出國報告（出國類別：國際會議）

參加2024年臺日韓事業廢棄物電子化管理三方交流會議報告

服務機關：環境部資源循環署
姓名職稱：曾志評科長、鄧丕信技正
派赴國家：日本
出國期間：113年9月4日至9月7日
報告日期：113年11月25日

摘要

臺日韓三方交流會議(Tripartite Network Meeting)是一個運行多年且成功及有效的模式，於會議召開前，各國互相討論該年度有興趣或正遭遇問題之議題，取得共識之後再訂定召開主題及議程，本次議題為廢棄物管理政策的發展、廢棄物管理系統現況及過去6年變化等，透過本次交流可針對單一議題深入探討，並了解各國所面對的問題挑戰及因應方式，亦可了解失敗及成功經驗作為借鏡。

參訪位於川崎市的JFE Urban Recycle Corporation，該廠主要進行冷氣、冰箱、洗衣機、電視機及PET塑膠回收工廠，廢家電拆解分為人工拆解和機器破碎分選，先以人工拆解分離金屬及回收冷媒，藉以提升回收利用價值及降低二次污染，最後再破碎分選出各類金屬及塑膠。PET回收廠原料向公益財團法人日本容器包裝回收協會(The Japan Containers and Packaging Recycling Association,簡稱JCPRA)採購，經破碎、分選、清洗、脫水、乾燥等工序，生產出再生PET片，後續再這些PET片將轉化為紡織品、塑膠粒或其他成型產品。

近年日韓積極導入AI技術及新型電子科技（如無人機等），運用系統所蒐集之大數據與外部連結之衛星影像資訊，進行非法廢棄物監控模式之建立，以及以服務為導向之AI客戶服務功能，來提升整體廢棄物管理、稽查及客服技術支援之量能，值得我國繼續朝此國際趨勢前進。

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壹、目的

我國自1997年成立廢棄物管制中心，以電子化申報管理達成廢棄物跨地區移動的流向追蹤，2000年，擴大編組建立專責單位，整體成果為世界各國所學習的對象，世界各國亦多次向我國拜訪請益，其中以日本、韓國，因同樣屬於亞洲鄰國，因此參訪次數最多。近幾年來，日本與韓國急起直追其電子化管理進度與成果已經與我國接近，部分機制與作為亦值得我國參考學習。因此於2012年起，臺、日、韓三國協定每年召開一次技術交流會議，持續保持友好關係以交換意見、互相學習各管理優點。辦理的方式每年輪流由一個國家主辦，2013年由日本主辦、2014年由臺灣主辦、2015年由韓國主辦並完成第一次三國輪辦循環，每年皆有非常具體的管理經驗交流，自2016年起為第二次循環，再次回到日本舉行，2017年由臺灣主辦，本屆三國會議則輪由韓國舉行，由韓國環境協會（K-eco）擔任主辦，也是第二輪會議的最後一年。

今年輪由日本主辦，於會議召開前，各國互相討論該年度有興趣或正遭遇問題之議題，取得共識之後再訂定召開主題及議程，今年度議題為廢棄物管理政策的發展、廢棄物管理系統現況及過去6年變化等。

貳、 過程

一、會議出席單位介紹

1. 日本與會單位介紹- The Japan Industrial Waste Information Center公益財團法人日本產業廢棄物處理振興協會。

為非官方的法人機構，負責推動日本產業廢棄物e化管理作業，其法人最初成立時由環境省主責。該單位所發展維護的e化系統需付費使用，故來使用其系統的事業或TSDF亦為其會員。

圖 1、日本交流單位網站-The Japan Industrial Waste Information Center

2. 韓國與會單位介紹- Korea Environment Corporation(KECO) 韓國環境協會

為韓國環保部的附屬法人單位，KECO扮演著全球環境服務提供者的角色，服務的範圍包括氣候、空氣、水、土壤、廢棄物、回收、環境健康，並且支援相關環境工程。來參訪者為其廢棄物管理部門。

