

International Expert Group Workshop
on Compendium of EST
for Converting Waste Plastics into a Resource

Introduction of EST Compendium for Waste Plastics and Business Model

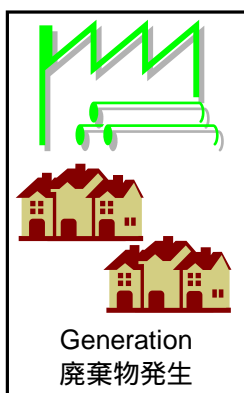
環境上適正な廃プラスチックの 資源化技術と事業モデル

小寺洋一, 独立行政法人 産業技術総合研究所
Yoichi KODERA, National Inst. of Advanced Industrial Science & Technology (AIST)

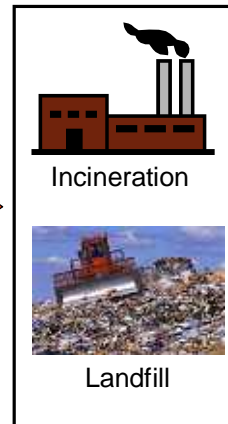
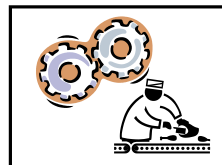
June 15-16, 2009 UNEP Osaka Office



Waste plastics for the people, the better life



Waste service sector

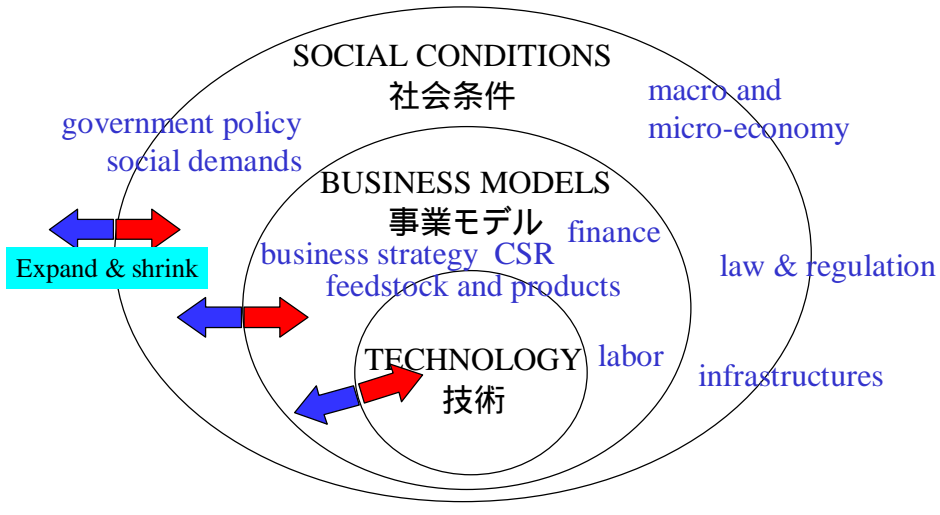


Any optional
way for the
local people or
the country?



Governing factors of technologies 技術を規定する因子

Social conditions and business models define a suitable technology to maximize business profits.
And a new technology will lead a new business, and stimulates social demands.



Contents of Presentation 発表内容

1. Introduction & Environmentally Sound Technologies (ESTs)

環境上適正な技術とは

2. Examples of technologies and the business models

廃プラスチック資源化技術と事業の実例

3. Suitable technologies to transfer to developing countries and the business environments

途上国事情に合致した移転可能な技術の選択の検討要素

Introduction はじめに

- This presentation is a part of keynotes to start the discussion of the ESTs for waste plastics.
 - Increasing demands of waste treatment in developing countries give the higher expenses to waste generators and the heavier cost to waste management sectors.
 - Agenda 21 (1992) and Bali Strategic Plan for Technology Support and Capacity-building (2005) encourage us to introduce environmentally sound technologies (ESTs) to developing countries.
 - Effective technologies and systems are required in order to reduce environmental impacts to the local societies and to reduce the cost for waste treatment.
-
- 本発表は廃プラスチックのためのESTの議論の基調をなす。
 - 廃棄物適正処理の必要性が高くなる中、処理量が増し、発展途上国における社会コストや個々の企業の処理費負担が重くなっていく。
 - アジェンダ21 (1992) および技術支援と技術の受容能力の確立に向けたバリ戦略計画 (2005) のもと、環境上適正な技術の途上国移転が求められている。
 - 環境負荷低減とコスト削減に効果的な技術・システムが求められている。

