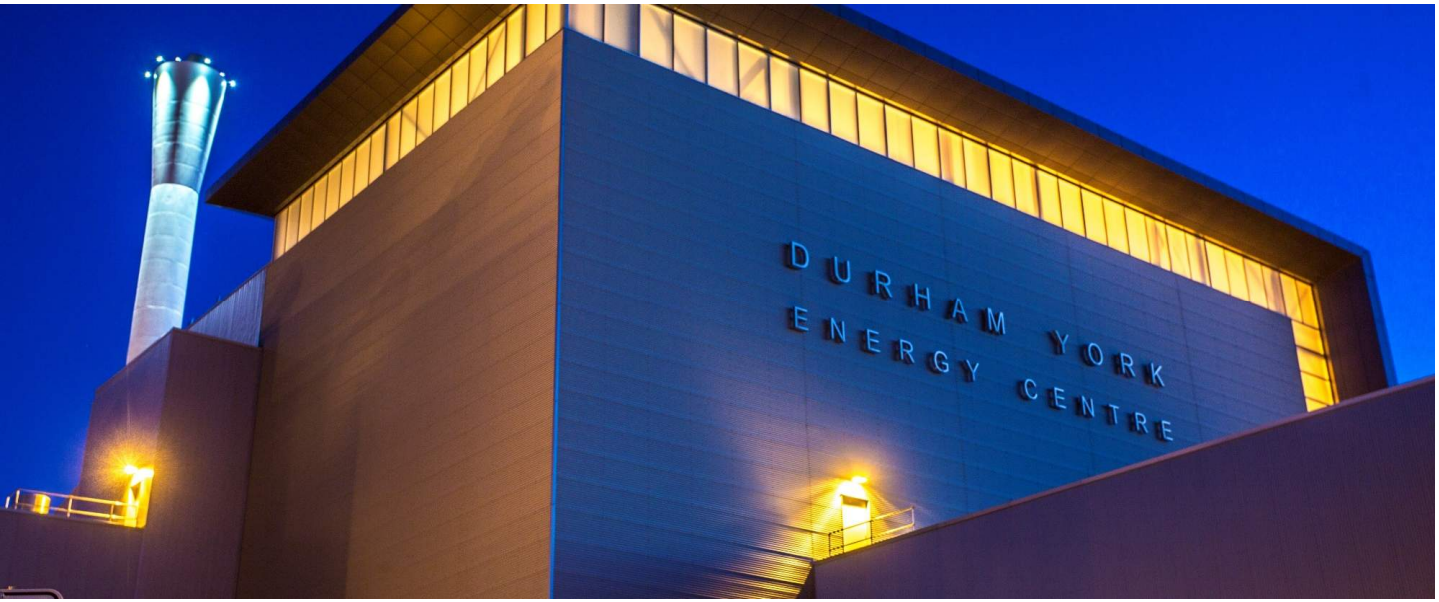


The Story of Durham York Energy Centre

Gioseph Anello, P.Eng. &
Bruce Howie, PE

10/20/2022

AGENDA

01 Durham Background

02 Project Planning

03 Technology Options

04 DYEC Design

05 Implementation

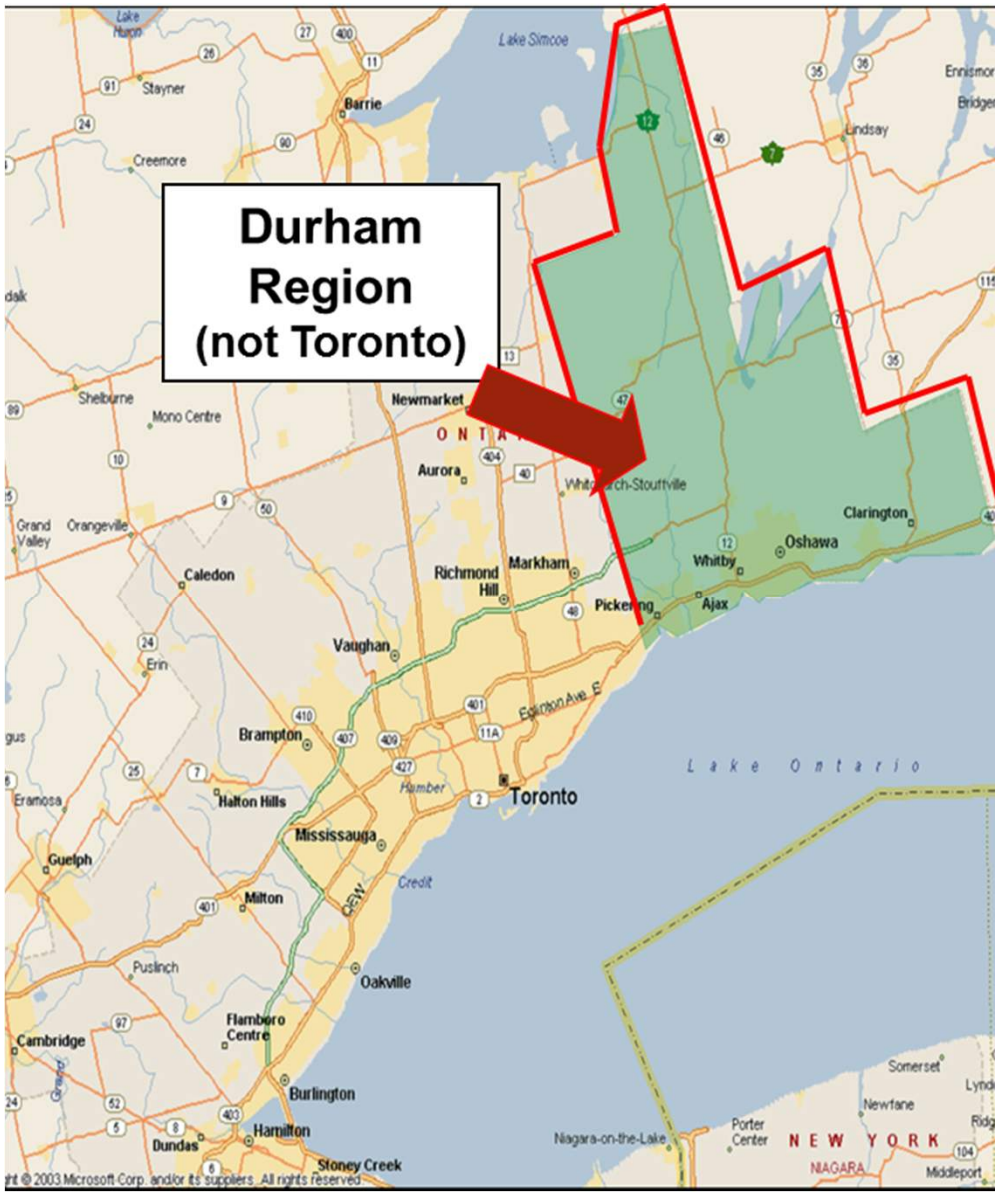
06 Facility Highlights &
Current Status of Operations