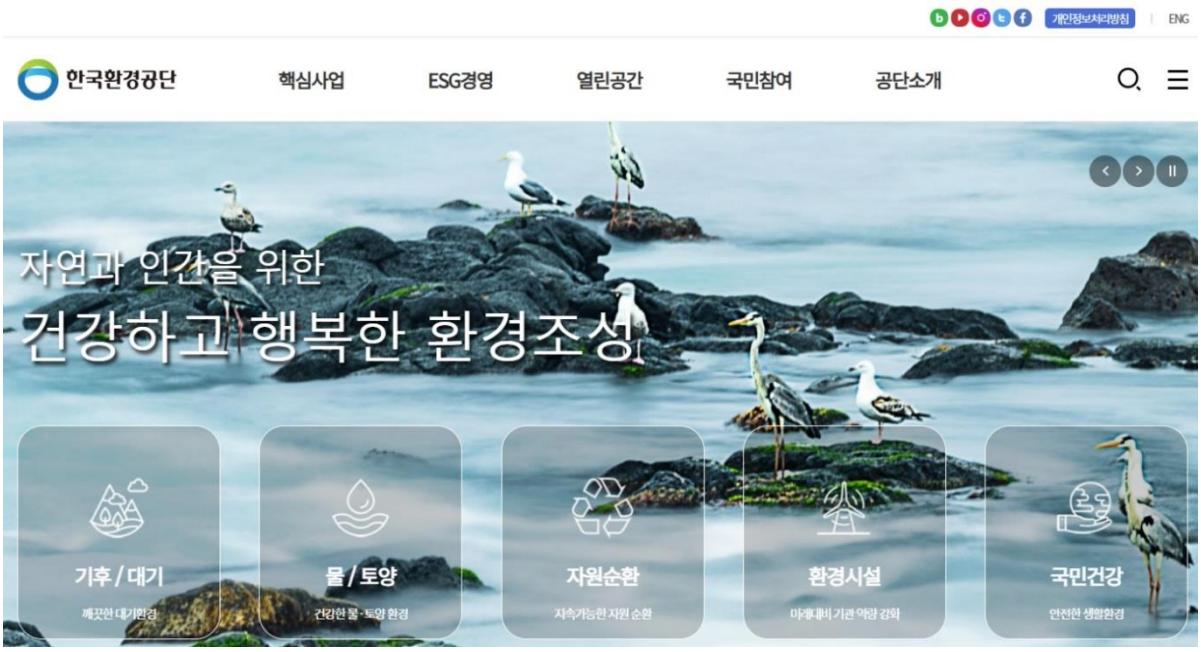


圖 2、韓國交流單位網站- Korea Environment Corporation

3. 臺灣與會人員

本次出席會議成員由環境部資源循環署曾志評科長、鄧丕信技正及幕僚單位環資國際有限公司代表。與會成員與單位如表1所示。

表 1、與會成員與職稱

單位	人員	職稱
環境部資源循環署	曾志評	科長
環境部資源循環署	鄧丕信	技正
環資國際有限公司	黃義芳	董事長
環資國際有限公司	倪雅惠	總經理
環資國際有限公司	陳緯豪	經理

二、 會議地點及議程

本次會議行程自113年9月5日至9月6日，共計2天，議程與內容重點所後

所述，會議地點為公益財團法人日本產業廢棄物處理振興協會會議室位置如圖3，整體會議議程概要列於表2。

圖 3、三國交流會議地點位置圖(JW Center)

表 2、2024年臺日韓三國交流會議(2024 Tripartite Network Meeting)議程

第一天 9月5日(四) , 2024		
時間	內容	講者
9:30~	報到	
10:00~10:30	開幕致詞 (三方代表)	Seki Soichiro (日本 JW 中心) 曾志評科長 (臺灣環境部) Kim,Soon-Ok (韓國 K-eco)
10:30-11:00	(主題一) 日本過去5年廢棄物管理政策的發展	Ms. Izumi Sasaki (日本 JW 中心)
11:10-11:40	(主題一) 臺灣過去5年廢棄物管理政策的發展	曾志評 科長 (臺灣環境部)
11:50-12:20	(主題一) 韓國過去5年廢棄物管理政策的發展	Ms. Han Hye-young (韓國 K-eco)
12:20-13:50	午餐	
13:50-14:20	(主題二) 日本廢棄物管理系統現況及過去5年變化	Mr. Hiroshi Sato (日本 JW 中心)
14:30-15:00	(主題二) 臺灣廢棄物管理系統現況及過去5年變化	倪雅惠 (臺灣環資國際)
15:00~15:20	交流時間	
15:20-15:50	(主題二) 韓國廢棄物管理系統現況及過去5年變化	Ms. Kim Da-young (韓國 K-eco)
16:00-16:10	2025年三國會議辦理方式討論	
16:10-16:20	閉幕	

16:20~	餐敘	
第二天 9月6日 (五) , 2024		
時間	內容	講者
9:10-12:00	參訪行程 J&T 環境株式會社	J&T 講者
12:00-13:00	午餐	

三、 會議情形

有別於過去辦理國際會議方式，常為多項議題，無法深入討論，臺日韓三國交流會議(Tripartite Network Meeting)為一個不同形式的交流方式，茲將本次成果與心得彙整如下，交流情形照片列於圖4~圖9。

圖 4、臺日韓三國交流會議(Tripartite Network Meeting)合照

圖 5、臺日韓三國交流會議(Tripartite Network Meeting) 交流情形1

圖 6、臺日韓三國交流會議(Tripartite Network Meeting) 交流情形2

圖 7、臺日韓三國交流會議(Tripartite Network Meeting) 交流情形3

圖 8、臺日韓三國交流會議(Tripartite Network Meeting) 交流情形4

圖 9、臺日韓三國交流會議(Tripartite Network Meeting) 交流情形5

今年會議主辦方日本有鑑於三國會議中斷數年，規劃交流近6年各國廢棄物管理政策的變化及系統精進的項目與方式，這是一個宏觀且多面向的討論議題，近年來正值我國環保部門組織改造及促進資源循環政策的推動，很感謝JW-Center提出如此重要的議題，讓我們能銜接各國在這中斷聯繫5年間制度及管理方式的演進，讓我們能夠藉此機會，掌握及探討近年的管理變革，也能夠更深入了解各國的資訊管理系統。茲將本次成果彙整如下：

（一）日本推動循環經濟策略

日本近6年廢棄物管理政策的發展，重點在於推動循環經濟的轉型以及實現2050年碳中和的目標。透過相關法律的訂定，及物料的循環研究，期望可提升資源回收及廢棄物管理的作為。

1. 日本第五次循環型社會基本計畫概述：

於令和6年8月（2024年8月），日本發布循環型社會形成推進基本計

畫，將循環經濟納入國家戰略，該計畫係依照「循環型社會形成推進基本法」所制定，目的在推動資源循環並減少環境負擔，建立永續的循環型社會。隨著全球資源需求增加與國際局勢緊張，日本面臨資源供應與需求保障的挑戰，因此推動循環經濟成為應對世界局勢變化及環境問題的關鍵。

