

# WESTINGHOUSE PLASMA GASIFICATION IS THE NEXT GENERATION OF ENERGY-FROM-WASTE TECHNOLOGY



**Energy from Waste 2012** 



# "The journey of a thousand miles begins with the first step."

Sun Tzu – The Art of War





#### WESTINGHOUSE PLASMA CORP.

#### Who We Are

Westinghouse Plasma is a wholly owned subsidiary of Alter NRG Corp, a publicly traded (TSX: NRG; OTCQX; ANRGF) alternative energy company

#### **Our Vision**

To provide the leading technology platform for converting the world's waste into clean energy for a healthier planet

#### **Primary Market is Energy from Waste**

Our core strength – and the reason we exist - is the ability to convert difficult waste streams, including municipal, incinerator ash, commercial, industrial, petrochemical, and medical waste into syngas and environmentally sound by-products (e.g. aggregate, insulation)

#### **Strategic Partnerships**

















### GROWING WASTE STREAMS & SHORTFALLS IN ENERGY GENERATION REQUIRE ENVIRONMENTALLY ADAPTABLE / COMMERCIALLY PROVEN SOLUTIONS

#### **Renewable Targets Set:**

- EU's Target for Renewable Energy: 20% of its final energy consumption to come from renewable sources by 2020
- UK's Target for Renewable Energy: 15% of its final energy consumption to come from renewable sources by 2020



- European Landfill Directive Targets: England and Wales no more than 8 million tonnes by 2012/2013 and 5.5 million tonnes by 2019/2020
- MSW Collection: England and Wales 30.9 million tonnes of municipal waste is collected in a year

#### **UK Incentivizes EfW Investments:**

- Landfill taxes have materially increased gate fees
- Renewables Obligation Certificates (ROCs) materially increases power revenues

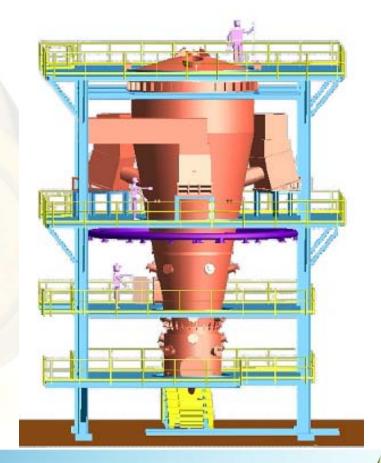




# WESTINGHOUSE PLASMA IS POSITIONED FOR RAPID DEPLOYMENT IN THE UK MARKET

- Qualifies for 2 Renewables
   Obligation Certificates (ROCs)
- Meets environmental standards and permitting requirements
- Validated by Fortune 500 Companies
- More than \$150 million invested in development and optimization programs over a period of +25 years







# 25 YEARS OF DEVELOPMENT AND OVER \$150MM HAS RESULTED IN THE GLOBAL LEADING WASTE GASIFICATION PLATFORM

- 34 global projects utilizing Westinghouse torches
- 20+ years of research and development @ the Westinghouse Pilot facility
- 10 years of successful operations @ Japanese MSW/sewage sludge facilities
- 3 years of successful operations @ the Indian hazardous waste facility
- 1 year ethanol demonstration with Coskata @ the Westinghouse Plasma Center
- Over \$150 million spent in research, development, testing and operational improvements
- Signed JDA with Air Products in 2009, a four year working relationship

#### **Facilities under construction**

- · Biomass: Wuhan Kaidi, Wuhan, China
- MSW & Incinerator Fly-ash Vitrification: GTS, Shanghai, China
- Air Products: Teesside, UK 950 tpd MSW to power 50 MW combined cycle

#### **Projects under advanced development**

- KDA: International Falls, MN 250 tpd Industrial waste to syngas
- India: 2 hazardous waste to reciprocating engines ~ 70 tpd

#### Technology Site Licenses to PGP Terminal a.s. for Czech Republic and Slovakia

Sold five site licenses to PGPT for \$4.375 million with option to purchase three more site licenses





