No Tonne Left Behind - Designing Decarbonized Waste Management Systems through the ADB WARPS Tool

Asia Clean Energy Forum 2023

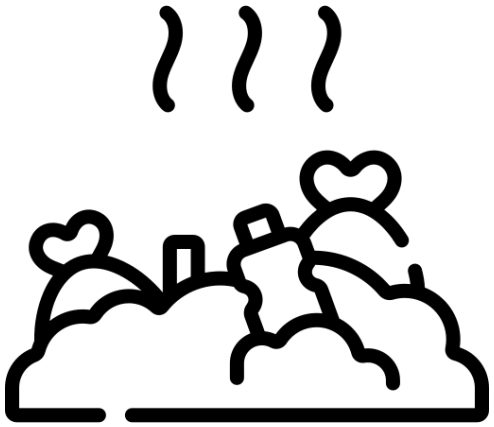
Spotlight Session: Digital Technology as a Driver of Decarbonization

14 June 2023, 2:00 – 5:30 p.m.

Dr. Piya Kerdlap, Managing Director, PXP Sustainability

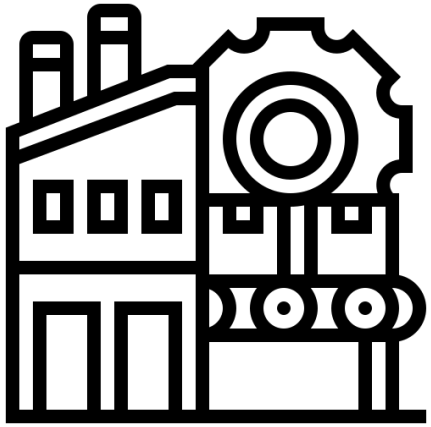
Waste in Developing Asia

Waste



- Waste continues to pile up in landfills as developing countries in Asia grow their economies
- 12% of global methane emissions come from solid waste in landfills