(1) 策略與重點方針

計畫提出向循環經濟轉型，包括資源減量、再使用、回收與可再生能源的應用。日本將以創新技術推動資源效率提升，並透過產品生命週期管理減少廢棄物。計畫也強調地區循環系統的建立，促進地方經濟活化和高品質生活，並應對人口老齡化及資源保障問題。

(2) 國際協作與政策創新

日本在國際上推動循環經濟合作，尤其重視與東南亞國家及G7的資源循環政策協作。日本同時加強對企業在資源循環及供應鏈中人權與環境盡職調查的要求，確保全球價值鏈的持續性與可靠性。

(3) 未來展望

通過計畫的實施，日本致力於建構資源有效利用、低環境負荷的社會體系，促進經濟增長和高生活品質，並逐步達成2050年碳中和目標。

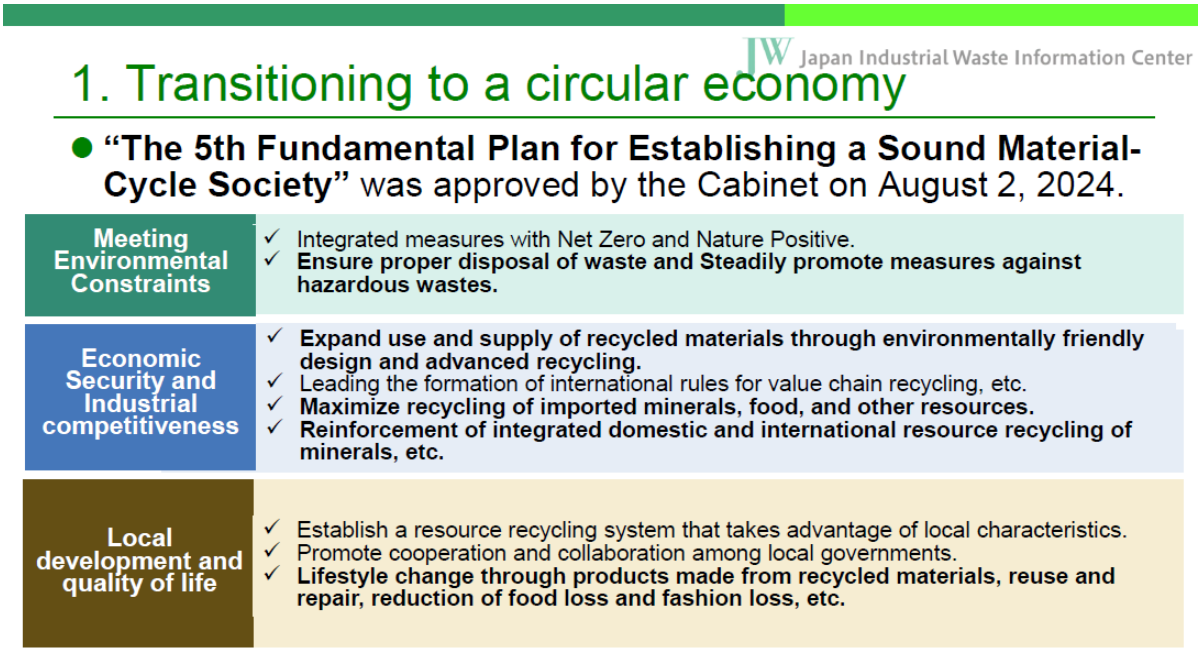


圖 10、日本第五次循環型社會基本計畫概述(1/2)

2. 循環型社會基本計畫的目標：

(1) 訂定2030年的目標為減少使用25%的一次性塑膠，並將回收塑膠使用量增加1倍、推動使用永續航空燃料(SAF)，占日本航空燃料之10%、金屬回收量增加1倍，以及推動建築材料的拆解及回收，並提高建築物壽命。