# THE PATH OF EVOLUTION: FROM DEMO...TO COMMERCIAL...TO INDUSTRIAL...

#### **WESTINGHOUSE PLASMA PROJECTS**

PILOT PLANT U.S. 48 TPD YOSHII, SYNGAS & MIHAMA MIKATA JAPAN 24 TPD

UTASHINAI JAPAN 220 TPD PUNE INDIA 78 TPD TEESSIDE - UK 950 TPD UNDER

CONSTRUCTION

**DEMO** 

SMALL COMMERCIAL MSW + SLUDGE COMMERCIAL MSW + ASR

COMMERCIAL HAZARDOUS

INDUSTRIAL MSW











#### **GASIFICATION SYSTEMS AND SOLUTIONS**

#### **P5**

- Up to 100 tpd Waste
- Up to 5 MW electrical
- Energy equivalent of up to 50,000 bbls/yr of fossil fuel



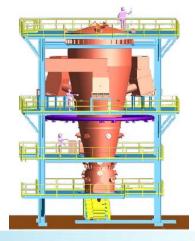
#### W 15

- Up to 300 tpd Waste
- Up to 15 MW electrical
- Energy
   equivalent of
   up to 150,000
   bbls/yr of
   fossil fuel



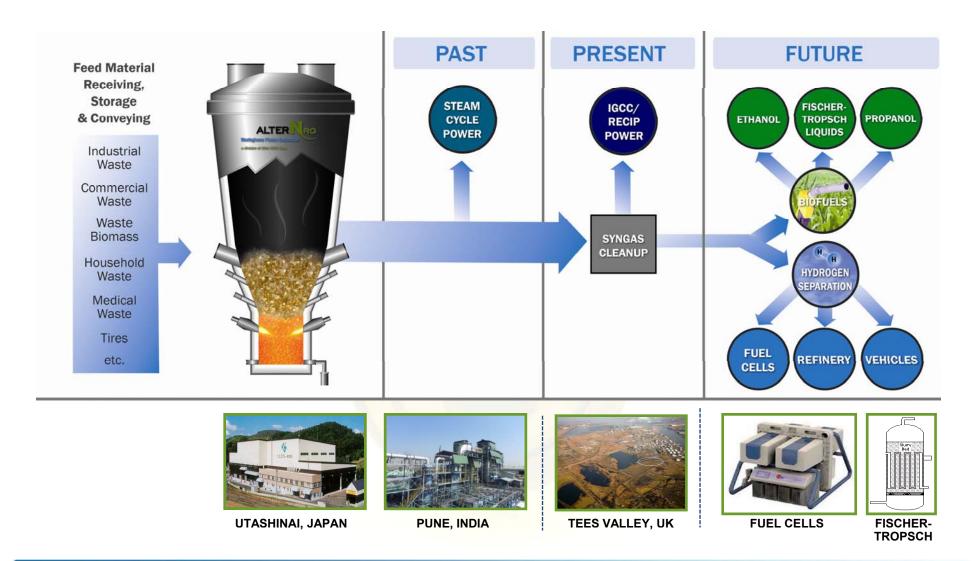
#### G 65

- Up to 1000 tpd Waste
- Up to 50 MW electrical
- Energy equivalent of up to 650,000 bbls/yr of fossil fuel





# PLASMA GASIFICATION – PROVIDING THE FLEXIBILITY TO DELIVER TOMORROW'S ENERGY SOLUTIONS







# ALTER NRG PLASMA GASIFICATION HAS DISTINCT COMMERCIAL ADVANTAGES

#### Optimize Gate Fee Revenue and Energy Output Revenue

- Process a blend of feedstocks or optimize feedstocks to take advantage of changes in gate fees over time
- In many markets, energy from plasma gasification qualifies for green energy incentives
- Ability to produce power in combined cycle mode and materially increase efficiency

#### **Reduce Start-up and Operational Risk**

 WPC installing fourth generation gasifier at APCI's Tees Valley project. Most competitors don't have commercial installations

#### **Reduce Permitting Time and Expense**

- Meets EU's waste incineration directive
- APCI project has received environmental permit

#### **Superior Environmental Footprint**

- Lower emissions vs landfill and other thermal treatment technologies
- Beneficial use of by-products and a reduction in the amount of material that must be sent to landfill
- · Lower greenhouse gas footprint







