BOSON ENERGY

THE IMBY COMPANY

Zero-emission waste to energy solutions with PAG – Plasma Assisted Gasification

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BOSON ENERGY'S
PLASMA ASSISTED GASIFICATON

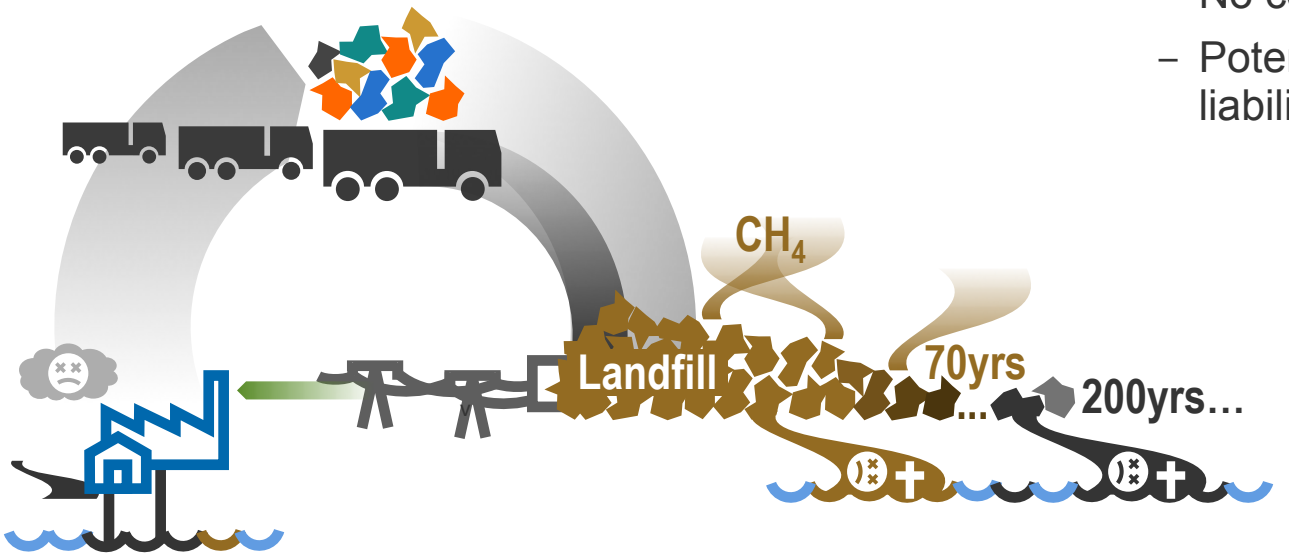
Global need for better waste treatment solutions

- Growing global waste disposal problem
- Increasing public pressure against conventional landfill and mass burn treatment techniques
- Tighter environmental regulations limiting land and air pollution
- Widening supportive legislation
- **Requirements for next generation waste to energy technology**