Technology/Infrastructure

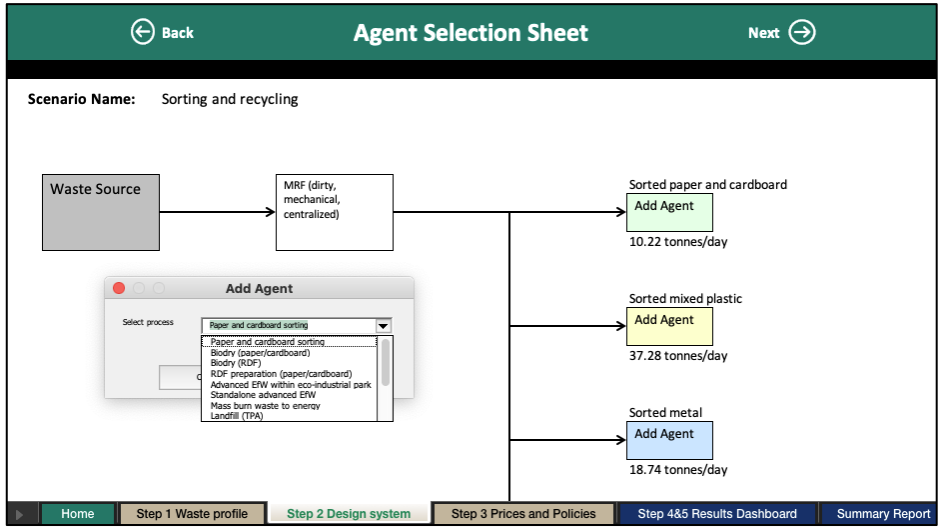


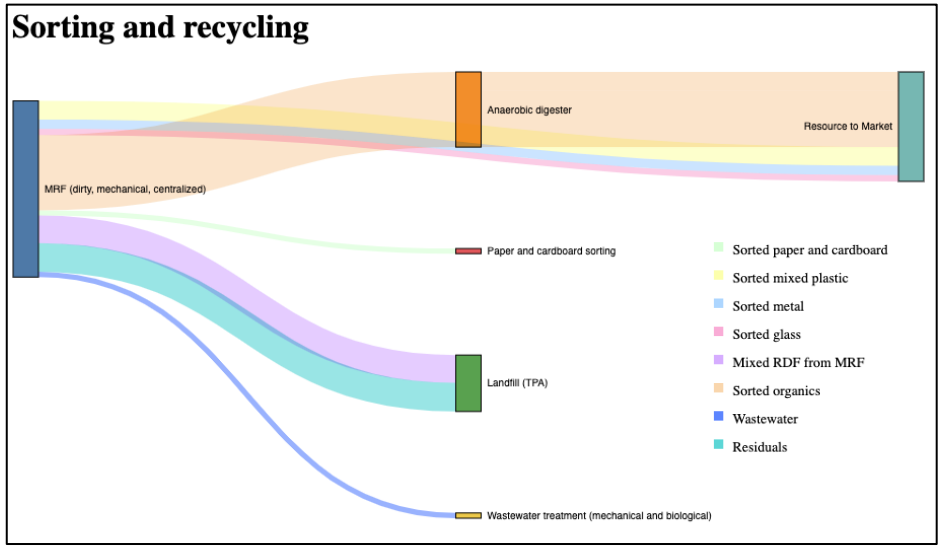
- Mature technologies and infrastructure exist for managing waste
- Able to recover materials and energy with monetary and environmental value

Planning

- Governments are responsible for planning waste management systems/infrastructure
- Lack skills/capacity to rapidly assess options to address a complex problem

Introduction to the ADB WARPS Tool





What is the ADB WARPS Tool?

- Waste Analytical Resource Planning Scenarios Tool
- Beta product that runs on Microsoft Excel

What does WARPS do?

- Design and plan waste management system scenarios
- Evaluate performance of each scenario based on environmental, financial, economic, and social indicators.

How do you use WARPS?

- Steps: (1) create a waste profile, (2) select agents to design system, (3) set policy and price conditions, (4) view results, (5) visualize system in a Sankey diagram

Why WARPS?

- Provide decision-support for policy makers and planners with limited to no technical expertise in waste management to compare potential waste management systems
- Not meant to replace a full feasibility study
- Give policy-makers and planners a means of carrying out a pre-feasibility scan by taking a first-cut look at a variety of what-if scenarios for managing waste at different scales

Demonstration of the ADB WARPS Tool

Asian Development Bank Waste Analytical Resource Planning Scenarios Tool (ADB WARPS Tool)

Introduction and Background

Enabling a circular economy requires strategic planning of waste management systems. Such systems should provide environmental, economic, and social benefits, but can be very complex due to the various types of waste streams and options for managing waste at different stages. The Asian Development Bank has developed this excel-based tool to compare potential waste management systems and measure their environment, financial, economic, and social performance. The tool provides users with a means of taking a first-cut look at a variety of what-if scenarios for managing waste at different scales.

Purpose of Tool

ASSIST

policy makers plan out pathways for managing different types of wastes.

EXPLORE

the effects of prices and policies on waste management systems.

QUANTIFY

environmental, economic, financial, and social performance to inform what aspects a future full feasibility study could focus on.

Tool Structure and User Guide

- Step 1: Create waste profile
- Step 2: Select agents to design system
- Step 3: Set policy and price conditions
- Step 4: View results

Color Coding

Values that users can vary.

Values that should be kept fixed.