Environmentally sound technologies (ESTs)

環境上適正な技術 (EST) とは

Defined by Chapter 34 of "Agenda 21"

- ESTs aim to
 - Protect the environment
 - Less polluting
 - Use all resources in a more sustainable manner
 - Recycle more of their wastes and products
 - Handle wastes in a more acceptable manner
 - ESTs are not only individual technologies but also systems.
 - ESTs depend on local conditions.
-
- ESTの目的
 - 環境保護、環境負荷の削減、より持続可能な方法による資源利用、廃棄物や製品の循環利用、より良い手法で廃棄物を処理。
 - ESTは個々の技術ばかりでなく、システムも含む。
 - 地域の社会・経済等の実状に合わせて、ESTは異なる。

UNEP's activities on waste treatment for developing countries
For technology support and capacity-building

•See <http://www.unep.or.jp/ietc/spc/publications.asp>

途上国のための廃棄物処理分野でのUNEPの貢献
—技術の支援と事業能力・機能の確立のために—

- Fundamental platform 基盤調査研究
Building a concept and definition of ESTs EST概念・定義
- International cooperation 国際協力
3R-Platform 3Rプラットフォーム
International support to developing countries 途上国援助
- Guidelines for practitioners 実務者向け廃棄物ガイドライン
Integrated solid waste management 複合廃棄物処理
E-Waste treatment 廃電気電子機器処理
Biomass conversion バイオマス資源化
Waste plastics conversion into fuel 廃プラスチック燃料化

Purpose of Waste Plastics Treatment
廃棄物処理および廃プラスチック資源化の目的

- A. Minimize waste volume to prolong the life of a landfill site.
 - B. Protect public sanitation by suitable treatment.
 - C. Obtain economic benefits by material recovery.
 - D. Save resources and energy.
 - Metal, glass and plastics
-
- A. 廃棄物の減容
 - B. 公衆衛生の保全
 - C. 資源回収による利益獲得
 - D. 省資源、省エネルギー
 - 金属、ガラス、プラスチック (PETボトル、その他)

Contents of Presentation 発表内容

1. Introduction & Environmentally Sound Technologies (ESTs)

環境上適正な技術とは

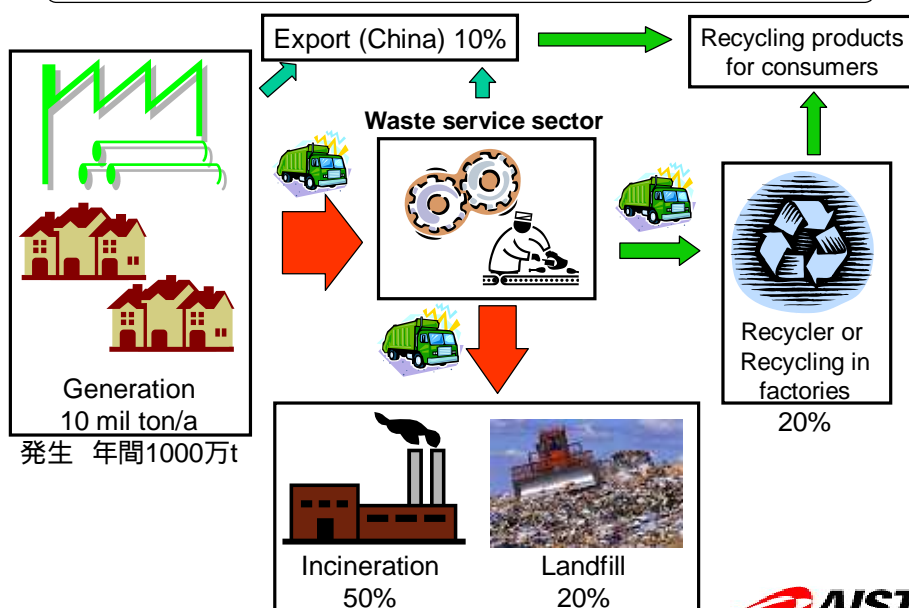
2. Examples of technologies and the business models