01

Durham Background

Regional Municipality of Durham

- Located in the highly developed and populated centre of Ontario east of Toronto
- Approximately 2,535 square kilometres in area
- Population of 700,000
- Upper level of a two-tier government; Regional and Municipal
- Responsible for residential waste collection for six municipalities
- Responsible for waste disposal for eight municipalities in its jurisdiction
- Blue box collection in all 8 municipalities



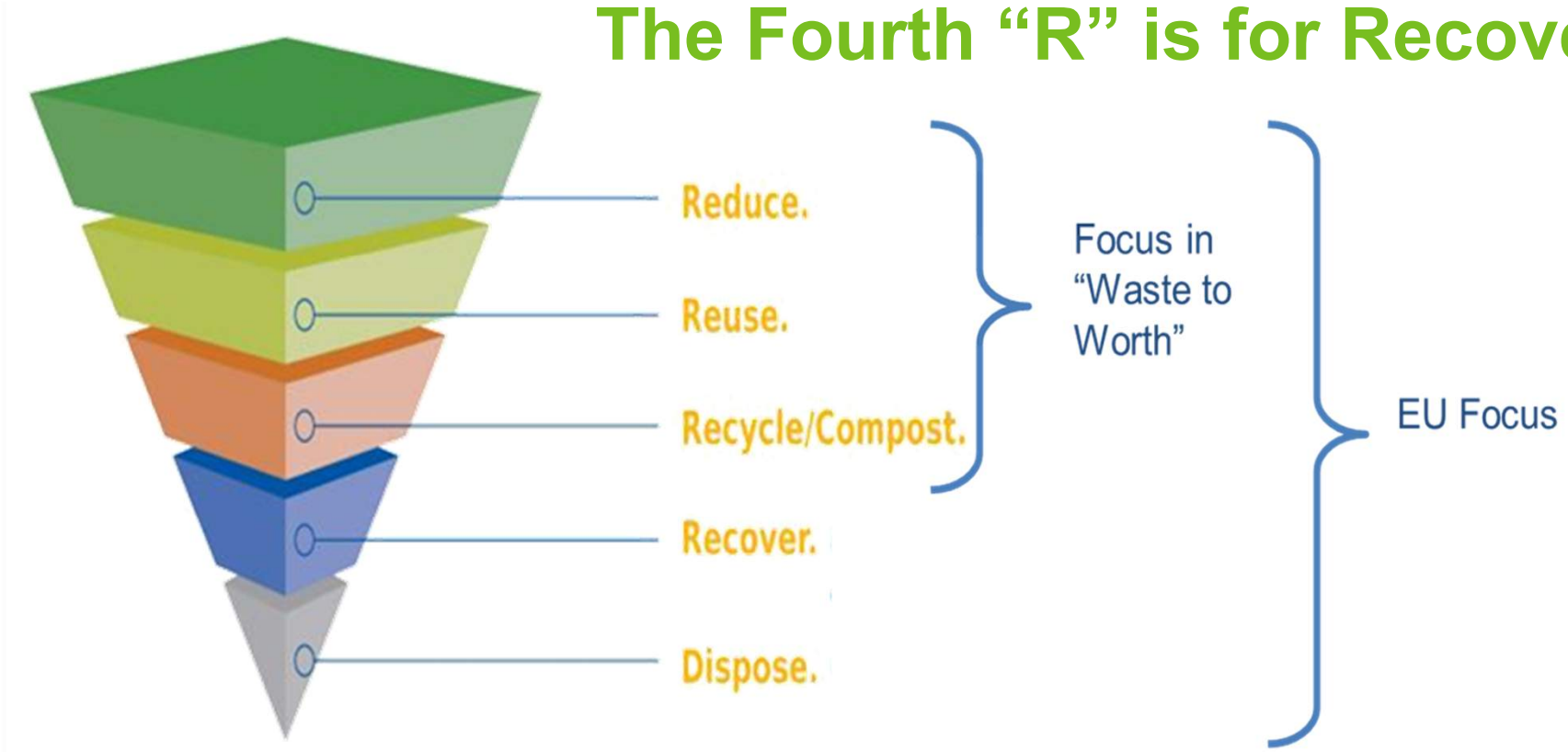
Durham Region

- Employs an integrated residential waste management system:
  - Blue Box recyclables
  - Food and yard waste compost program – AD Facility planning
  - Bi-Weekly trash collection
- Annual Waste Diversion of >60%
  1st for Urban Municipalities and 3rd in Province Overall
- Ontario Resource Productivity and Recovery Authority (RPRA) recognizes EFW as diversion

What more can the region do with its waste?

Was there a role for EFW in the Region's integrated waste management system?

