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STRIKING OIL IN KRAAIFONTEIN

PRESENTATION TO IMIESA (WESTERN CAPE)

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Making progress possible. Together.

Background to Pyrolysis Pilot Project at Kraaifontein Integrated Waste Facility

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Pyrolysis Pilot Project Background

- Mid-2013: Japan International Cooperation Agency (JICA) approached City to accommodate pyrolysis test plant at Kraaifontein IWM facility.
  - Alternative technology to reduce waste to landfill (NEMWA and National Waste Management Strategy targets: Key driver.
  - Grant funding available for pilot project: US$1-million (R10-mill) for capital works, opex for Japanese supervision & training of SA staff.

- Big hurdle to overcome: MFMA, SCM & Asset Transfer Regulations – how does a municipality accept foreign government grant funds involving a commercial party (no prejudice or bias, fair, equitable, transparent)?
  - Memorandum of Agreement (MoA) drafted, terms and conditions finalised between City, JICA, and CFP/Kanemiya (service providers).

Pyrolysis Pilot Project Location: Kraaifontein Integrated Waste Facility

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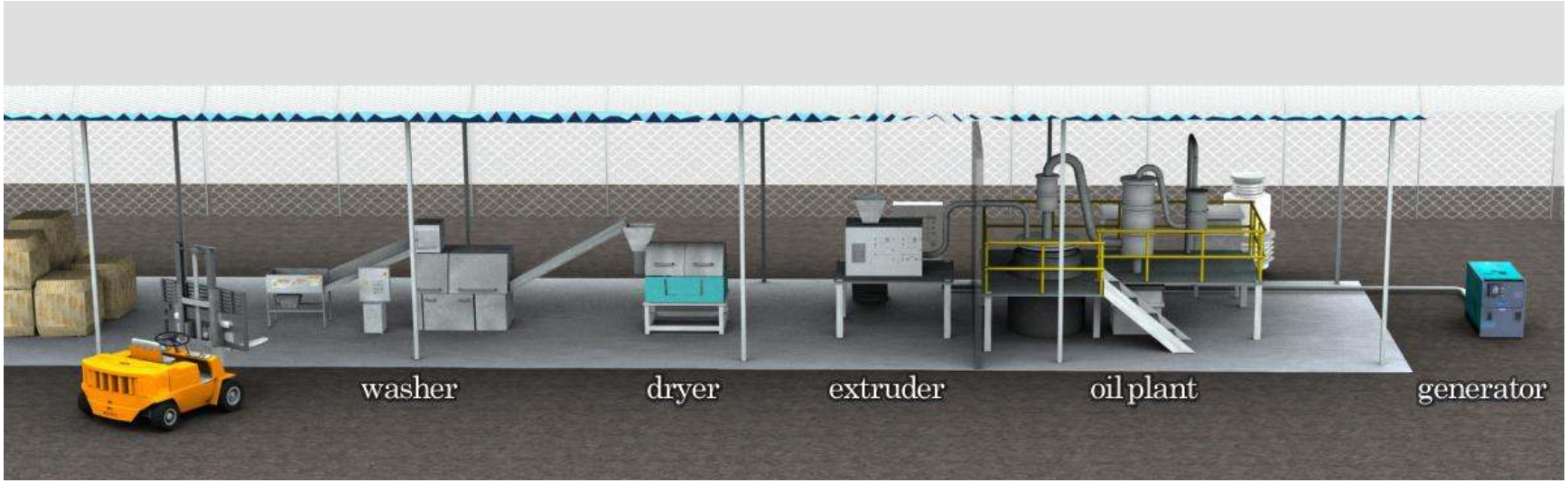
Pilot Plant: Design Parameters

- Input capacity: 500 kg waste plastic per day (10.8 tonnes per month/ 130 t.p.a. or 0.01% of est. plastic waste generated in Cape Town).
  - Feedstock: Only Polypropylene (PP), Polyethylene (PE), Polystyrene (PS) (not plastic tailings: would be ideal – landfill reduction).
- Theoretical output capacity: 500 litres of heating oil – variation in quality caused by different combinations of plastics feedstock.
- Plant is scalable - cost does not increase in line with scalability factor when larger vessels are used (base capital already spent).
  - CFP plants in Japan and Malaysia (8 & 4 t.p.d. design capacity).
  - Pyrolysis typically used at plastics factory or where homogenous packaging materials are recovered (clean feed stock).

Pyrolysis Pilot Plant Process

- Three stage production process (1) materials preparation stage, (2) pyrolysis stage, and (3) filling and storage of drums of oil not used for process heating or for use in generator (ancillary power supply part of the design).
- Thermo-chemical conversion process:
  - Non-incineration, high pressure & temperature process takes place in the absence of oxygen or halogens, with nitrogen fed to into process.
  - Generically, organic-type materials (e.g. plastics, tyres, etc.) converted.
  - This technology: Breaks down hydrocarbon bonds to produce a gas between 350 – 570 degrees Celsius through chemical conversion of solid material in reactor vessel operating, then condensed and cooled to produce oil.
  - Oxidation occurs, with unconverted materials due to imperfect process and enhancers used in plastics that need reactor to be cleaned.
- City objective: to test efficacy & viability (sustainability) of pyrolysis technology as a viable alternative mechanism to landfill disposal in Cape Town.