Landfill: Problems don't go away when you dump them into the ground

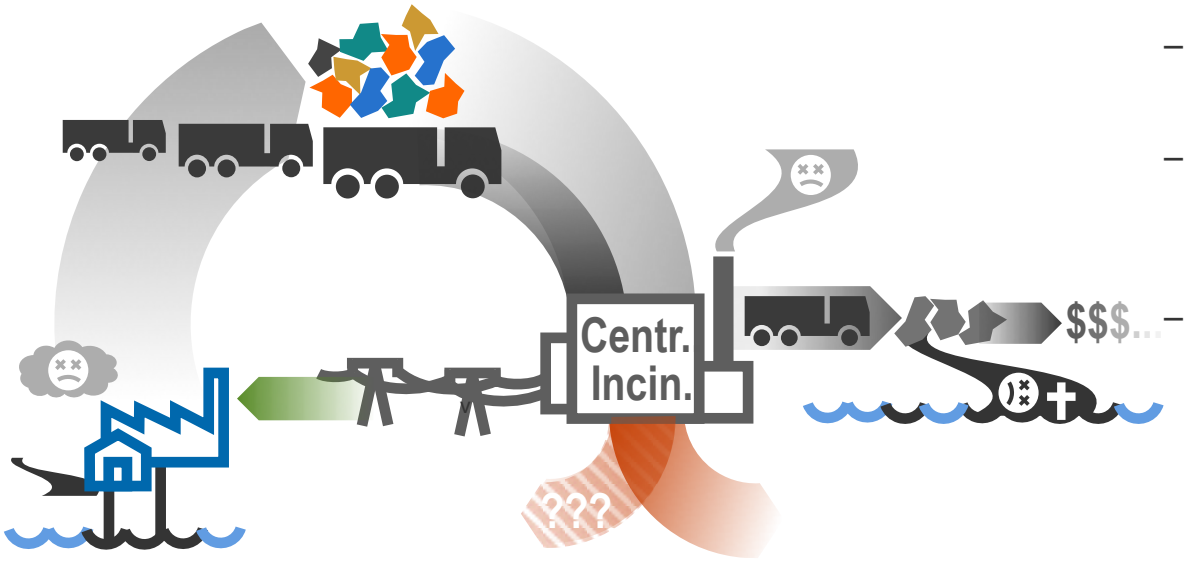
- **Centralized NIMBY solution**
  - Located far from waste producers, energy users, and communities
  - Congestion and pollution from transportation
  - Any energy use requires transmission and distribution investments
  - Social license to operate issues

- **Open-ended waste solution**
  - No volume reduction
  - Immediate leaking of potent methane greenhouse gas (still active 70 years after closure)
  - Long term leaking of pollution into water and soil
  - No control over total cost over lifetime
  - Potential future health issues and liabilities



Incineration: Formerly considered a clean technology

- **Centralized NIMBY solution**
  - Typically located far from waste producers, energy users, and communities
  - Congestion and pollution from transportation
  - Energy use requires transmission and distribution investments
  - Social license to operate issues



- **Open-ended waste solution**
  - Only 70% volume reduction
  - Ash residuals to landfill or cement:
    - Landfill: long term leaking of pollution into water and soil
    - Cement: Health effects unknown
  - Fly ash treated as hazardous material: capex & opex
  - Expensive to gain total cost over lifetime
  - Air pollution control brings down emissions, but total volumes emitted still considerable
  - Potential future health issues and liabilities

PAG is an Advanced Thermal Treatment Technology (ATTT)

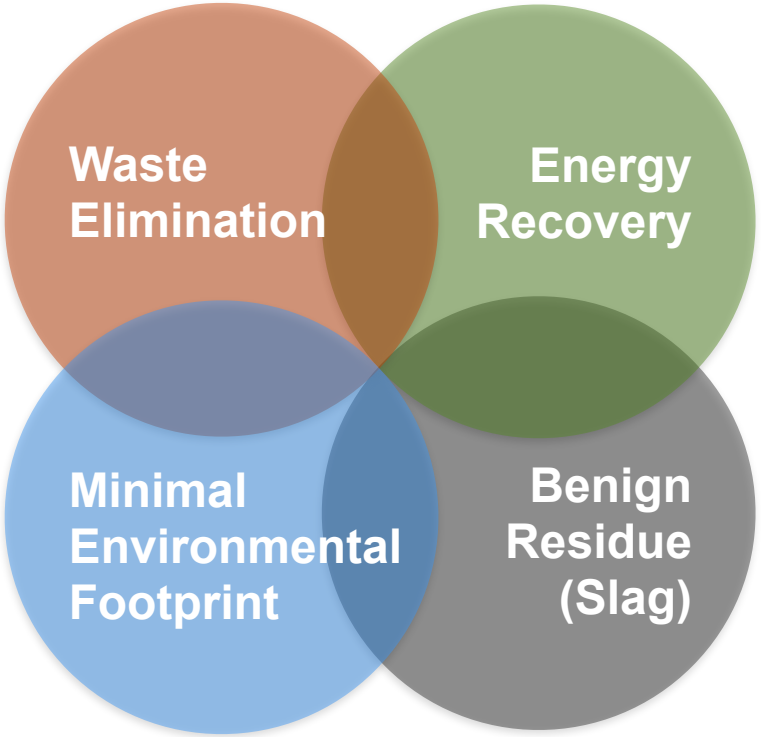
- **Advanced Thermal Treatment Technologies (ATTT)**, such as Gasification, Pyrolysis, Plasma and Plasma Gasification, convert thermal energy of waste into a high calorific syngas. The syngas is then processed to create energy such as electricity, heat, steam, biodiesel and other types of energy.
- **PAG is a gasification technology and part of the ATTT family**. The process converts organic waste matter into syngas, by using a plasma heat source. It also generates a benign vitrified material from the inorganic content that was not converted.