(2) 研究及推動廢棄物回收，針對畜牧糞便採用厭氧發酵轉廢為能、廢棄食品採用發酵產生飼料及沼氣、廢食用油做為生質柴油，以及運用厭氧發酵處理污泥，及回收磷。

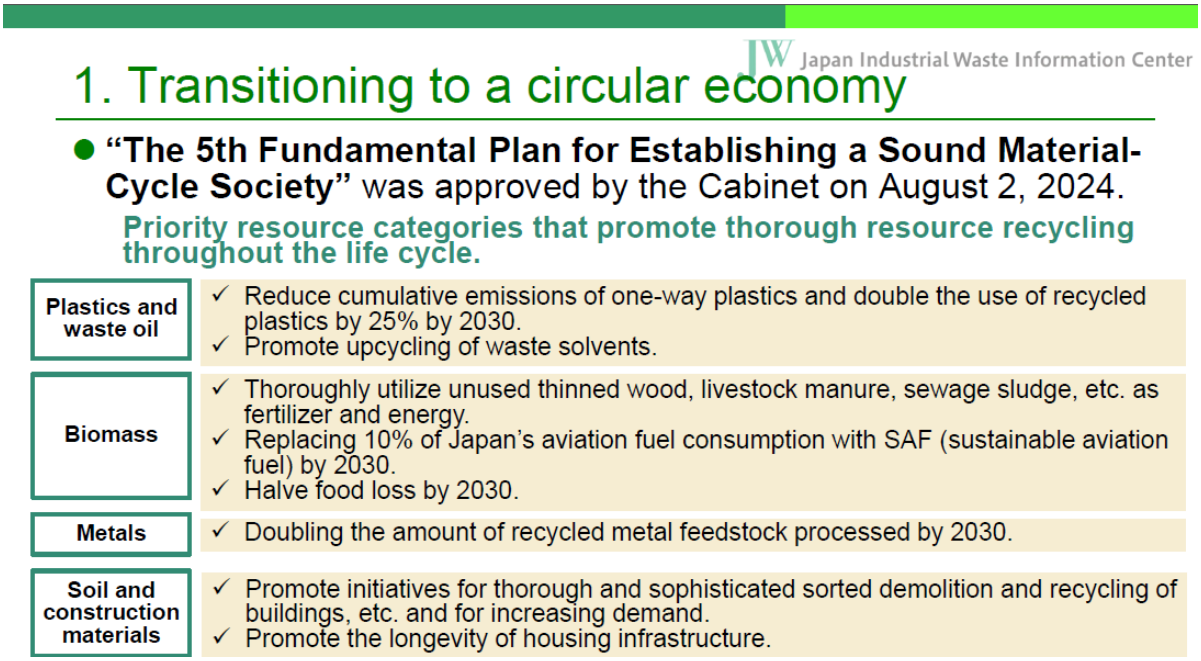


圖 11、日本第五次循環型社會基本計畫概述(2/2)

(3) 頒布新的循環法令，包含塑膠資源循環法(The Plastic Resource Circulation Act, 2022.08)，以3R+Renewable策略，減少、重複使用和回收塑膠，推動日本國內塑膠資源的循環再利用。以及訂定促進資源循環回收法案(Law on Advancement of Recycling Businesses, for Promotion of Resource Recycling ,2024.05)，提升資源回收業水準及強化競爭力。

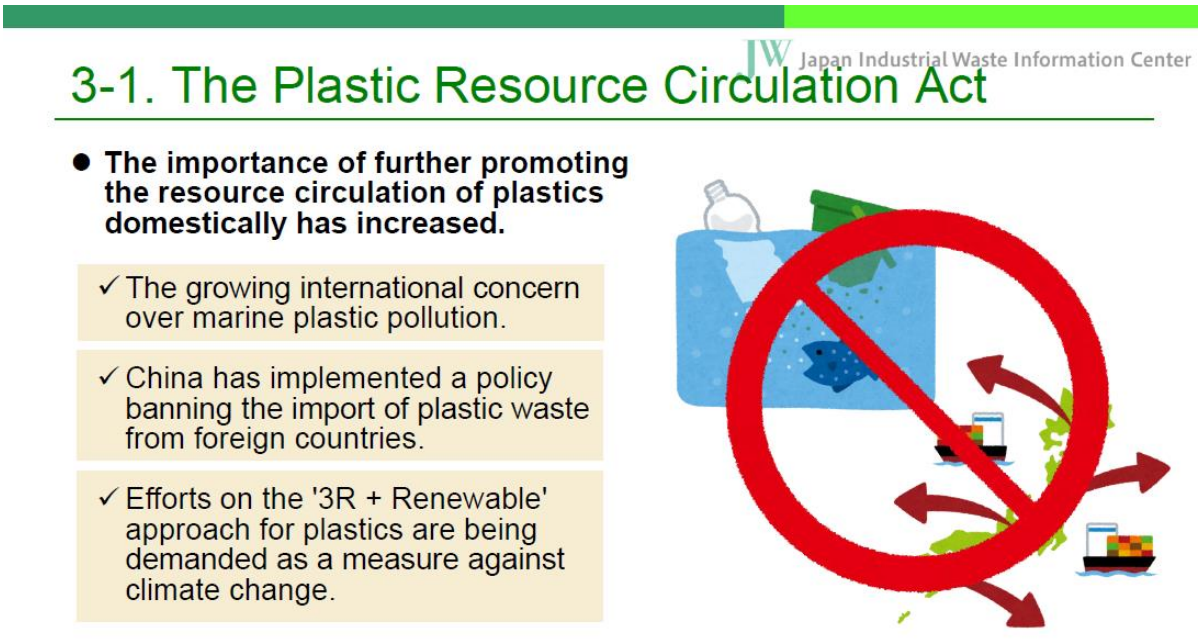


圖 12、日本塑膠資源循環法(1/2)