Schematic of the Pyrolysis Plant & Generator



Key design parameters:

- Approx. 500 litres of heating oil converted from 500 kg plastics (claim to be tested).
- Approx. 52% used for plant heating.
- Approx. 34% of the oil, blended with diesel for 150 kVA electricity generator.
  - Internal combustion engine that drives a generator.
  - Electricity for powering the plant (almost self-sufficient – positive sustainability).
- Approx. 14% of oil could possibly be used in forklifts on site (blended with diesel).

Pyrolysis Pilot Plant: 1st oil produced 27 October 2015

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Pyrolysis Pilot Plant Project Team

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Main Objectives: City Perspective

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City Objectives

How sustainable is pyrolysis technology as an alternative waste disposal mechanism that will assist City to meet NWMS targets?

- Opportunity to test thermal technology (using capex grant funding) as one of the alternative disposal methods for waste management in terms of the topical "Waste-to-Energy" drive in municipalities at the moment.
- How effective and efficient is pyrolysis technology (efficacy)?
  - What are the operating costs?
  - What are the returns (revenue or off-set of costs, saving on landfill, etc.)?
- Are there technical or operational issues that are not apparent in the implementation of the technology?
- Results will inform decisions of Transaction Advice process currently underway for Cape Town's waste disposal alternatives.

Main aspects of the Memorandum of Agreement (MoA)

To produce results, define roles and responsibilities, protect all parties' interests, to comply with requirements of MFMA, SCM Regulations and Asset Transfer Regulations.

MoA between City, JICA, CFP/Kanemiya for the "Survey"

- Strict definition of period of test (survey): 6-months from date of commissioning (26 October 2015 – 26 April 2016).
- Defines clear deliverables: data & test results in accordance with plan.
- Roles, responsibilities & relationship between the parties.
  - Intellectual property
  - Operating, supervision.
  - Training.
  - Communication about the project, marketing, etc.
  - Authorisations, approvals, etc.
  - Defines cost responsibilities: Capex vs. Opex.
- Defines "consortium": CFP/Kanemiya (technology).
- Defines ownership of infrastructure and transfer of assets (plant).
- Determines periods City has for decision on after-use, or not/dismantling:
  - 1-month: provisional decision to continue operation, (26 May 2016).
  - Final decision: 12 months after that for (26 May 2017).

Key elements of City's responsibilities in the MoA

- City must provide space at no cost at Kraaifontein Integrated Waste Facility.
- City staff will be involved in operation (skills transfer through training and supervision).
- City will source and provide plastics (from the Kraaifontein facility):
  - Only Polystyrene (PS), Polypropylene (PP) and Polyethylene (PE) plastics.
- Operating costs will be borne by City:
  - Utility services, feedstock, staff, forklift and fuel costs.
- At end of test (after 6-months):
  - Plant & equipment becomes City's property.
  - Formal evaluation or results to determine if it is viable for the City to retain and operate.
  - No obligation to keep the plant or purchase from same suppliers if test is successful (SCM policy).

Timelines, Milestones

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Timelines, Milestones

- Council approved MoA: end-Feb 2014.
- MOA signed at formal ceremony: 12 Mar 2014 -
- Environmental Assessment Practitioner RFP appointed: September 2014
  - Downscaling application submitted to follow a BA.
  - Public participation, including authorities: October 2014.
  - BA finalised: November 2014.
  - EA, AEL by DEADP: July 2015.
- Export to Cape Town: Jan 2015 -
  - Customs clearance for ship transport to SA.
- Plans approval process (City – usual process involving Fire Dept., Water & Sanitation, Stormwater, Engineering, zoning, etc.): September 2015.
- Construction: Early Oct 2015.
- Commissioning: 26 October 2015.
- Test end-date 6-months – asset transfer: 26 April 2016.
- Provisional decision by City: 26 May 2016.
- Final decision by City regarding end-use (if semi-operation is to continue after 26 May 2016): 26 May 2017.

What has the pilot project achieved?

Pilot Project Achievements

- Allowed for real-time evaluation of high-end thermal technology.
- Learning experience all round.
- City staff trained to operate the plant independently.
- Highlighted practical and unknown issues associated with the implementation of advanced technology.
- Final evaluation of results being done at present:
  - Too soon for final recommendation and decision.
  - Extranuous factors also to be considered.
    - How beneficial for the environment?
    - How beneficial for the economy?

Unforeseen pitfalls, unintended consequences

- Competing with sustainable alternatives: unintended consequences for recycling industry, especially if materials are high value recyclables.
- Environmental authorisations:
  - Regulatory staff are inexperienced with new technology.
  - Legislation is not geared to small, pilot plants. (air emissions)
  - This implies additional costs: not willing to relax requirements.
- Air Emissions Licence (AEL):
  - Temporary for 6-month period.
  - Authorisation for full licence needed if operation continues.
  - Annual Dioxin & Furan test: only done overseas – typically costs an additional R250 000-00 per annum (subject to exchange rate).
- Local content vs. imported equipment (cost estimates influenced by exchange rate fluctuations).
- NERSA, oil producer's licence – if oil is produced for commercial sale.
- SARS: Excise duty due for petroleum products (no exception).

Questions?

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Thank You

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