The global market for waste to energy technologies has increased from $4.83 billion in 2006, to 7.08 billion in 2010, and will continue market growth through the global economic downturn to $27 billion by 2021.*

Solving The Waste Problem

- **Boson Energy develops and builds solutions based on an innovative technology for solid waste disposal**
- Using novel non-incineration thermal treatment technology known as PAG – High Temperature Plasma Assisted Gasification.
- Zero emission to air, water and soil

- PAG is a single-step process delivering four key results:



PAG – Plasma Assisted Gasification: The distributed full-stop no-pollution system with a solid business case

- **Distributed IMBY solution**
  - Located close to waste producers, energy users, and communities
  - Minimal congestion and pollution from transportation
  - Local power and heat use without transmission and distribution
  - In My Back Yard solution – “we take care of and leverage our own waste assets”

- **Full-stop waste solution**
  - No residuals – benign value-added material produced (slag) without additional capex & opex
  - Known and low total cost over lifecycle
  - No potential future health issues and liabilities

- **Versatile and future proof**
  - Highly energy efficient and agile
    - Thermal energy used for cooling
  - High energy security
    - Local fuel
    - Baseload generation
  - Approved for various complex waste streams (hazardous medical waste, Commercial & Industrial, etc)

Waste-to-value opportunity driven by unique technology in well defined markets

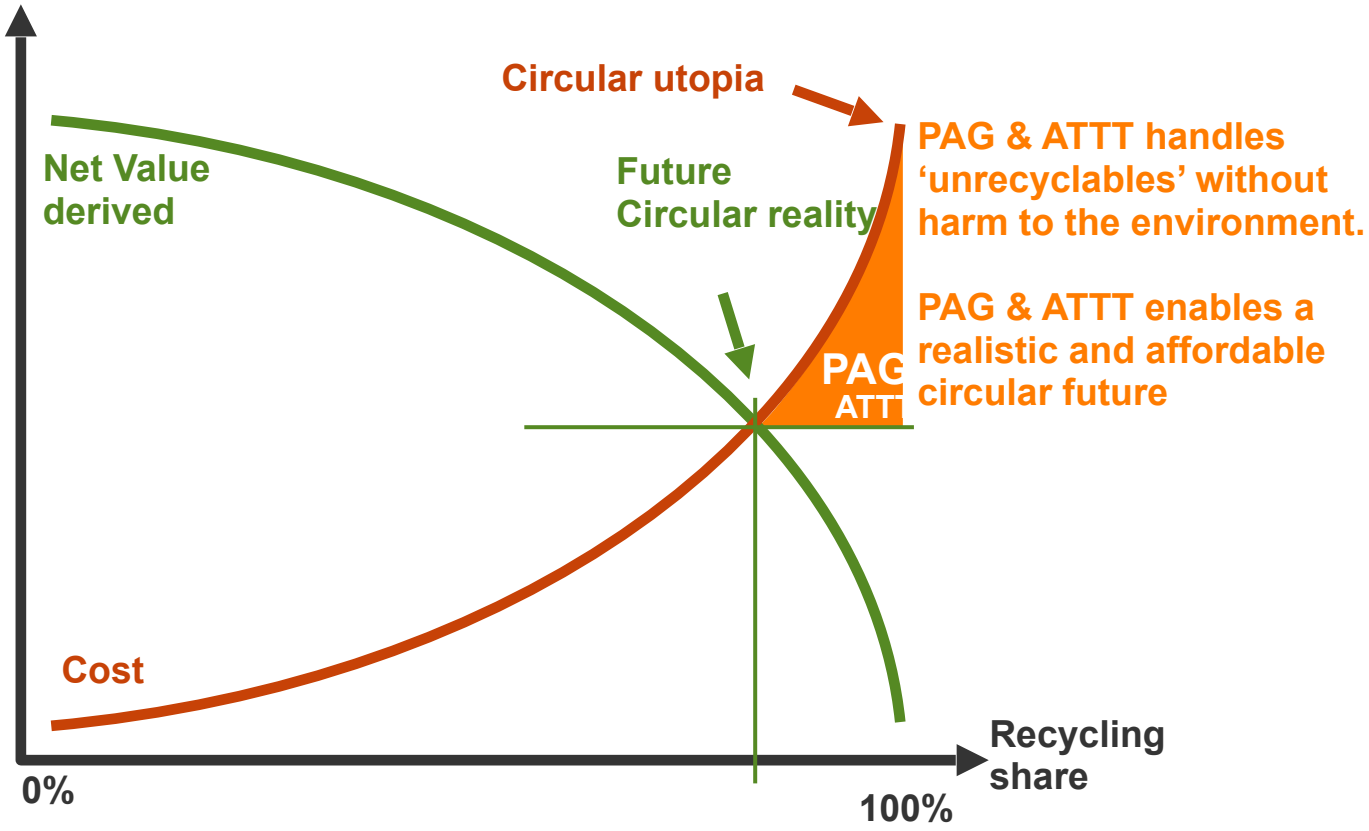
The world is drowning in waste. 'Litter-ally'

- Waste volumes grow with population and prosperity – and is recession proof