The Fourth "R" is for Recovery



02

Project Planning

Municipal Approach and Complexity of Approval

- **Business Case** - Detailed economic and financial analysis undertaken
- The **EA** and the **Procurement Process** –
  RFQ and RFP documents all needed Council approval
- All other staff reports were approved by Regional Council
- Council authorized staff to proceed with contract negotiations with Covanta

Public Education

Complete transparency including extensive public education strategies

- **Public Education: 2004 to 2015**
  - 100+ Public consultation series and workshops
  - 184 News advertisements placed
  - 80 Advertisements using other sources

Host Community Agreement

Required for the municipality to become a willing host

The Agreement included:

- Covering cost of arterial road construction
- Establish a hazardous waste depot for the residents
- Construct a paved segment for a waterfront trail
- Establish an EFW community liaison group
- Incorporate modern state-of-the-art emission controls
- Monitor ambient air for a three (3) year term
- Incorporate $9 million of architectural enhancements

Technology Evaluation

- High-level Technology Screening
- Request for Expressions of Interest (REOI)
- Request for Qualifications (RFQ)
- Reference Facility Tours
- Request for Proposals (RFP)

Selection of Preferred DBO Contractor

Procurement Approach: 

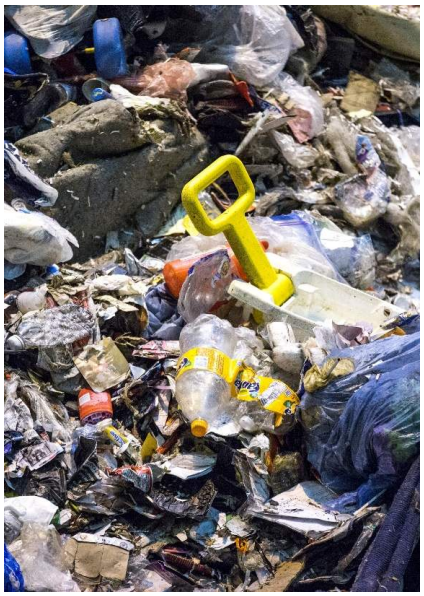
- Regions selected a Design-Build-Operate-Maintain Procurement Model
- RFP Proposals evaluated based on the following:
  - Technical
  - Project Delivery
  - Cost & Commercial Readiness
- Regions' evaluation team unanimously recommended Covanta Energy Corporation as the preferred vendor.

03

Technology Options

WTE & Waste Conversion Technologies 101

- Thermal Technologies
  - Traditional WTE (Mass Burn, RDF, Fluidized-Bed)
  - Pyrolysis
  - Gasification
- Biological Technologies
  - Aerobic Composting
  - Anaerobic Digestion
- Hybrid Technologies
  - Mechanical Biological Treatment
  - Waste-to-Fuel Technologies
  - Refuse Derived Fuel/Solid Recovered Fuel



Classifying Waste Conversion Technologies

Technology Selection

✓ Established Technologies

- Wider commercial application
- Mass burn & RDF combustion

✓ Emerging Technologies

- Pilot-scale and some commercial-scale facilities
- Commercial experience with specific waste streams & feedstocks
- Gasification, pyrolysis & plasma arc

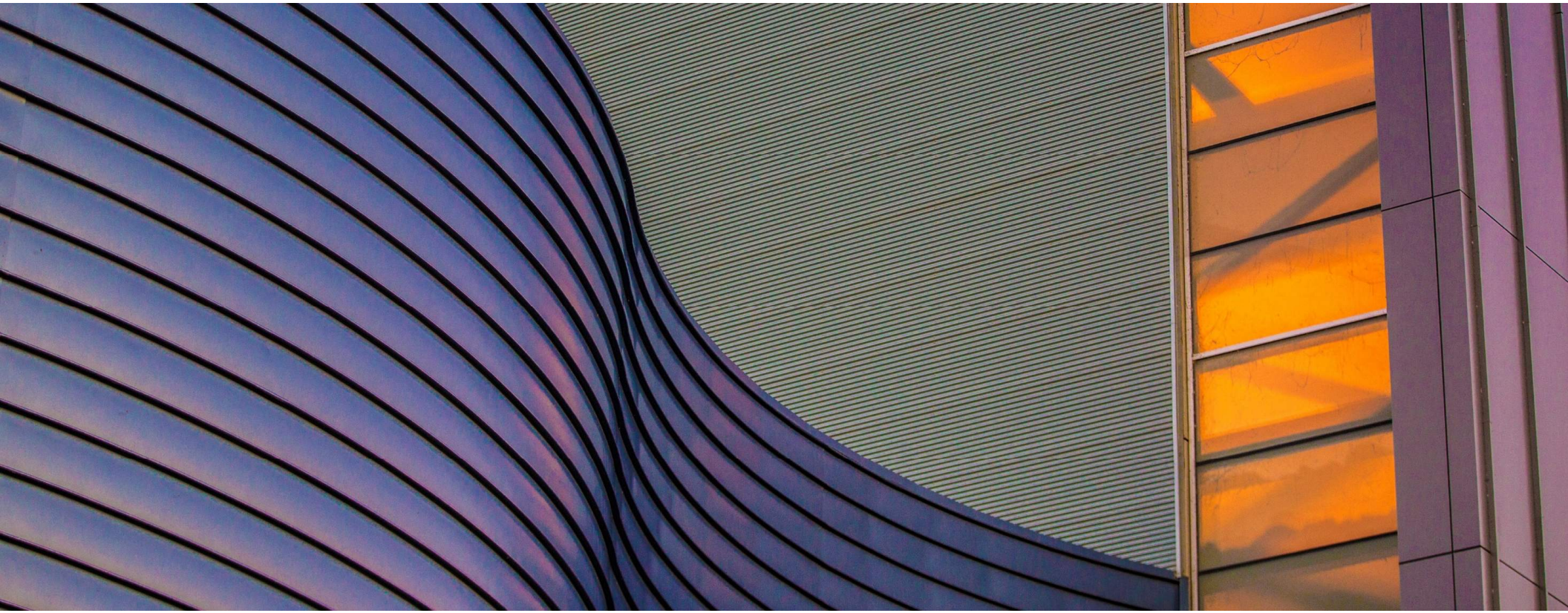
The Regions of Durham York ultimately selected Covanta to design, build, and operate the facility using a mass burn combustion technology