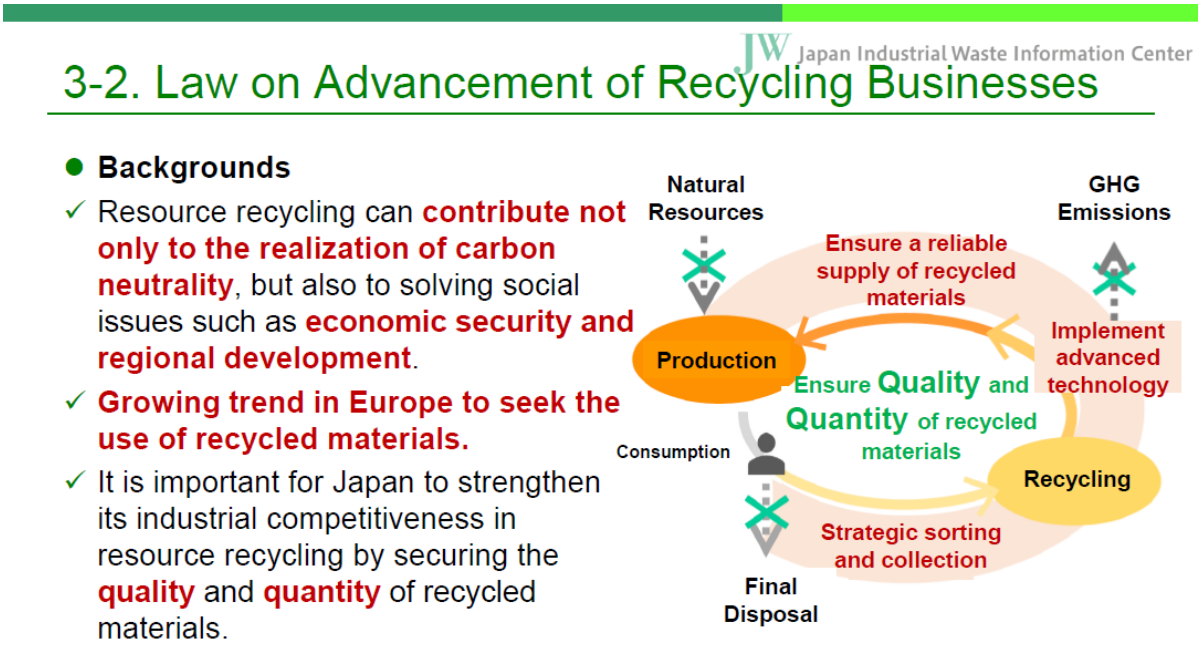


圖 13、日本塑膠資源循環法(2/2)

（二）韓國推動循環經濟策略與管理方法

1.（循環經濟促進法(Enforcement of the Circular Economy Promotion Act)

韓國過去幾年的廢棄棄物管理政策，以源頭減量及提升再利用或能源回收，作為推動資源循環的策略，新政策預計於2025年1月1日推動，主要為訂定綠色設計及源頭減量規範，規定生產者及進口商促進產品循環或維修，以延長物品使用壽命；以及於廢棄物產生後，以最大限度循環再利用，並訂定擴大特殊循環經濟稅收專戶，於廢棄物處理費用及處理設施營運收益徵收，說明如下：