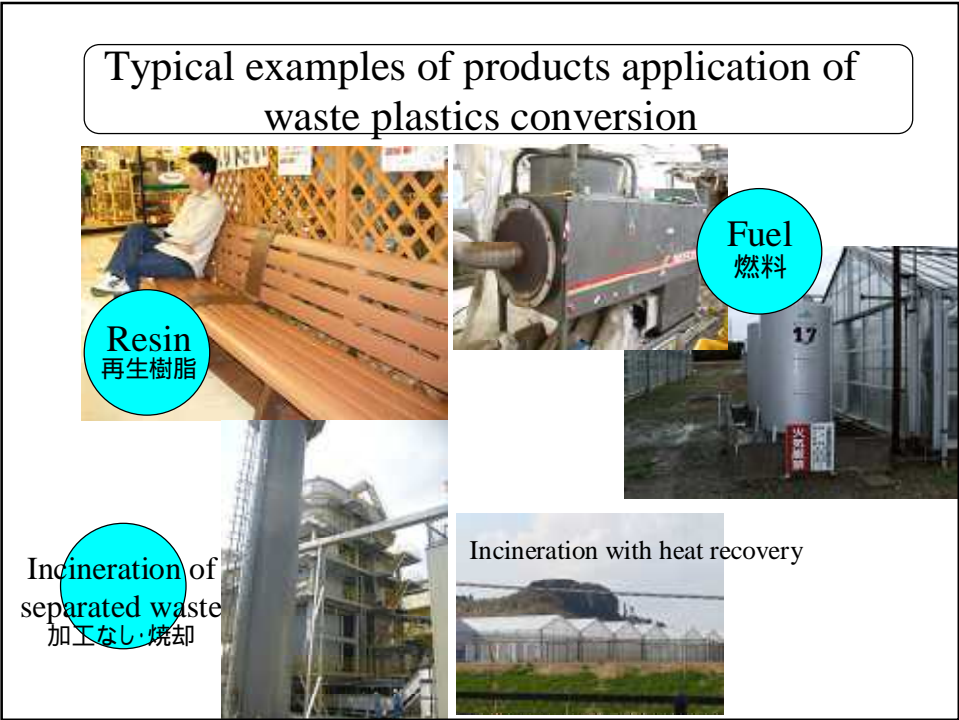
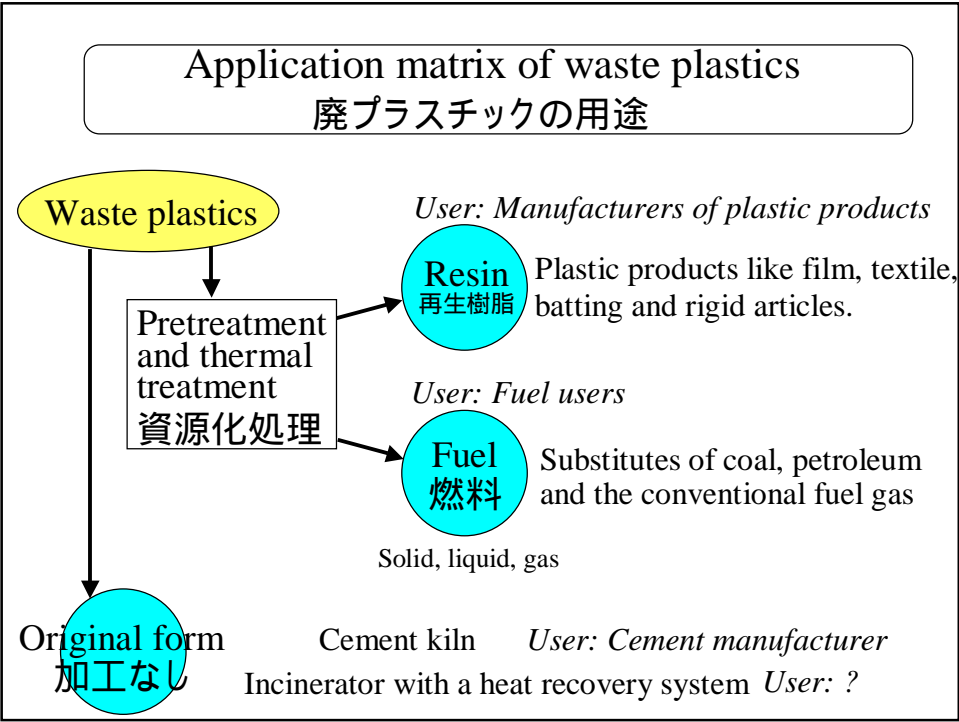
廃プラスチック資源化技術と事業の実例