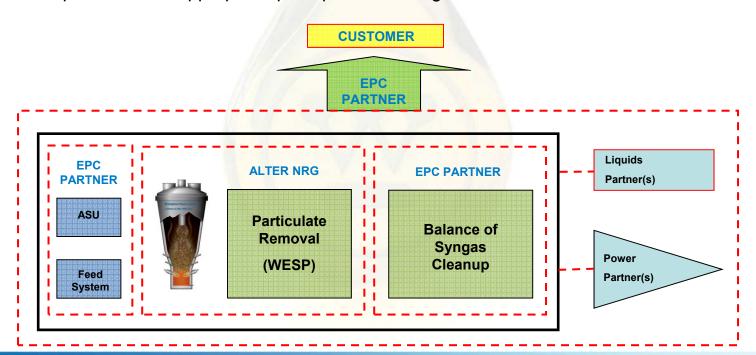
#### LEVERAGING SUCCESS TO INCREASE OUR COMPETITIVE ADVANTAGE

# 25+ years of development and optimization has culminated in the world's first 1000 tpd, 50 MW, waste to combined cycle plant

This commercial tipping point has created significant global interest in the Westinghouse Plasma Gasification technology from customers, EPC firms and syngas recipient technologies

#### As a result:

 Alter NRG is in strategic partnership discussions with EPC's and syngas recipient technologies to offer a complete EfW plant with the appropriate plant performance guarantees





#### CONCLUSIONS

#### **Westinghouse Plasma Gasification:**

- Is feedstock flexible and efficient
- Is commercially proven at scale
- Is economically viable and environmentally accepted
- Is the core technology for today and tomorrow's energy from waste solutions for the UK and global markets







# TEES VALLEY RENEWABLE ENERGY FACILITY, UK



### **About Air Products**

- \$10.1 billion company
- \$1.6 billion in capital spent in FY2011
- More than 20,000 employees worldwide (~1,600 in the UK and Ireland)
- Operations in over 50 countries with UK operations since 1950
- Previous owner/operator of five waste-to-energy plants in US
- Global industrial gases, performance materials, equipment and technology company. Enabling customers to become more productive, energy efficient and sustainable for over 70 years
- Supplying innovative solutions to the energy, environment and emerging markets
- World class capability to run complex technologies and facilities in a safe, reliable, and cost effective manner



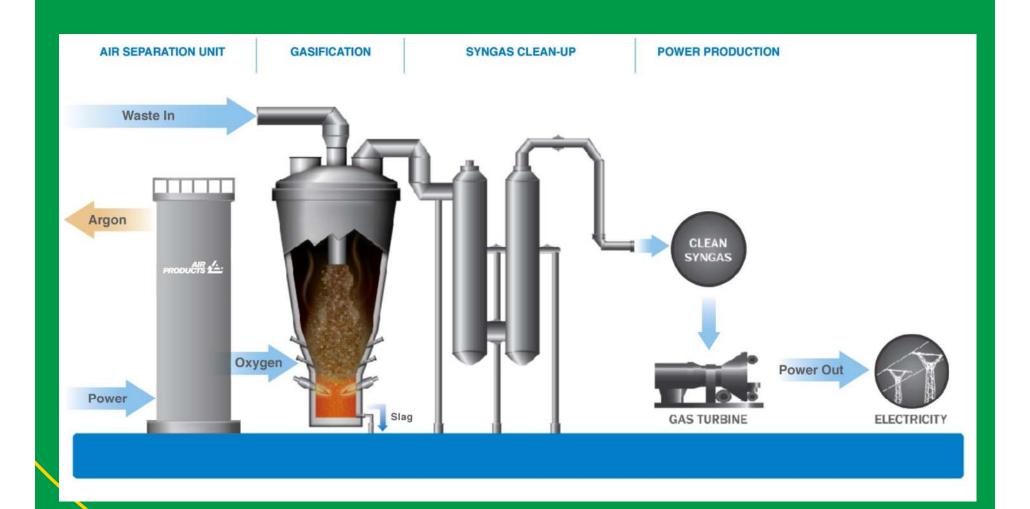


# Air Products Major Energy Sector Experience

- Waste-To-Energy: Owned and operated 5 waste incineration plants in US
- Solid Fuel Cogeneration: 50-85 MW solid fuel CFBs, processing coal, waste coal, petcoke, tires and biomass
- Hydrogen: World's largest producer with over 150 hydrogen fuelling stations worldwide
- Landfill Gas Recovery: Owned and operated 11 plants w/gas cleanup
- Other Power Production: Numerous facilities (NGCC, NG Cogen, and peaking plants) up to 154 MW
- LNG: worldwide leader in baseload LNG