  - Municipal waste congests, pollutes, and kills people in growing cities across the globe.
  - Industrial waste bottlenecks are preventing companies and economies from growing.
- Pollution from waste knows no site-, municipal-, or national boundaries. It is becoming a big geopolitical challenge.
- Clear damage and costs to environment and health in the future from both landfills and previously considered 'clean' incineration.
- These environmental risks expose investors in conventional waste solutions to future liabilities.

Boson Waste Solution

- **BW provides a system with no pollution to air, water or soil**
  - It provides an unmatched 95% volume reduction of waste into an inert construction material – eliminating future liability risk for investors.
- **A distributed waste treatment system allowing for treating waste locally**
  - Reduces dangerous waste storage, limits congestion and pollution from transportation of waste and residues.
- **Integrates waste treatment with distributed cogeneration**
  - Produce local power, heat, and cooling for local use at high levels of final energy efficiency.
- **Combining both proprietary- and partner technologies**
  - Cover a broad spectrum of waste treatment needs.
- **Low total system-level CAPEX and OPEX**
  - In combination with high modularity, energy security, and revenue from energy produced.

PAG and other Advanced Thermal Treatment Technologies will only increase – together with recycling and circularity



PAG: An Innovative solution addressing market needs

- An economical and environmentally superior replacement to current waste treatment methods
- Maximum waste reduction for a range of waste applications
- Urban environmentally friendly configuration
  - Metropolitan approved
  - Smart City approved
  - Circular Economy approved