3. Suitable technologies to transfer to developing countries and the business environments

途上国事情に合致した移転可能な技術の選択の検討要素

Macro-flow of waste plastics in Japan





Recycled resin/fiber and its products in China




-China is a typical industrial center of mechanical recycling in the far east. Various types of waste plastics are imported to produce recycled products rather than plastics-derived fuel.


-“Clean waste plastics” are converted into plastic bag, rigid products and textile products.



Pretreatment for producing plastic flakes from fluffy wastes.

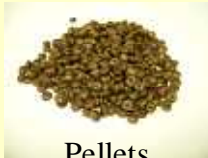


Extruder 2軸押出機




Recycling Products

Recycled pellets, molded products, textile, and nonwoven fabric are prepared from waste plastics.



Pellets

Sheet and molded products



Nonwoven fabric

Waste plastics: High combustion heat
廃プラスチック: 高い燃焼熱に特徴

Table Features of typical components in wastes

Components ごみ成分	Heat of combustion 燃焼熱量 kcal/kg	Typical recycling products 代表的なりサイクル製品
Plastics	11000 (Polyethylene) 9600 (Polystyrene) 4300 (PVC)	Recycled resin. Solid fuel, liquid fuel : Conversion products also have high heat of combustion.
Biomass (paper, wood, food, excrement)	4300 (dry) 1010 (moisture 35%) 120 (moisture 80%)	Recycled paper (paper & wood), compost, methane by fermentation (food & excrement)
Metal	0	Metal ingot
Glass	0	Glass products

Solid fuel production, 3 ton/day, in Japan

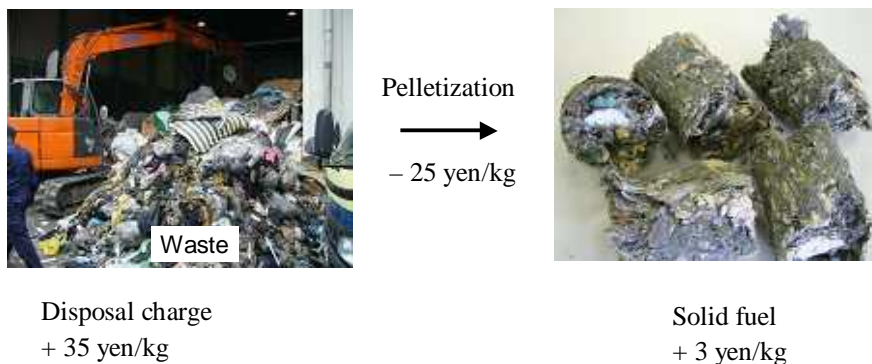


Whole image of a production facility: Crusher, Conveyer, Twin-screw pelletizer.
Wastes are brought from manufacturing factories.

Waste

Solid fuel

Driving force for business



User's merit : Coal 5 to 10 vs 3 yen/kg

Recycler : $35+3-25 = 13$ yen/kg

AIST's research: Proposal of new solid fuel

Cross-Linked PE: Non-thermoplastics



*No recycling application
Direct combustion; difficulties in handling
In transportation, storage, and feeding to a boiler.*



Sawdust



New Clean Solid fuel

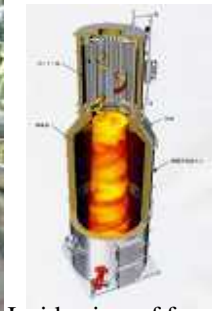
Expecting the higher commercial values than the conventional solid fuel.