Lee County EFW Facility, Ft. Myers, FL

Anaerobic Digestion Facility, Netherlands

Technology Advantages & Disadvantages

Technology Type	Advantages	Disadvantages
Direct Combustion (Conventional WTE)	• Proven (~70 facilities in N. America, over 500 in Europe, and over 2,000 worldwide (decreasing in US, increasing overseas) • Flexible: Can process variable waste streams	• Requires a large waste stream to be economical (1,000 TPD at current electric rates) • Often controversial build • Residuals 10 – 30%
Conventional Gasification	• Proven and well-established overseas (20 plants in Japan and Korea since 2000) • Very low residuals (<5%) • Suitable for small-medium scale facilities	• Requires more pre-treatment than mass burn (shredding)
Mixed Waste Processing and MBT Technologies	• Commercially operating plants in parts of EU and some development in U.S. • Combined with other thermal and biological CTs	• High residual waste generation (up to +40% of incoming waste stream • Potential for high capital and operating costs
Waste-to-Fuel Technologies	• Produces a marketable biofuel • Some experience on select waste streams • Lower emissions	• Limited commercial application on mixed MSW • Potential for high capital and operating costs
Anaerobic Digestion	• Commercially proven on organics • Environmentally accepted	• Limited commercial scale projects on mixed MSW • High potential for odor impacts • Contaminants in compost by production impact marketability of product



04

DYEC Design

DYEC Technical Summary

Parameter	Performance Specifications/Guarantees
Combustors	Two (2) 9.1 Tonne/Hour Martin GmbH stokers at 13 MJ/kg (~5,600 btu/lb)
Boilers	Two (2) Jingding boilers each rated at 33,640 kg/hr steam at 499°C and 91 bar
Electrical Generation	868 kWh/tonne (Gross)/767 kWh/tonne (Net) @ 13 MJ/kg (~5,600 btu/lb)
Boiler Availability	90% (or 7,884 hours per year per unit)
Metals Recovery	Ferrous = 80% Non-Ferrous = 60%
Emissions	Best of EU, USEPA and Ontario A-7
Residue Quantity/Quality	<30%$_{wt}$ Residue at 13 MJ/kg (~5,600 btu/lb) <3% Combustible Matter <25% Moisture Content

Waste Processing

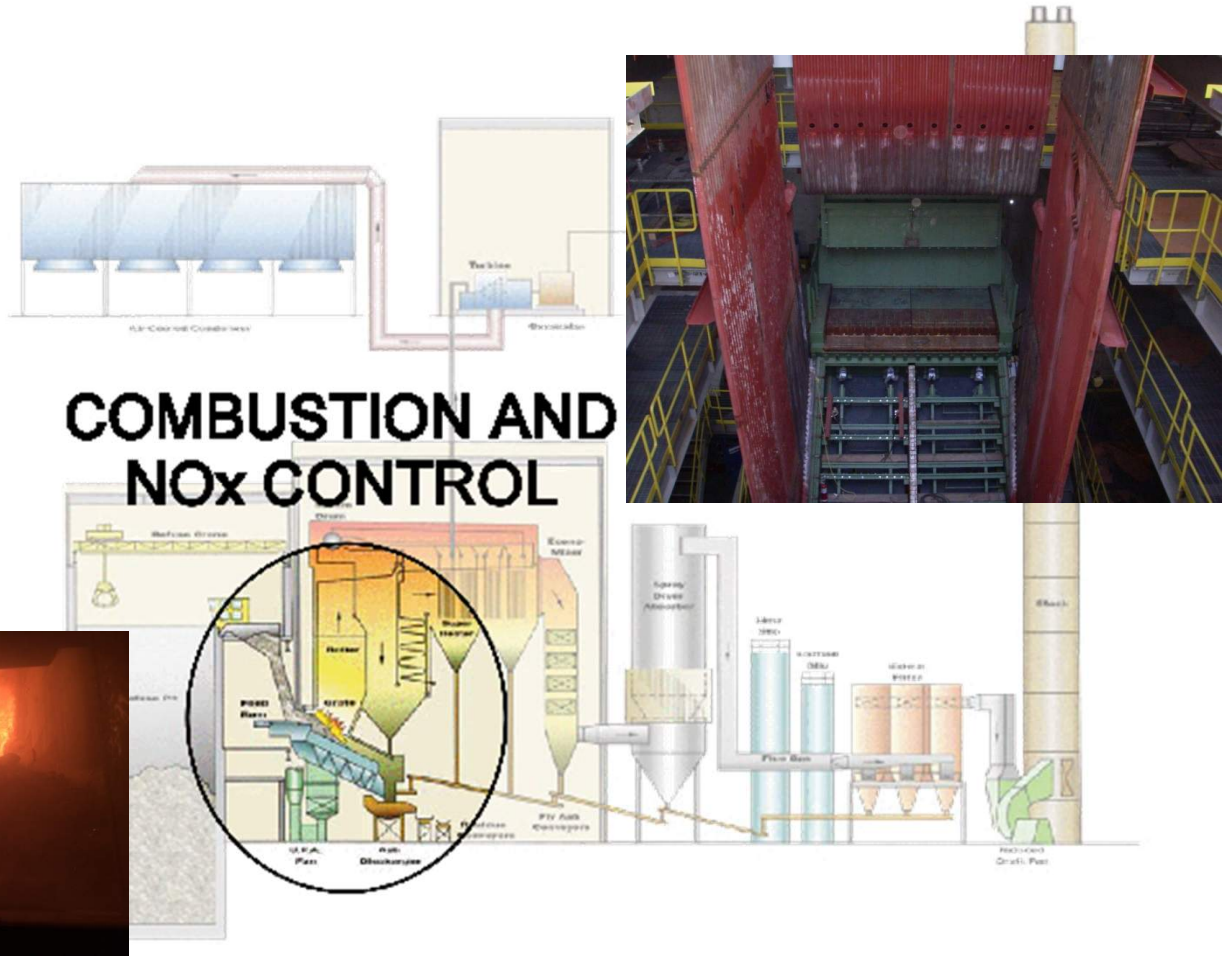
Combustion fan draws air through Waste Receiving Area and over Refuse Pit to control odors and maintain negative pressure

Combustion Process

Martin Grate mixes embers and incoming waste creating an even burn. Spent ash discharges to quench pit.