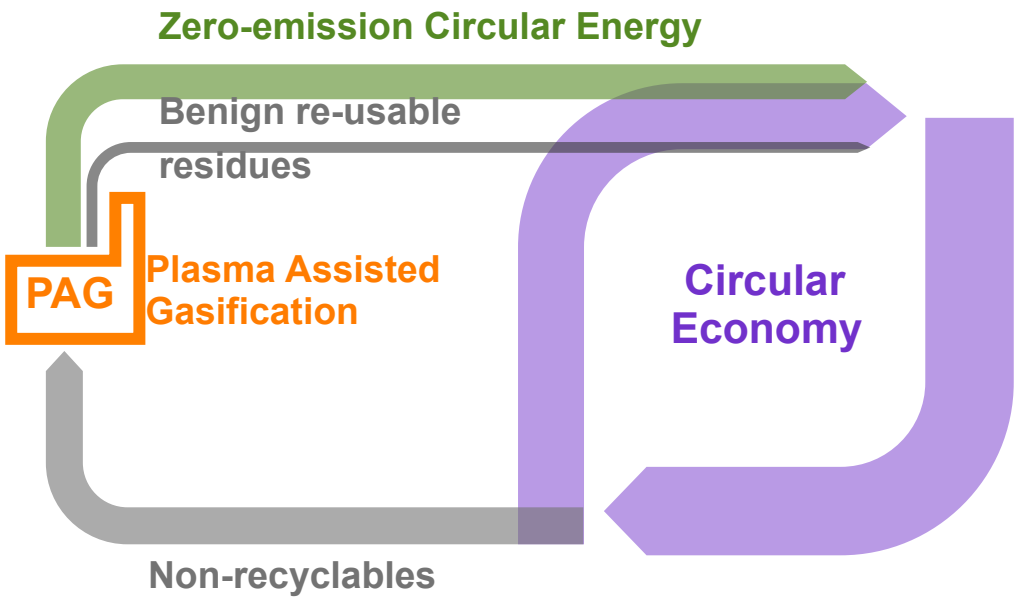
- Unique flexible design to suit a wide range of volumes
- Fully automated process
- Cost effective

Waste is reduced to reusable slag – and 5% of the input waste volume

PAG outperforms landfill and incineration on all KPIs

	Volume	Land & Water Contamination	Air pollution	Final Energy Balance	Future effect
Landfill	**100%**	**High**	**High**	**Weak**	**Highly Negative**
Incineration	**30%**	**High (ash)**	**Low**	**Medium** Ash treatment lowering balance	**Expensive to avoid negative**
PAG	**5%**	**None** (closed loop)	**Very Low** on critical pollution components below Limit-of-Detection	**Good** Commercial-scale baseload cogeneration	**No effect** Closed loop & full stop

Squaring the Circular Economy: Circular Energy closes the loop with retained operational- and financial performance



- Advanced recycling economies will still produce important waste volumes
  - UK reopening landfills to handle volumes
- Distributed thermal generation based on PAG efficiently recovers the energy
  - 'Full-stop' solution – no environmental load on future generations
  - Produce benign and usable material (up to 95% reduction of waste volume)
  - MSXW/RDF, C&I waste, Medical Waste, LILRW,
  - 'Zero emission' and no pollution to air, water, and soil
  - Eliminate waste-flow bottlenecks

PAG: ENERGY BALANCE FOR 1 TON/HR

Waste Thermal Energy:
2830 kW (10.2 MJ)