#### Tees Valley Renewable Energy Facility <u>Process Description</u>





#### Tees Valley Renewable Energy Facility Location



- Northeast England site close to major industrial complex
- Part of the New Energy & Business Technology Park
- Existing landfill site nearby



# Why Tees Valley?

Tees Valley has a number of advantages:

- available industrial zoned land
- good access to electrical infrastructure
- excellent road links



Our scheme provides an alternative to some of the landfilling that is already occurring in the North East region.



# Tees Valley Renewable Energy Facility <a href="mailto:Status Update">Status Update</a>

- Tees Valley: our first facility
- Capital investment of \$500MM
- Secured planning permission and environmental permit
- Signed waste feedstock supply agreement with Impetus
- Signed Power Purchase Agreement with well-known high street chain
- Signed agreement with bank for renewable credit purchase
- Announced project go-ahead in August 2012
- Groundbreaking ceremony October 2012
- Anticipated on-stream in 2014



#### Air Products UK Vision

#### Advanced Gasification Solution for Waste

- Tees Valley Renewable Energy Facility
  - \$500 million invested
  - 700 temporary construction jobs created
  - 50 permanent jobs created
  - 350,000 tonnes of waste diverted from landfill
  - 50MW renewable electricity produced
- Second and third UK projects in the early stages of development with real potential for additional projects
- Potential for up to five Tees Valley scale projects in the UK
  - Divert over 1.5 million tonnes of waste from landfill
- Produce enough base-load quality power (~250MW) for up to 250,000 homes in the UK



# **THANK YOU**



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# **APPENDIX**

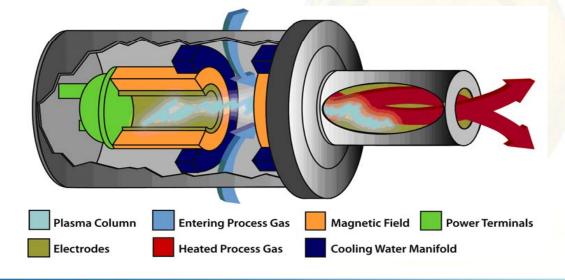


# OUR TECHNOLOGY AND PROCESS ARE DRIVEN BY WESTINGHOUSE PROPRIETARY PLASMA TORCHES

- Plasma is a highly ionized or electrically charged gas
- Torches are capable of producing temperatures above 7,000°C







Westinghouse plasma torch systems create the intense heat inside the plasma gasifier





#### **GLOBAL PROJECT OF WASTE GENERATION IN 2012**

Location	Population	Tons per yr. of MSW generated	G65 project potential for 100% of market	Total MW generation potential
North America	450,525,697	29 <mark>4</mark> ,118,784	806	40,290
UK/Europe	532,039,766	<b>277</b> ,518,311	760	38,016
China	1,336,540,000	390,269,680	1069	53,462
India	1,178,647,000	193,592,770	530	26,520
Balance of Asia	1,051,946, <mark>548</mark>	293,519,768	804	40,208
Africa	632,059,500	184,472,150	505	25,270
Brazil	192,3 <mark>76,496</mark>	63,195,679	173	8657
Australia	26,559,300	17,017,827	47	2,331
Russia	141,9 <mark>27,297</mark>	48,255,281	132	6,610
Total	5,542,621 <mark>,604</mark>	1,761,960,249	4,827	241,364
Unaccounted	1,457,378,396	463,290,296	1,269	63,464
Total	7,000,000,000	2,225,250,545	6,097	304,829