(1) 循環使用評估制度

I. 此制度設立的目的是對產品的可循環性進行全面評估，以促進生產者在產品全生命周期內重視資源的有效使用。

II. 評估標準：

A. 循環材料使用：產品需儘可能使用可循環利用的原材料或環保建

築材料，以減少對自然資源的依賴。

B. 耐用性和修復性：產品應具備較高的耐用性和易於修復的特性，以延長使用壽命，降低資源消耗。

C. 全生命周期的循環性：從生產到分配、消費、到最後的處置階段，產品應具備高循環使用的可能性。

D. 碳排放影響：需考量整個過程中的碳排放量，以減少對氣候的負面影響。

E. 評估週期：韓國環境部決定將循環使用評估的週期從原本的3年延長至5年，以便企業有足夠的時間進行改進。

(2) 循環資源認定制度

I. 鼓勵資源回收，通過認定特定資源為「循環資源」，這些資源將不再被視為廢棄物，從而簡化處理流程。

II. 認定標準：

A. 無害性：循環資源須符合無害性標準，確保在再利用過程中不對環境和健康構成危害。

B. 高附加價值：資源必須具有一定的經濟價值，支持在工業或其他領域的高效利用。

III. 認證流程：經環境部長批准後，這些循環資源將獲得認定，企業可以依法進行再利用，減少監管限制和相關成本。

(3) 循環資源品質認證制度

I. 透過品質認證制度，提升消費者對使用循環資源產品的信心，並鼓勵企業採用符合標準的再生材料。

II. 認證標準：

A. 其他物質含量：循環資源中的其他物質含量須符合一定標準，以確保資源純度。

B. 危險物質含量：嚴格限制危險物質含量，確保產品安全性。

C. 再生材料標準：根據不同的再生材料，設立專門的質量要求，例如金屬、塑膠和紙類等不同類型的資源，都需符合特定的標準。

III. 標識制度：獲得品質認證的循環資源可標示為“使用循環資源的產品”，便於消費者辨識並選擇環保產品。

(4) 新技術/服務的管制豁免

I. 此制度旨在推動創新循環經濟領域，特別針對新技術與新服務的應用。

II. 管制豁免制度：在循環經濟創新技術應用的過程中，允許企業在特定條件下獲得管制豁免，這將加速新技術的落地和試點營運。例如，企業可在此制度下測試新型資源回收技術或服務模式，並在法律規範內嘗試不同的商業模式。

III. 政策支持：通過此制度，韓國政府希望降低新技術的進入門檻，鼓勵企業投入循環經濟創新。

(5) 近期政策進展

I. 執行細則修訂：2024年8月，韓國環境部進一步修訂了施行細則，以加強產品全生命周期的循環使用，並制定相關指標計算方式。前述指標包含資源回收率、循環材料使用率等，便於評估企業在循環經濟中的實際成效。

II. 下位階法規草案：為了全面推動「循環經濟促進法」，韓國環境部發布了5項下位階法規草案，詳細規定了循環資源的認證程序、危險物質的控制標準等，以利企業更易於遵循法規。

(6) 未來展望

I. 強化循環經濟目標：韓國將進一步推動政策創新，以實現資源循環效率的提升和可持續發展。透過新技術的推廣、制度的完善和

社會意識的提高，讓韓國在循環經濟領域成為全球領先國家。

II. 推廣綠色消費：規劃透過標識、品質認證等機制，鼓勵消費者選擇使用再生資源的產品，藉以形成市場需求，推動循環經濟的長期發展。

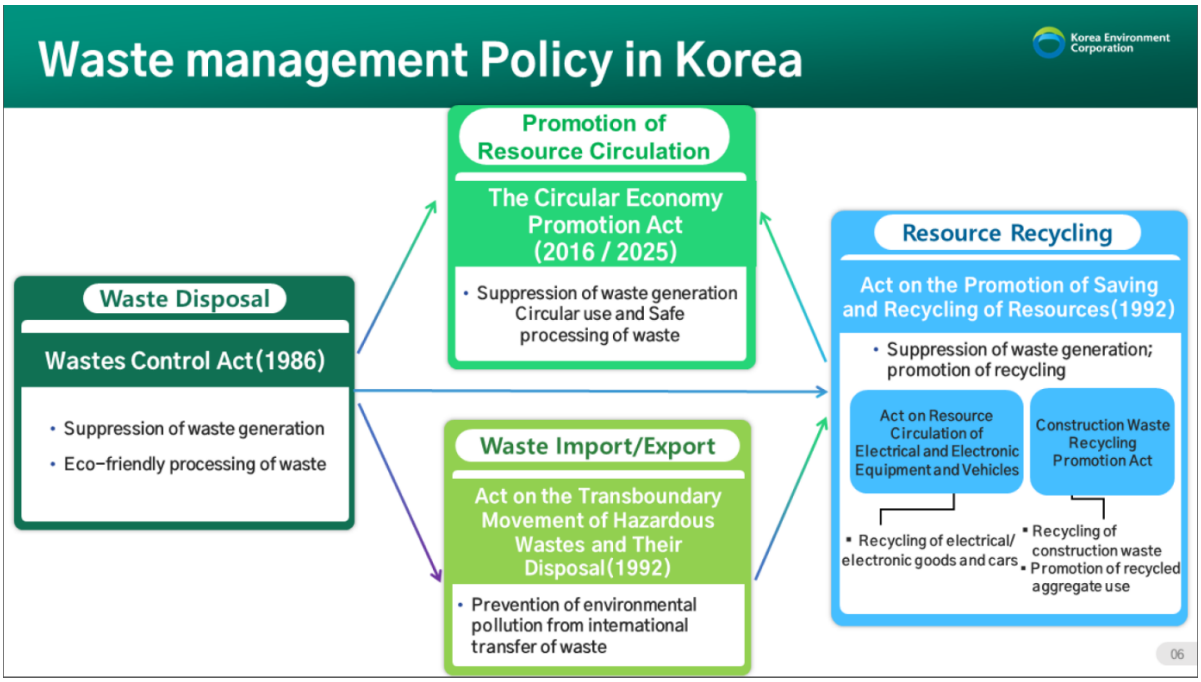


圖 14、韓國廢棄管理法規演進

（三）韓國廢棄物管理資訊系統發展

1. 廢棄物管理系統(Allbaro)

韓國自自2007年起發展廢棄物管理系統(Allbaro)，目前列管對象約為430,000家，如同我國事業廢棄物申報及管理資訊系統，透過網路管理事業廢棄物清運過程，並於2020年擴大列管廢棄物處理者及回收者，利用無線射頻辨識(RFID)管理醫療廢棄物之清理流程，早期Allbaro僅運用電子聯單管理廢棄物，2022年起導入即時追蹤系統（GPS設備、處理廠CCTV及重量監測）。此外運用該系統，韓國依循巴塞爾公約及