Heat loss: 300 kWhth

Net Heat to the grid:
1,500 kWhth

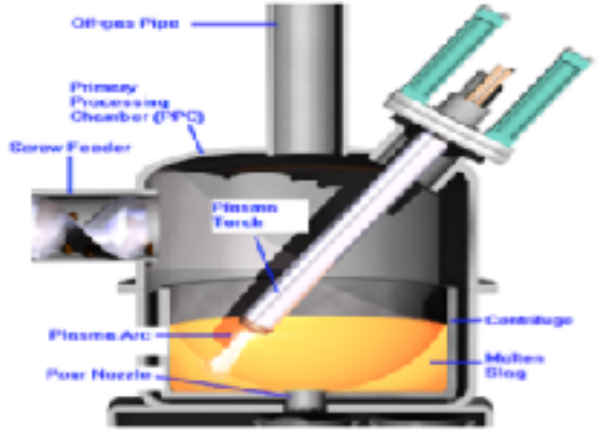
Net Energy to the grid:
> 700 kWhe

Self use

330kWe

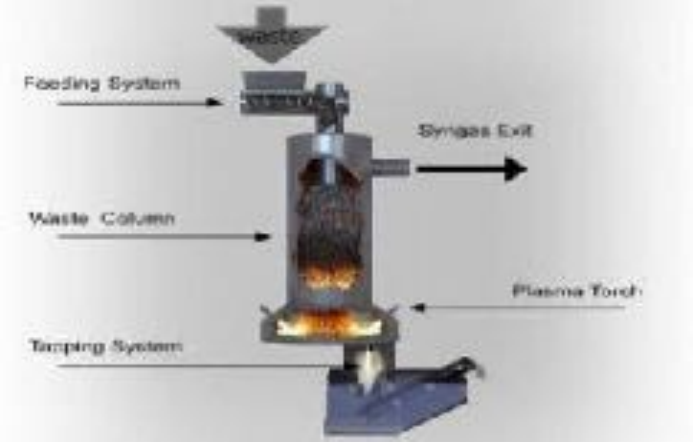
Advantages of PAG over other plasma torch-based processes

Other Plasma Process



- High rating plasma torch
- Entire plasma torch inside high temperature zone
- Waste dropped onto surface of molten pool
- Syngas removal at high temperature and with heavy pollutant load
- Vitrified slag tapped out continuously
- High specific energy consumption
- Extensive off-gas cleaning required
- Syngas with low CV

PAG Process



- Multiple low rating plasma torches
- Minimal plasma torch exposure to high temperature
- Waste supplied via “Air Lock” chambers to form a waste column
- Syngas removed at low temperature and low pollutant loading
- Vitrified slag tapped out intermittently
- Low specific energy consumption
- Off-gas cleaning easy
- Syngas with high CV
- **Below regulatory emission limits**

Pyrolysis	**Pyrolysis + Hydrocarbon burning +**	**Intermediate calorific value**	**Hard**	**Medium**	**Ash and char requiring further treatment**
Other plasma process tech	**Plasma melting + Syngas recuperation**	**low calorific value**	**Hard**	**Medium**	**Benign slag**
PAG	**Gasification + Plasma melting**	High calorific value	**Easy**	**Good**	**Benign slag**

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PAG Demonstration Plant

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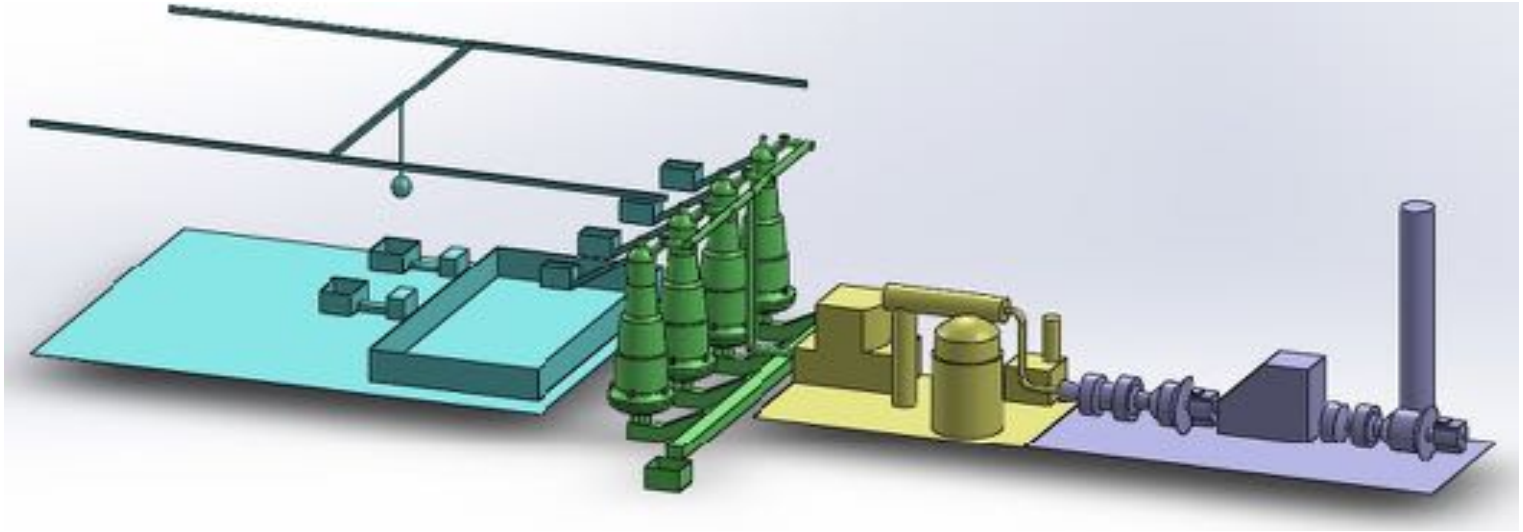
PAG Treatment Process for Waste to Energy Plants

