep – Reception Hall / Shredder
Monsal Re:Sep – Turbo Dissolvers

- Fed via screw conveyors
- ~20 minute batch process per unit
- 10-12% TS Slurry to drop grit from suspension
- Liquid from digestate, centrate, whey, etc.
- Load cells for fill / draw sequence
- Drains by gravity to drum screen
Monsal Re:Sep – Drum Screens / polishing

• 10 mm Rotating drum screen
• Slurry drops into Grit Channel
• Reject sent to polishing
• Polisher sprays contaminant and removes remaining organic fraction
Monsal Re:Sep – Reject Collection

- <90% overall organic recovery from feed
- 5-6% of total feed recovered as reject
  - Organic and inorganic grit / plastic / etc.
  - Combined from Grit channel and polishing step
Monsal HPD – Hydrolysis

- Preconditioning of slurry from Re:Sep process
- EQ buffer tank (4-5 days)
- Provides consistent flow to pasteurization
- Monsal Jet Mixing
- Ambient Operation
- Anaerobic conditions
- CO₂ generation tied into biogas system
Monsal HPD – Pasteurization

- Monsal 70
- 240m³/day & 360m³/day
- 70°C for 1 hour batch hold
- Continuous Flow
- Heat Recovery
- ~250kW heat demand
- Hot Water from CHP
Monsal HPD – Digestion

- Retention ~ 18 – 22 days
- COD reduction ~ 80%
- VS reduction ~ 80%
- Total solids reduction ~ 72%
- Monsal Sequential Gas Mixing
- Standardized design
Sequential Gas Mixing (SGM)

Local PLC/HMI

Condensate Trap
Monsal SGM™

Overview

• Biogas externally drawn from roof space, compressed, & delivered via a series of mixing points within the tank
• Effective sequential mixing for all sludge types up to 12% DS feed concentration
• Sustained performance verified by lithium tracer test (little loss of active volume with time)

Value Proposition

• High active volumes (≥ 90%)
• Proprietary software
• No internal moving part
• Low energy demand
• Oil free compressor
• Feed dispersion (120 min)
• Short circuiting (5-6%)
Sequential Gas Mixing (SGM)
Cogeneration and End Product

- GE Jenbacher Engines
- 10,000 tpa → 0.5 MW power
- Heat recovery loop
- Class A End Product
- Landfill cover / Fertilizer
- Odor Free
Monsal De:Odor

Typical Figures

- Typical 3 air changes per hour
- Odour control regulatory requirement
- Monsal design biofilter
- Fully automated
- No chemical addition
- Each standard unit 20,000m³/hr
Monsal Re:AmmCycle

Typical Figures

- SBR Tech treating high strength Ammonia
- Compact Process
- WW Recycled back to process
- Non Odorous
Biowaste Installations

Scottish Water Horizons, Cumbernauld, Scotland:

- 30,000tpa food waste plant built for Scottish Water Horizons.
- Commercial and local authority waste.
- Gas is utilized in an onsite 800kW CHP unit (under upgrade to 2MWe).
- Liquid is treated and discharged to sewer and cake is utilized for soil improvement.
- Operational since 2011.

Technology
- Re:Sep
- HPD
- Amm:Cycle
- De:Odor
Biowaste Installations

Local Generation, March, Cambridgeshire:

• 60,000tpa food waste plant.
• Commercial and local authority waste.
• First development phase 30,000tpa.
• Gas is utilized in an onsite 1.85MWe.
• Dewatered cake and liquid fraction used for soil improvement.
• Operational since 2011.

Technology
• Re:Sep
• HPD
• De:Odor
Biowaste Installations

Geneco, Avonmouth, Bristol:

• 40,000tpa food waste plant.
• Commercial and local authority waste.
• First co-located plant in the UK with sewage plant. Combined power potential 5.75MWe.
• Digestate is separated into a cake which is used for soil improvement.
• Centrate is treated by the main waste water treatment plant.
• Operational since 2012.

Technology
• Re:Sep
• HPD
• De:Odor
Biowaste Installations

**Walpole**

- 30,000tpa food waste plant with scope to expand to 60,000tpa.
- Primarily curbside collected food waste.
- Gas utilized in the onsite CHP units with 2MWe of capacity.
- Digestate is separated into a cake which is utilized for landfill cover.
- Liquid is treated prior to discharge to surface water.
- Operational since 2012.

**Technology**

- Re:Sep
- HPD
- De:Odor
- Amm:Cycle
Biowaste Installations

**Codford AD**

- 55,000tpa food waste plant.
- Commercial food waste.
- Gas utilized in the onsite CHP units with 2MWe of capacity (ability to expand to 4MWe).
- Digestate utilized as a liquid fertilizer on adjacent farmland.
- Operational since spring 2014.

**Technology**

- Re:Sep
- HPD
- De:Odor
Biowaste Installations

Halstead

- 45,000tpa food waste plant
- County’s organic food waste (commercial and industrial)
- Gas utilized in the onsite CHP units with 2.4MWe of capacity.
- Commissioning August 2014

Technology

- Re:Sep
- HPD
- De:Odor
- Amm:Cycle
Biowaste Installations

SITA, Charlton Lane, Surrey:

• 40,000tpa food waste plant.
• Curbside collected food waste.
• Gas utilized in the onsite CHP units with 2MWe of capacity.
• Detailed design stage.

Technology
• Re:Sep
• HPD
• De:Odor
• Amm:Cycle