Studies on Pellet Preparation

Using an extruder



New pellet boiler is under development
-Greenhouse cultivation for melons-



Inside view of furnace and heat exchanger

Hopper



Furnace & heat exchanger

Cyclone for ash removal

Liquid fuel production, 2x3 ton/day, in Japan

Environment System Co.,Ltd. in the compendium.

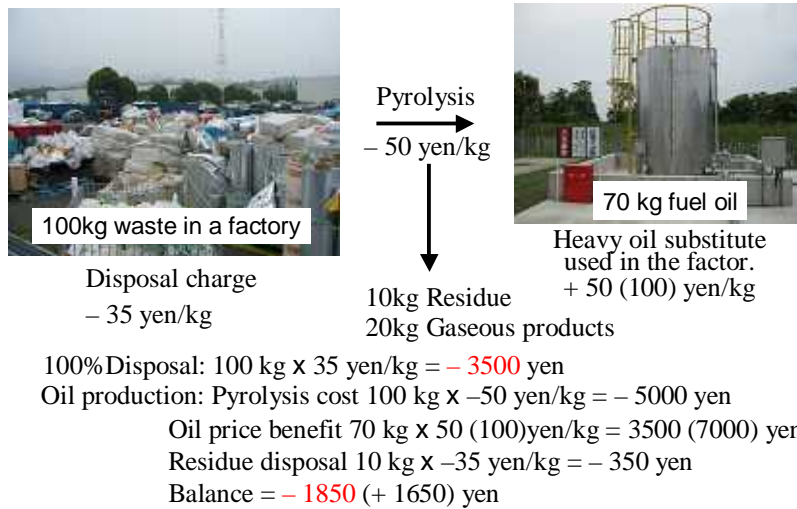


Waste plastics in a factory a packaging manufacturer



Liquid fuel production plant in a waste generation site

Driving force for business



1650 (5150) yen benefits to 100% disposal.

Liquid fuel production, 2x3 ton/day, in Japan

Mogami-Kiko Co.,Ltd. in the compendium.



Liquid fuel production, 20 ton/day, in Japan



Table Types of fuel considering user application

User application	Fuel type	Major feedstock	Conversion method
Heat 熱回収			
Boiler/heater	Solid(RDF) (RPF)	Mixture of combustible wastes Mixture without food residue	Pelletization, dehydration Pelletization
	Liquid (hydrocarbons)	Plastics	Thermal decomposition
Steel production	Solid	Mixture of combustible wastes	Pelletization
Incinerator with heat recovery	Original form of waste	Combustible wastes mixture	None (simple sorting only)
Electricity 発電			
Diesel engine	Liquid (hydrocarbons)	Plastics	Thermal decomposition
Transport 車両燃料			
Diesel/Gasoline engine	Liquid (hydrocarbons)	Plastics	Thermal decomposition

Contents of Presentation 発表内容

1. Introduction & Environmentally Sound Technologies (ESTs)

環境上適正な技術とは

2. Examples of technologies and the business models

廃プラスチック資源化技術と事業の実例

3. Suitable technologies to transfer to developing countries and the business environments

途上国事情に合致した移転可能な技術の選択の検討要素

Choice of conversion method of waste plastics



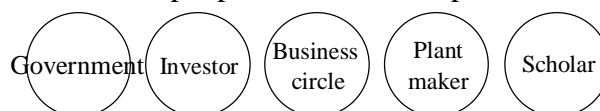
Type of Business and business-governing factors 廃プラスチック処理・資源化事業例と事業の支配因子

Waste-oriented Business 手元の廃棄物処理を優先する事業	Technology-oriented business 技術的優位性を生かした事業	Product-oriented business 製品の市場価値を生かした事業
Waste 廃棄物	Technology 技術	Product 製品
<div style="border: 1px solid black; padding: 2px;"> Composition Generation rate Source location/logistics Fluctuation/Changes </div>	<div style="border: 1px solid black; padding: 2px;"> Target material Type of product Production efficiency Cost </div>	<div style="border: 1px solid black; padding: 2px;"> Market value (Quality, Price, Number of users) Competitive product </div>
組成、発生量、発生元、輸送、およびその変動	対象物、製品、処理・生産効率、コスト	製品の市場価値(品質、価格、ユーザー数)

A business planner or administrator will consider type of business, considering the governing factors above and the type of business player, e.g., a public service or private business, operation inside manufacturing factory or in waste management sector.