OECD，規範廢棄物進行廢棄物進出口管理措施，除了進出口管理巴塞爾公約規範之88項有害廢棄物，亦加強管理許可清單以外之26項廢棄物，相關功能如下所述。

(1) 廢棄物清運流向資訊管理

A. 全程追蹤：廢棄物從產源到最終處理的每個步驟均需上傳至Allbaro系統。系統要求產源、清除者和處理者需連線申報廢棄物的即時流向資訊，並通過RFID技術來遞送過程，以確保透明化。

B. 即時管理：事業廢棄物的清運過程，可透過行動應用程式進行監控，提供即時更新和追蹤，有助於預防非法棄置行為。

(2) 廢棄物處理證書的電子化

A. 電子聯單與妥善處理文件：系統取代了傳統紙本申報的流程，事業在廢棄物產生或處理時逕行向系統報告，並自動生成相關文件。

B. 管制作業：所有的文件均記錄於系統中，方便環保機關即時查核。

(3) 輸出入申報管理

A. 連線申報：輸出入廢棄物之公司可在系統上申報進出口申報，簡化了繁瑣的手續。申報資料上傳後由環境部進行審核。

B. 減少企業負擔：線上申報功能節省企業前往行政機構辦理的流程，有效減少了時間與人力成本。

(4) 統計數據分析

A. 數據分析與政策制定：大數據分析，有助於韓國內廢棄物管理的統計分析，幫助政府了解廢棄物產生及處理的現狀，從而制定更精準的廢棄物管理政策。

B. 違法行為分析：系統自動分析各種廢棄物數據，並對異常情況提出警示，有效提高對廢棄物非法行為的監控強度。

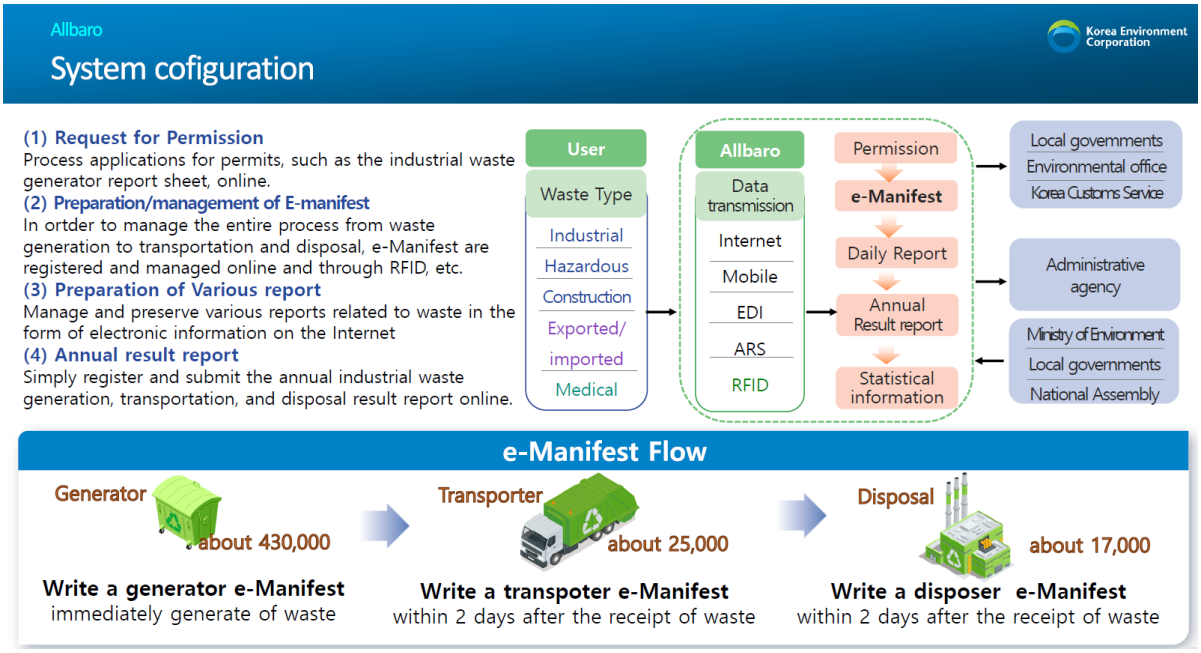


圖 15、Allbaro 系統概述(1/2)

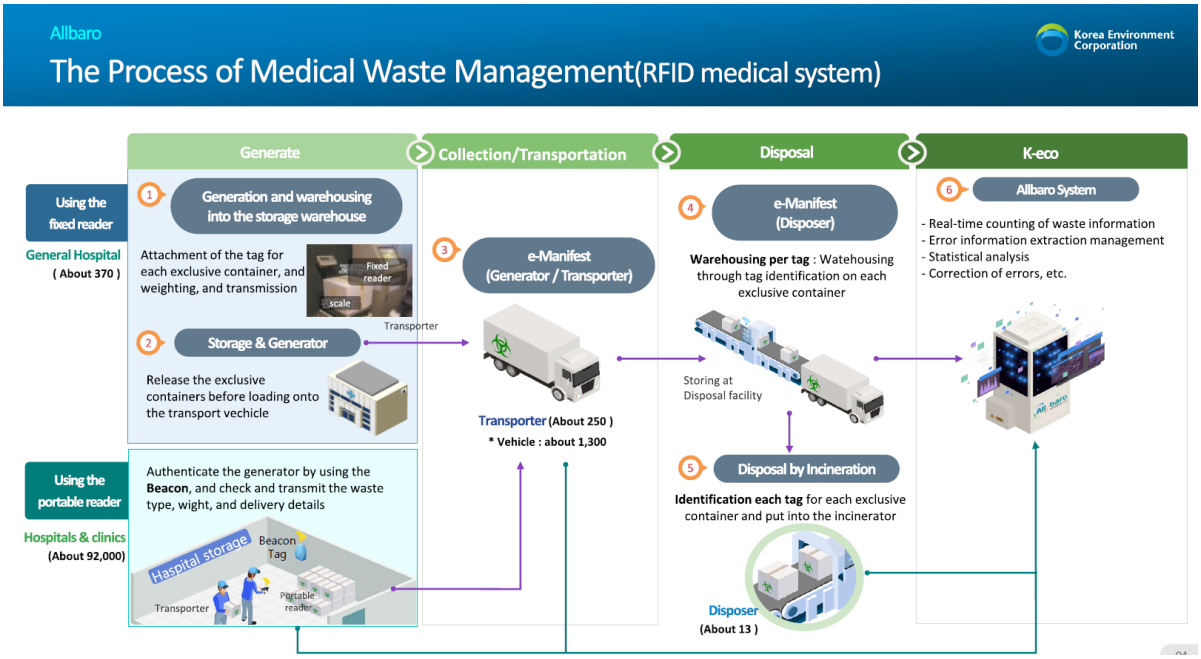


圖 16、Allbaro 系統概述(2/2)

2. 即時監控系統(Srien)