# CONTINUOUS TECHNOLOGY OPTIMIZATION WPC COMMERCIAL DEMONSTRATION FACILITY, PA, USA

- Up to 48 tpd pilot facility in Madison, Pennsylvania, USA
- Completed over 125 pilot tests to provide baseline information on various feedstock's
- Recently completed a 2 year commercial demonstration of the Coskata cellulosic ethanol technology
- WPC testing was a critical piece of the Air Products commercial facility design process
- State of the art, real-time gas composition monitoring
- Predictive modeling capability through VMG simulation software, including balance of plant
- Actively working on refining the core plasma torch and gasification technology
- Capability to test almost any feedstock
- Wide range of feedstocks tested, including:
  - Waste (municipal solid, refuse derived fuel, hazardous waste, construction and demolition waste)
  - Waste Water Sludge
  - Wood and Bagasse
  - Coal







- Excavated Landfill Material (PCB disposal)
- Tires
- Auto Shredder Residue
- Heavy Oil
- Ash 24



#### **PRODUCT PORTFOLIO - CORE GASIFIER MODELS**

	G65		
	tpd	FT Liquids GPY ('000)	Net Power MW
MSW	1000	7,879	2.6
RDF	1000	8,990	2.9
RDF/Tires	956	13,730	5.7

	W15		
	tpd	FT Liquids GPY ('000)	Net Power MW
MSW	265	2,047	0.6
RDF	265	2,344	0.7
RDF/Tires	226	3,246	1.4

	P5		
	tpd	FT Liquids GPY ('000)	Net Power MW
MSW	87	682	0.2
RDF	87	773	0.3
RDF/Tires	75	1,077	0.5





#### **ENVIRONMENTALLY SUPERIOR**

#### **Vitrified Slag**

- Produces non-leaching vitrified slag used as a construction aggregate, landscaping blocks, rock wool insulation and floor tiles
- Inorganic materials and metals can be separated and sold
- Leachate tests at the Mihama-Mikata facility including JLT-46, NEN-7341 and TCLP, show that slag components are below the test detection limits and considered non-leaching
- Analysis conducted by independent laboratories Shimadzu Techno-Research Inc. and ALS Laboratory Group

#### **Air Emissions**

- Superior air emissions performance
- A 2008 Golder Associates Report concluded that the Utashinai and Mihama-Mikata facilities are operating significantly below the permitted air emissions limits







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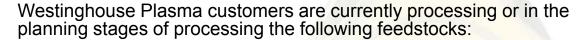




#### PLASMA GASIFICATION - FEEDSTOCK FLEXIBILITY

#### Westinghouse Plasma Corp gasification technology can:

- Process heterogeneous feedstock with minimal feed preparation
- Process high moisture and high inert content waste
- · Blend solids, liquids and slurries
- Reduce dependence on one feedstock, optimize revenue based on available feedstocks
- Produce a tar free syngas something most non-plasma gasification technologies cannot do



- MSW
- RDF/SRF
- Medical Waste
- Garbage dredged from river
- Paints/solvents
- Petrochemical waste oil sludge
- · Sewage waste
- · Auto Shredder Residue
- Tires
- E-waste
- Biomass including wood chips, rice husks, bagasse, etc

- Construction and Demolition waste
- · Petcoke flyash
- · Spent ammunition
- · Animal waste
- · Meat processing plant waste
- Hazardous waste
- Cuttings from drilling activity
- · Waste mined from landfill
- Waste coal or coal dust
- Pharmaceutical waste
- Forestry Industry waste (black liquor, paper sludge)
- PCB contaminated soil



















#### PROVEN FEEDSTOCK FLEXIBILITY

#### Mihama-Mikata, Japan

- 24 tpd of waste to power
- MSW and waste water sludge
- Commissioned in 2002

#### Utashinai, Hokkaido, Japan

- 220 tpd of waste to power
- MSW and auto shredder residue
- Constructed in 2002, operational since 2003

#### Pune, India

- 72 tpd of hazardous waste to power
- Over 40 different hazardous waste streams blended
- Commissioned in 2009

#### **Westinghouse Plasma Center**

- 48 tpd Pilot Facility
- Completed over 125 tests, including a 2 year waste to cellulosic ethanol demonstration
- Over 40 different feedstocks tested, including MSW, hazardous, biomass, tires, medical, petrochemical, ash, liquids etc.