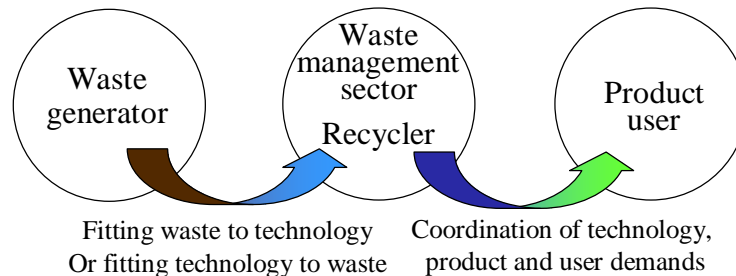
公共サービスか私企業の産廃事業、工場内廃棄物処理か産廃事業者、といった事業の性格が処理・資源化の事業計画に関わる。

Difficulties in the promotion of waste plastics conversion into raw material and fuel - Different people, different viewpoints -



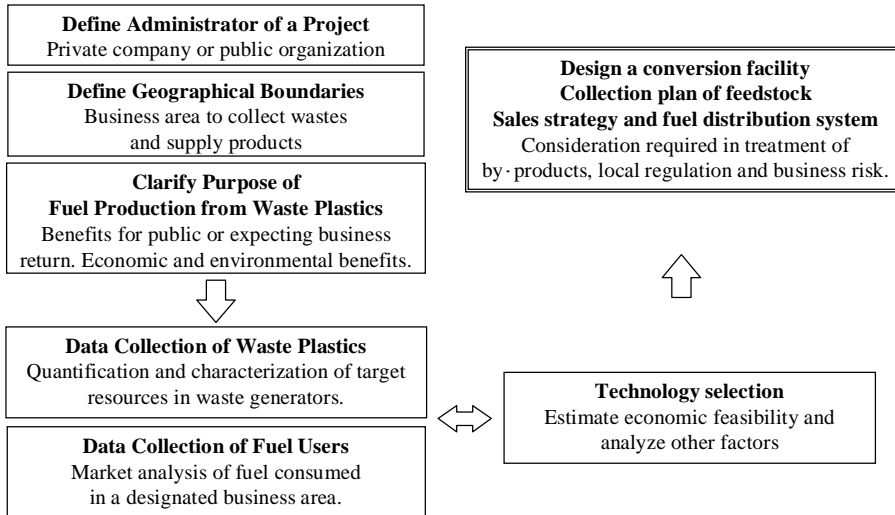
Rationality of waste-to-resource business

Economic feasibility and environmental soundness
with social demands or user's benefits



Business planning strategy for waste conversion

Example



Choice of waste conversion method 廃プラスチック資源化手法の選択

1) Waste generation
廃棄物発生の特徴

2) Product application
ユーザーニーズ

Thermoplastics
熱可塑性プラスチック単一

Mixed/composite/
Non-thermoplastics
混合/複合/非熱可塑性

3) Technology
技術

Recycled resin
材料リサイクル

Fuel 石炭・石油代替燃料
coal and petroleum substitutes

Incineration with heat recovery
焼却熱回収

4) Energy saving, Environmental impact, Economic feasibility
省エネルギー効果、環境影響(効果)、経済性

Viewpoints as EST for waste plastics conversion

Three Viewpoints of the ESTs for Waste Plastics 環境上適正な廃プラスチック処理・資源化技術の3つの視点

Based on "Methodology for Assessment of Environmentally Sound Technologies" by UNEP-DTIE-IETC

- A. Technological suitability
 - High performance with lesser energy input
 - Sustainability of technical performance
 - B. Environmental soundness
 - Lesser pollution and waste handling in a more acceptable manner
 - C. Economic validity
 - Business profit with lesser capital costs, operation and maintenance costs
-
- A. 技術の適正さ
 - 低エネルギー消費で最大限のプロセス効率と機能維持
 - B. 環境健全性
 - 低環境負荷で、より受容可能な方法で廃棄物を取り扱う
 - C. 事業性
 - 低投資・低維持費で適正な収益、また事業継続性