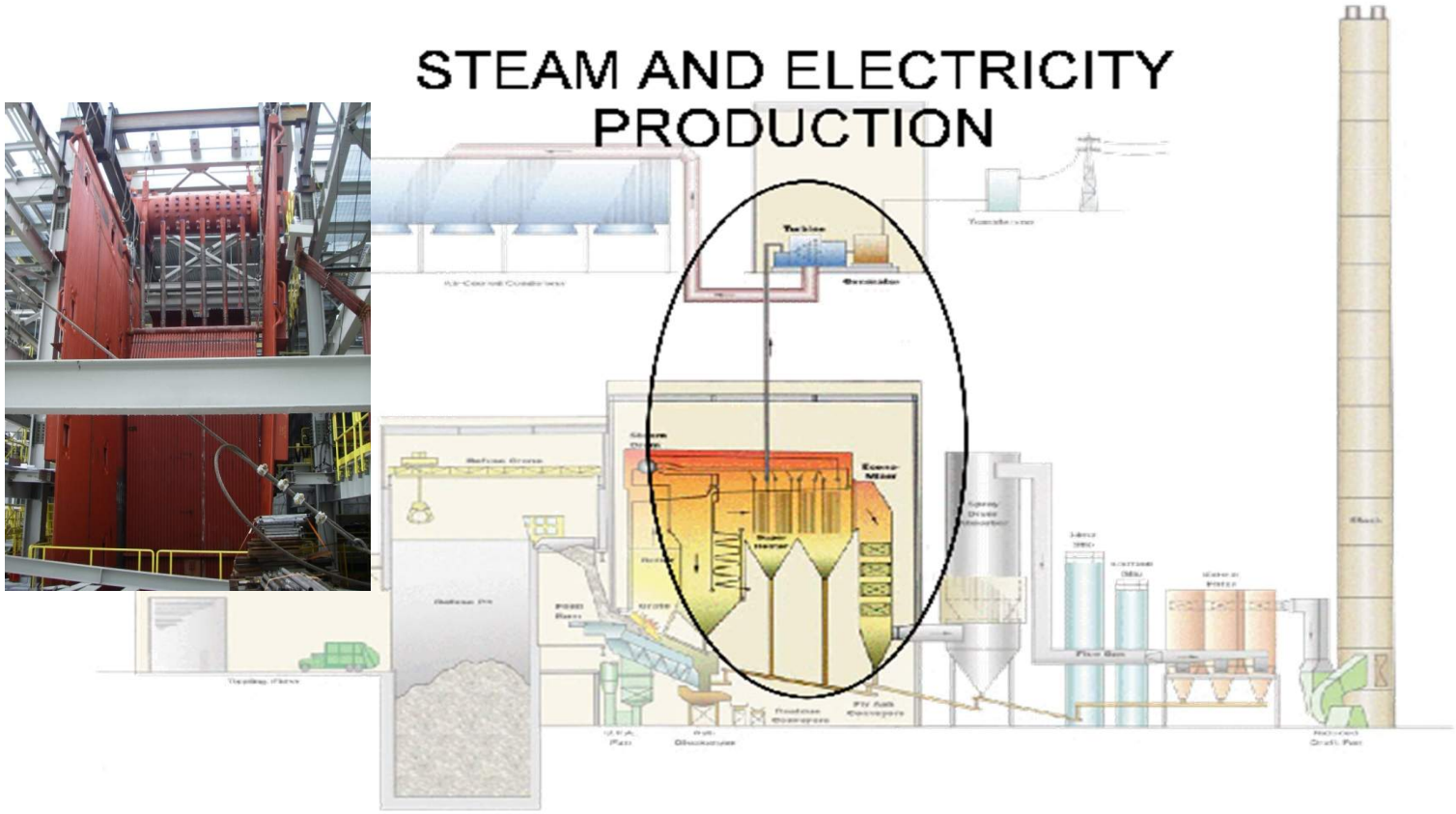
SNCR with VLN system with ammonia injection in furnace controls thermal Nox