Home | Step 1 Waste profile | Step 2 Design system | Step 3 Prices and Policies | Step 4&5 Results Dashboard | Summary Report

Indonesia Case Study

Case study description

- City in Indonesia
- Tonnage: 555 tonnes per day

Scenarios analyzed

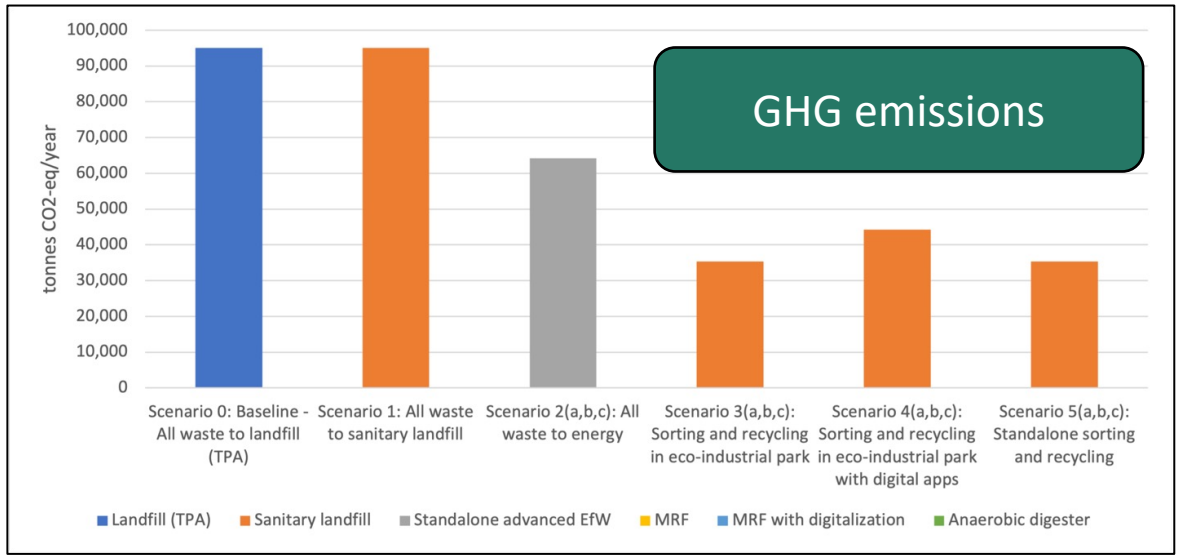
- Systems: Standalone and built in an eco-industrial park
- Technologies: Landfill, incinerator, material recovery facility (MRF), digital apps to promote waste segregation, anaerobic digestion (biogas)
- Price and policy variations: Tipping fees, subsidies, carbon pricing

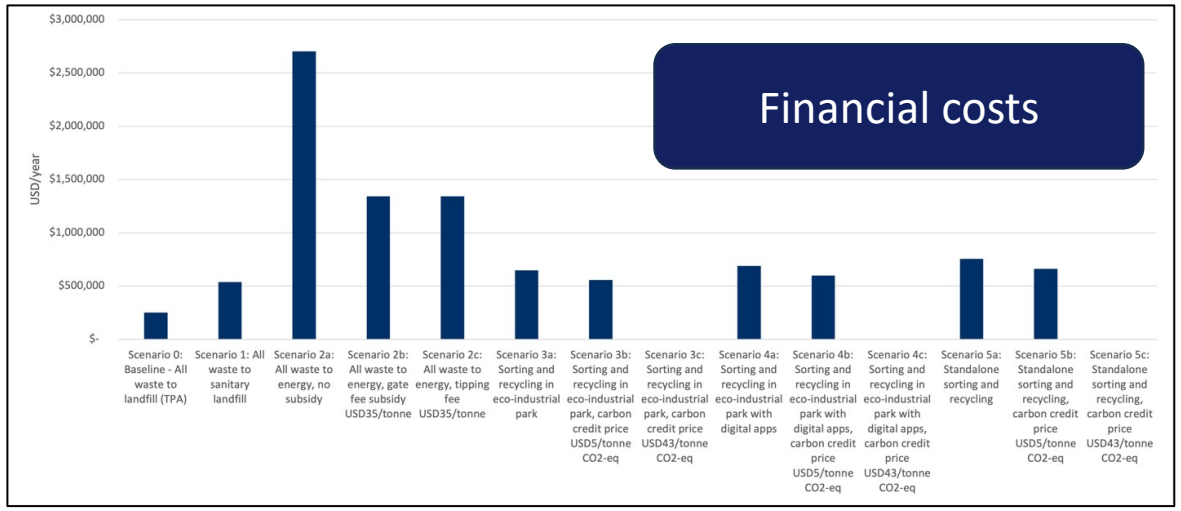
Indicators measured

- Economic: Annual shortfall, new jobs
- Financial: Capital expenses, costs, revenue, net present value
- Environmental: GHGs, NOx, SOx, PM, uPOPs
- Social: Employment opportunities, formal vs informal employment, human health impacts (disability adjusted life years)