- A tailor made and flexible design concept based on existing plant configurations.



Front End Handling & Feeding

PAG Processing Chamber Island

Gas Conditioning

Power Island

Boson PAG advantages over competition and alternatives

Technology, Operation, Financing

- Single step, fully automated process
- Designed for maximum CAPEX and OPEX savings
- Superior W2E technology
- Flexible design to fit full range of projects
  - Large or small
  - Refurbishment and new
- Handles all solid waste types
- Zero waste solution

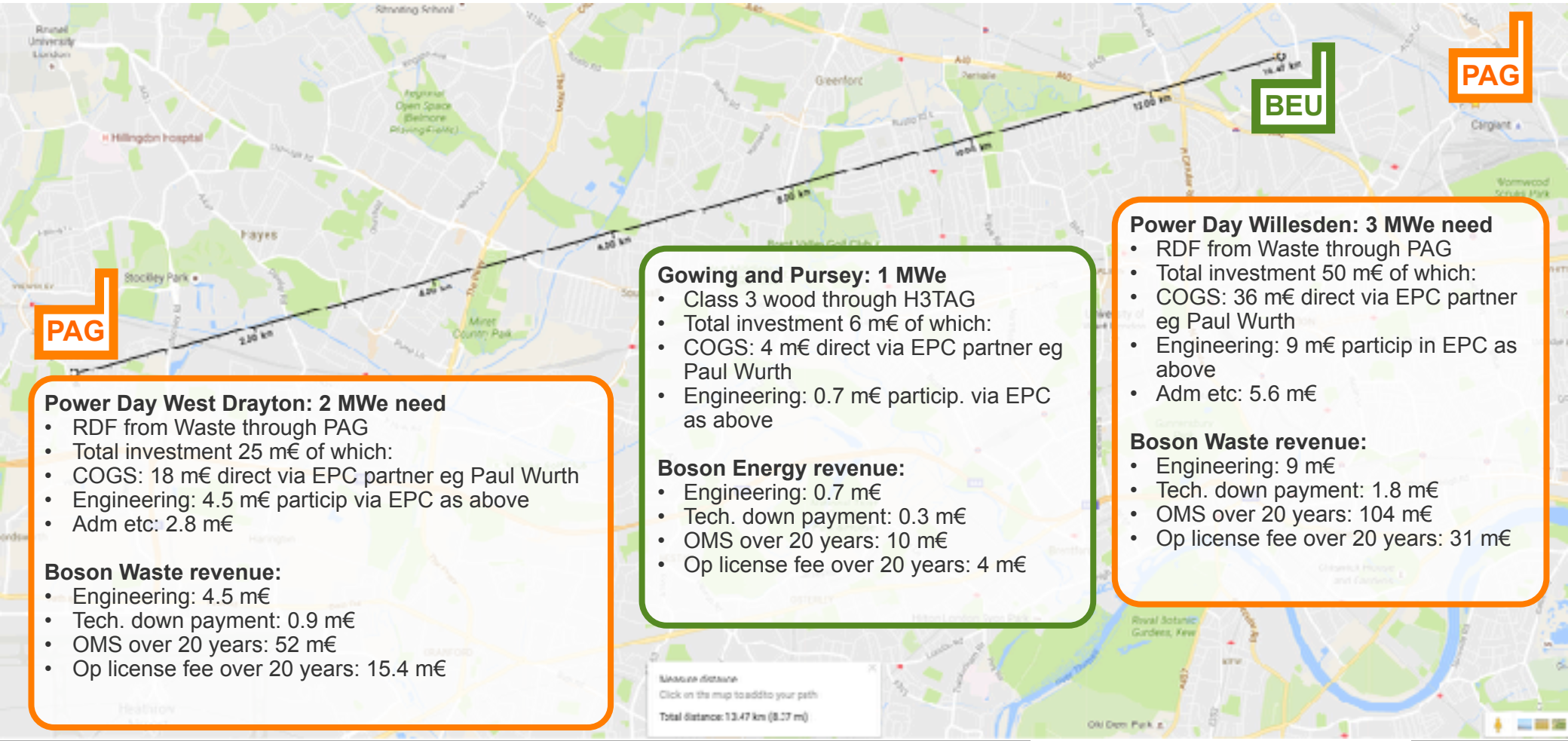
Environment

- Small environmental footprint
- Suitable for metropolitan areas
- Substantial land savings
- Lower transportation costs
- No fossil fuel consumption
- Minimized emissions and other contaminations

Boson Waste status

- **Solves acute environmental and health problems in communities globally – now and for future generations**
- **A new breed technology that eliminates waste completely – with no pollution to air, water, and land**
- A distributed waste-to-energy solution that reduces transportation, congestion nuisance, and hazard of waste management – while producing power and heat or cooling
- **Team and partners with experience and high execution capacity**
  - **Partners: global niche leaders (Paul Wurth, etc)**
