Developing a Green Waste Management System for Brunei Darussalam - What is required?

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ADVISORY SERVICES

EDUCATION AND TRAINING
Outline

• “Conventional” Waste Management
• The World Context & Resulting Issues
• Trends and Technologies
• Edmonton Example
• Brunei Darussalam Context
• Conclusion
“Conventional” Waste Management

End-of-pipe control

Natural resources → Extraction → Fabrication → Consumption → Disposal

Environmental & Health Protection

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Risk and Liability
Increasing world population $\Rightarrow$ rising demands

United Nations Population Division
“Since 1980, global resource extraction increased by 36%, and is set to grow to 80 billion tonnes in 2020”

Strange, 2008
World context – Resource Costs

Inflation Adjusted
Monthly CRUDE OIL PRICES
(1946-Present) in November 2008 Dollars
© www.InflationData.com
Updated 1/8/2009

Dec. 1979 Monthly Ave. Peak
$106.43 in Nov 2008 Dollars

June 2008 Monthly Ave. Oil Price
$122.64 in Nov. 2008 Dollars

Nominal Peak $38 (Mo. Ave. Price)
Intraday Prices peaked much higher

Inflation Adjusted Oil Price

Nominal Oil Price

Source of Data:
Oil Prices: www.ioga.com/Special/crudeoil_Hist.htm
CPI-U Inflation index: www.bls.gov
Key Issue – Resource Value

• Can we afford to continue to dispose of ‘end of life’ materials?
• How can we obtain maximum value from them?
World context – Global Warming

The Greenhouse Effect

- Some solar radiation is reflected by the Earth and the atmosphere.
- Some of the infrared radiation passes through the atmosphere, and some is absorbed and re-emitted in all directions by greenhouse gas molecules. The effect of this is to warm the Earth’s surface and the lower atmosphere.

Solar radiation passes through the clear atmosphere

Most radiation is absorbed by the Earth’s surface and warms it.

Infrared radiation is emitted from the Earth’s surface.
Key Issues – GHGs & Energy

Trend of GHG Emissions from Waste
IPCC Fourth Assessment Report (Bogner et al., 2008)

Uncertainties: 10-30% for countries with good annual waste data (IPCC)
World context – Economic Shifts

Newly Industrialized Countries (2007)
World context – Growth vs. Environment

Growing economies: deteriorating environments

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Key Issue – Growth Pressure

• Economic growth
  – Increased resource use
  – Waste generation related to GDP

• Environmental impact
  – Potential threats related to economic activity
  – But education/awareness also increases

• Waste management gap
  – Supply typically lags demand
Key Issues – Growth Pressure

Decoupling resource use from economic growth:
“more value per kilogram“

Decoupling environmental impact from resource use
“less impacts per kilogram“

Economic activity (GDP)

Resource use (kg, km², kW…)

Environmental impact (‘indicators’)
World context – Water Scarcity

Predicted water scarcity and stress in 2025

SOURCE: UNEP
Key Issues – Water Quantity

Water Allocations in Alberta since 1900
By Major Sector, by Decade

- Municipal
- Other Uses
- Industrial (Oil, Gas)
- Commercial
- Agriculture

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Key Issues – Water Quality

human/veterinary drugs
- e.g. analgesics, lipid-lowering agents, beta-blockers, antibiotics

endocrine disruptors
- natural hormones
  - e.g. estradiol, estrone
- synthetic hormones
  - e.g. ethinyl estradiol

pesticides
- e.g. simazine, diuron, bentazone, glyphosate
- DDT, lindane, amitrole, vinclozolin

industrial chemicals
- e.g. NTA, EDTA
- e.g. bisphenol A, nonylphenol, phthalates, dioxins

Wintgens et al. 2008
Key Trend – Resource Recovery

Resource recovery: Recycle & re-manufacturing

- Recovered materials, energy, & water
- Recycled water, Compost, Nutrients

Fabrication (Sustainable design)
- Raw materials

Consumption (Social marketing)
- Recovered energy & water

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Resource Recovery - Solids

Feed  Processing  Intermediates  Marketable Materials  Conversion to Energy

MSW  

Separation  Recyclables  Wet organics  Compost  Anaerobic digestion

Dry organics  Glass, metals, etc  Pyrolysis  Gasification  Combustion

RDF

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THE 4 Rs

1. REDUCE
2. REUSE
3. RECYCLE
4. RECOVER
Resource Recovery - Recycling
Resource Recovery - Recycling

http://www.geepinc.com/processes.php
Resource Recovery - Composting
Resource Recovery - Landfill Gas
Resource Recovery – Bioreactor Landfill
Resource Recovery - MBT/A Anaerobic Digestion

www.essexcc.gov.uk/vip8/ecc/ECCWebsite/content/binaries/documents/mbt.pdf?

http://www.kompogas.ch/
Resource Recovery - Gasification

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Edmonton Gasification Project

• Construction 2009 – 2011
• Capacity 100kt/y → 35 Ml/y Methanol/Ethanol
• Research Facility 2009- 2010
Integrated Resource Recovery – Edmonton
Edmonton – Elements of Success

- Facilities & Technology
  - Good Management & Operation
  - Public Co-operation & Support
- Education & Training
- Continuous Improvement
- Commitment to Research
The Brunei Darussalam Context

Obligations

– Safeguard human health
– Protect the environment

Waste Management **System** Requirements

– Appropriate to current and future material streams
– Appropriate to the local physical environment
– Appropriate to the local social environment
– Technical viability
– Economic viability
Summary

• Economic and population growth lead to environmental pressures
• Approaches to waste management are changing to focus on resource recovery
• Waste management systems should be viable:
  • Technically
  • Economically
  • Environmentally
  • Socially
Your turn: questions and comments?

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