Martin Infrared Combustion Control for CO and grate combustion control



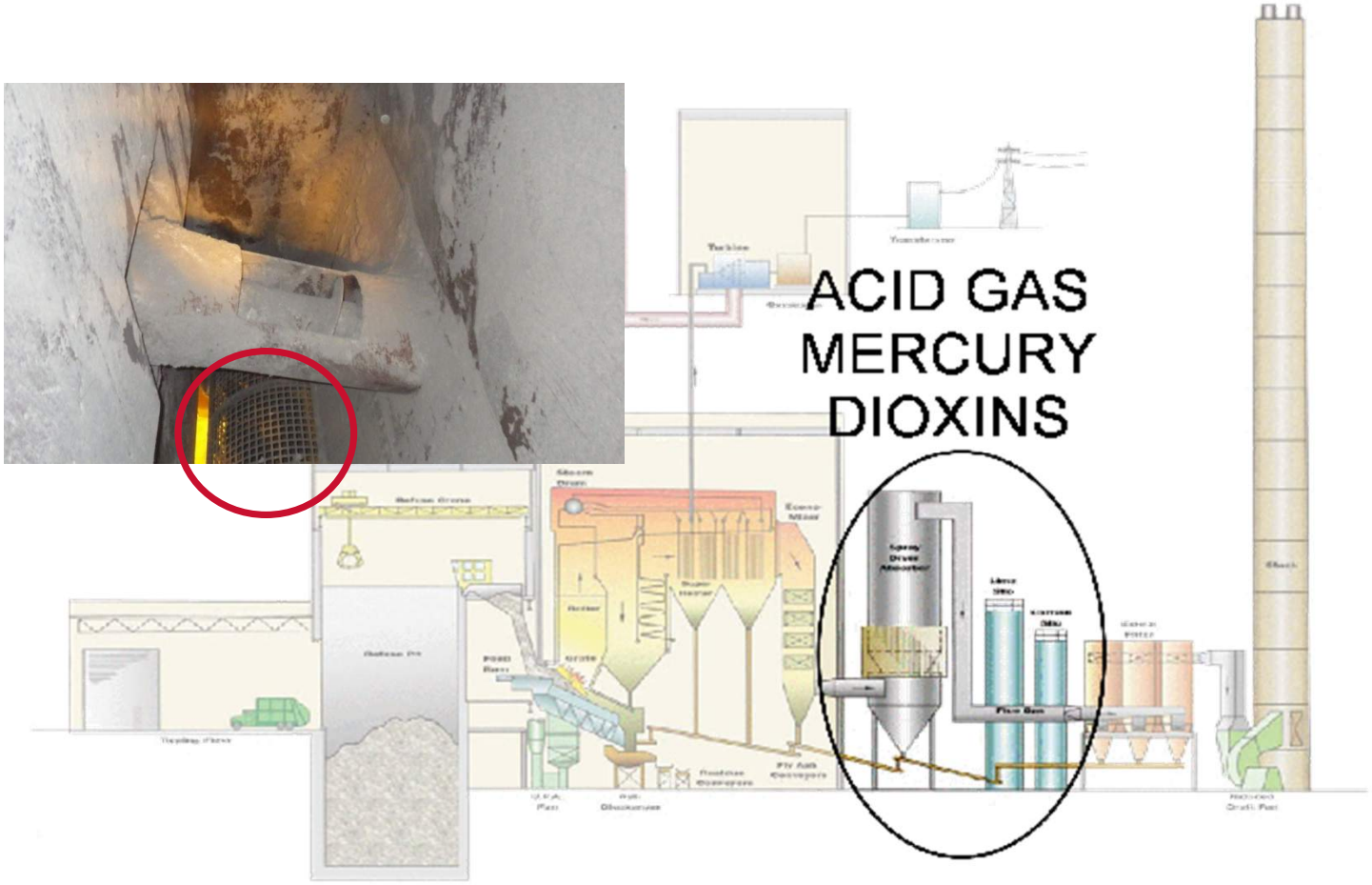
Energy Generation Process

The steam production process produces dry steam at 499ºC and 91 bar (932ºF and 1300 psig) used to produce 15 MW of electricity net of facility usage to the grid. (Higher temperature/pressure than typical to increase efficiencies)



Flue Gas Treatment

Flue gas cooling tower with reactor for lime and carbon injection to control acid gases, mercury and dioxins



Flue Gas Treatment (Cont.)

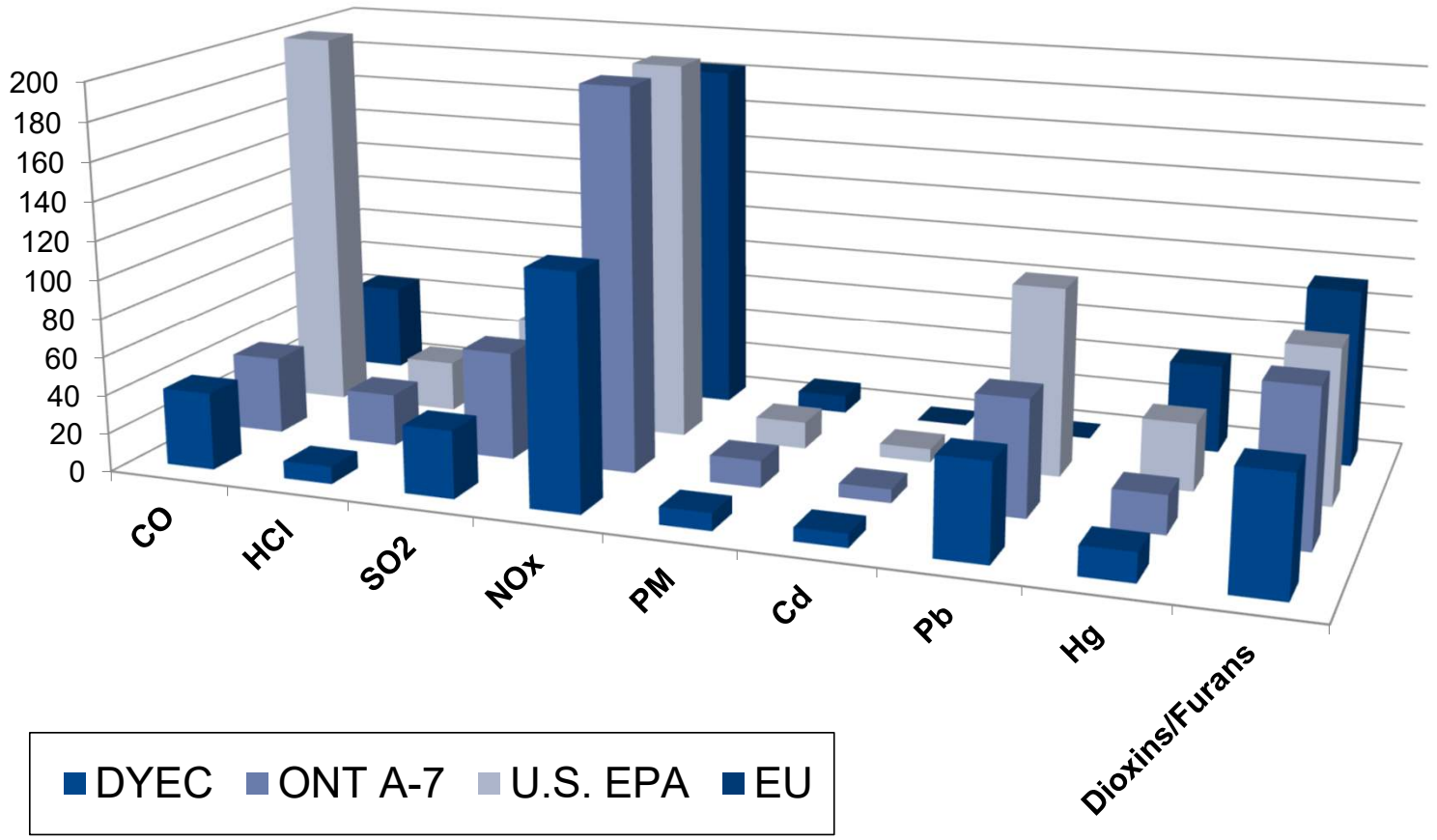
Filter bags remove particulate prior to discharge through the Induced Draft fan into the stack