  - **Partners: Global brand leaders (Siemens Energy)**
- Previous investments in market relations and execution by team allows for short-cutting the sales cycle – entering the market with a performing solution ‘five to twelve’
- Identified project financing opportunities of €118m today

Cluster Case: West London 3 satellites



Power Day West Drayton: 2 MWe need
- RDF from Waste through PAG
- Total investment 25 m€ of which:
- COGS: 18 m€ direct via EPC partner eg Paul Wurth
- Engineering: 4.5 m€ particip via EPC as above
- Adm etc: 2.8 m€

Boson Waste revenue:
- Engineering: 4.5 m€
- Tech. down payment: 0.9 m€
- OMS over 20 years: 52 m€
- Op license fee over 20 years: 15.4 m€

Gowing and Pursey: 1 MWe
- Class 3 wood through H3TAG
- Total investment 6 m€ of which:
- COGS: 4 m€ direct via EPC partner eg Paul Wurth
- Engineering: 0.7 m€ particip. via EPC as above

Boson Energy revenue:
- Engineering: 0.7 m€
- Tech. down payment: 0.3 m€
- OMS over 20 years: 10 m€
- Op license fee over 20 years: 4 m€

Power Day Willesden: 3 MWe need
- RDF from Waste through PAG
- Total investment 50 m€ of which:
- COGS: 36 m€ direct via EPC partner eg Paul Wurth
- Engineering: 9 m€ particip in EPC as above
- Adm etc: 5.6 m€

Boson Waste revenue:
- Engineering: 9 m€
- Tech. down payment: 1.8 m€
- OMS over 20 years: 104 m€
- Op license fee over 20 years: 31 m€