Findings

- Beneficial to invest in a waste management system that features sorting and recycling, specifically an MRF and an anaerobic digester.





Cambodia Case Study

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Case study description

- City in Cambodia
- Tonnage: 3,000 tonnes per day

Findings

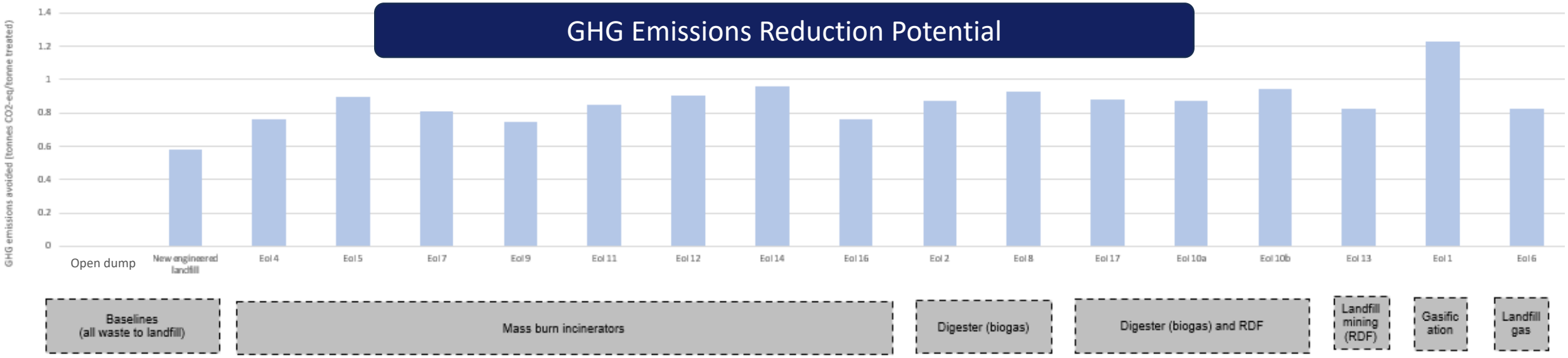
- Higher financial costs on solid waste treatment expenditure results in lower economic costs, where economic costs are largely driven by emissions.

Scenarios analyzed

- Systems: Standalone and combination of multiple technologies
- Technologies: Mass burn incinerators, digester, refuse derived fuel (RDF), landfill mining for RDF, gasification, landfill gas capture
- Price and policy variations: Price of carbon, price of damage to human health

Indicators measured

- Financial: Annual costs to government (gate fees, tipping fees, electricity sales)
- Environmental: GHGs, NOx, SOx, PM, uPOPs
- Economic: Sum of financial costs and economic costs of health based on disability adjusted life years and impacts from GHG emissions



Conclusions and the Way Forward for WARPS

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Achievements to date

- Built a tool that allows governments and other stakeholders to rapidly design waste management systems and evaluate their performance to support decision-making and planning

Next stages of development

- Build up the database further, rollout tool on a web-based platform that offers enhanced analytical functions, resolve domain knowledge gaps for users by applying AI (Waste GPT?)

Application in other sectors

- Apply this agent-based approach for developing infrastructure planning tools for other sectors (e.g. transport, industry) to measure financial performance, decarbonization potential, and other sustainable development indicators of interest

Waste, Energy & Ocean Nexus

Thank You for Your Kind Attention

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ADB Project Officer: Stephen Peters (speters@adb.org)