Flyash is recycled back into the system to optimize removal efficiencies

Flue Gas Treatment System

Target Pollutant (s)	Pollutant Control Device
Nitrogen Oxides (NOx)	SNCR w/ammonia injection & Covanta VLN® System
Carbon Monoxide	Martin Integrated Combustion Control System (MICC)
Hydrogen Chloride Sulfur Dioxide	LÜHR Dry hydrated lime injection with fly ash recirculation
Particulate Matter Lead Cadmium	LÜHR Six (6) compartment Fabric filter baghouse
Mercury	Powder Activated carbon injection
Dioxins/Furans	Furnace temps >1,000°C for 1 second

Air Emissions Requirements



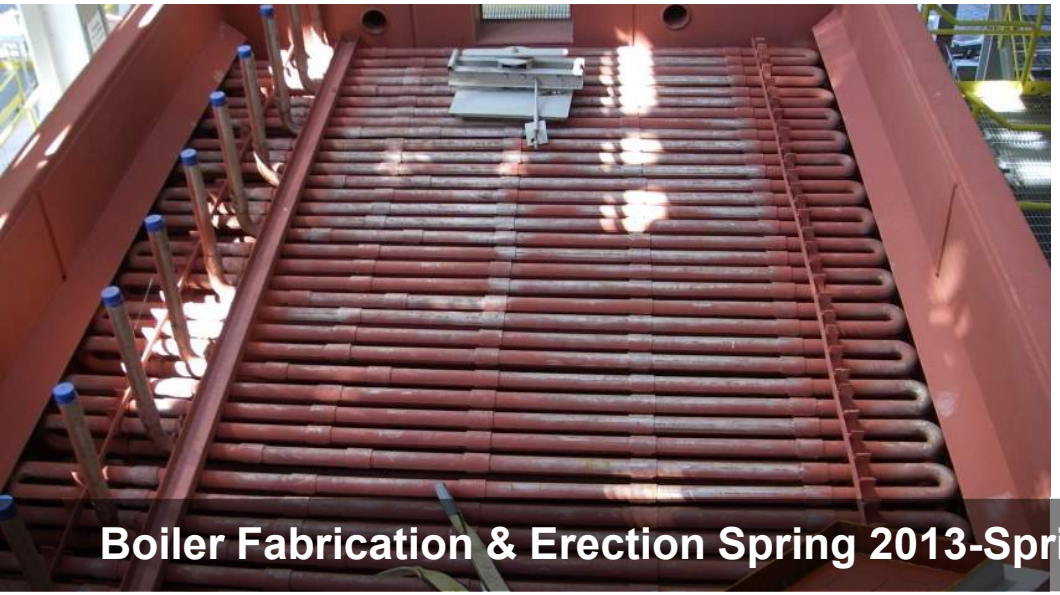
05

Implementation

Pouring The Waste Storage Pit Fall 2011-Spring 2012

Erection Of Foundations, Boiler & Building Support Steel Spring 2013

Turbine Generator Installation Spring 2013

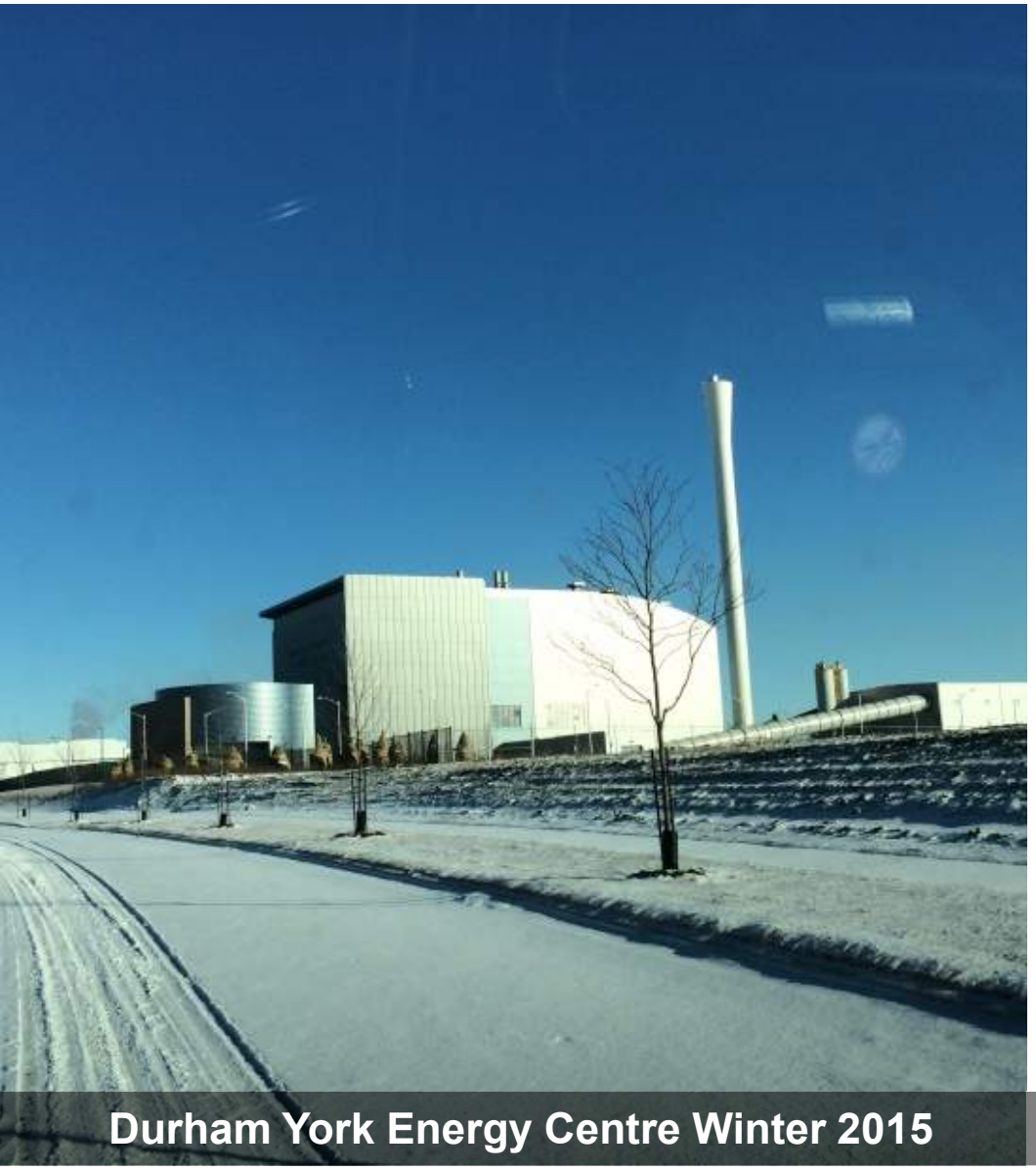


Boiler Fabrication & Erection Spring 2013-Spring 2014

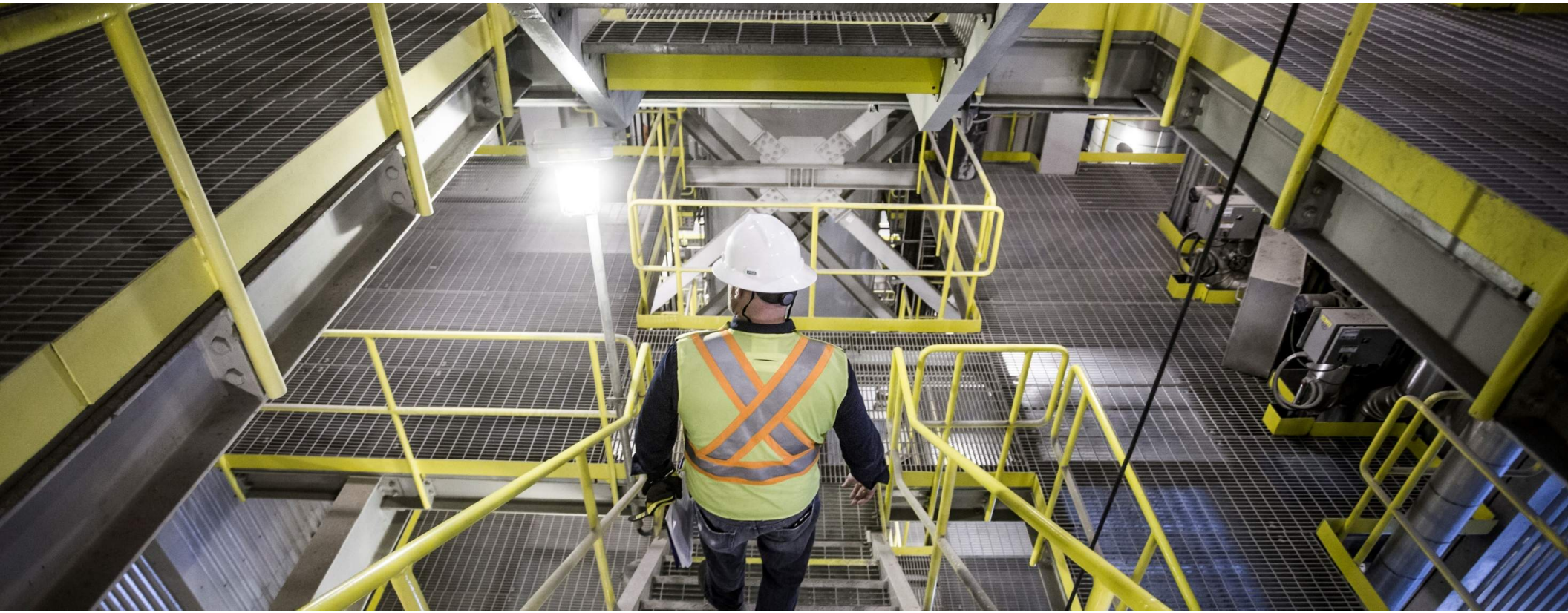
Durham York Energy Centre Fall 2014

Visitor and Education Centre

First Fire On Waste February 13, 2015



Durham York Energy Centre Winter 2015



06

Facility Highlights & Current Status of Operations

Facility Highlights

- 1st "Greenfield" energy from waste facilities in N. America in over 20 years
- Mass burn technology capable of processing up to 140,000 tonnes (154,000 tons) per annum
- Features latest boiler design & air pollution control design capable of meeting lowest emission standards in N. America & EU
- Generates up to 17 MW of electricity to grid & potential to generate up to 7 MW thermal
- Maintains transparency with community but publishing emissions data in real time

Operating Performance

- Since commercial operations began on Feb 13, 2015:
  - ~1.1M tons of MSW processed
  - ~27,300 tons of ferrous metal recovered
  - ~3,500 tons of non-ferrous metal recovered
  - ~676,000 MWh of exported electricity to grid
- Over the past two full years of operation, the facility exported 670 kWh per ton of waste processed, representing excellent energy recovery
- Over the past five years, the facility has averaged over 90% availability

Questions

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