韓國於2022年推動即時廢棄物監控管理，如同我國管理機制，由產源Allbaro系統申報聯單，清除者車輛安裝GPS設備，處理者安裝

CCTV監控（包含進場、過磅及貯存區），確保廢棄物的運輸和處理過程完全透明化。

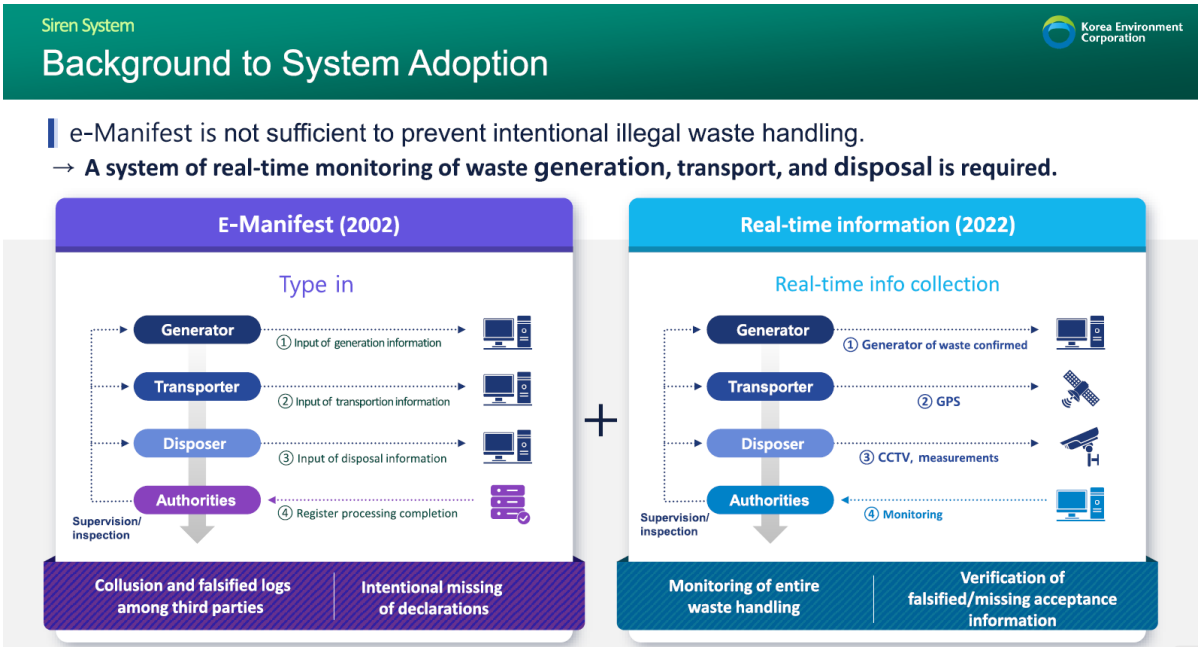


圖 17、Srien 系統概述(1/3)

圖 18、Srien 系統概述(2/3)

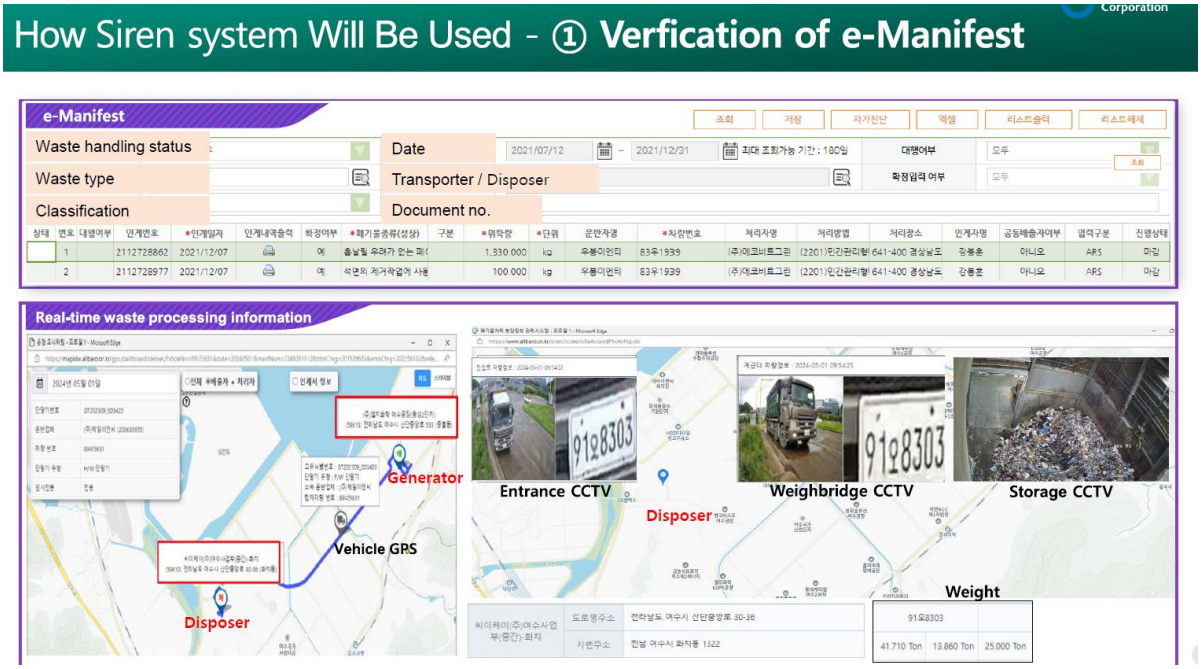


圖 19、Srien 系統概述(3/3)

3. 韓國非法棄置監控方法

近年來人工智慧及無人機的普及，利用相關技術建立非法廢棄物監控系統，運用大數據（包含聯單及貯存短漏申報、清運軌跡異常與疑似違規者）分析建置廢棄物異常檢測模型；以及透過衛星影像輔以無人機，進行空中監控非法棄置活動，提升整體查核效率（7小時縮短為1小時）。

圖 20、韓國以無人機追蹤非法棄置場址

4. 運用生成式AI輔助客服

韓國的廢棄物諮詢團隊共計12名客服人員，每年服務250,000通諮詢電話，為了解決人力短缺問題，韓國導入AI模型進行廢棄物管理客服支援，運用生成式AI，提供107種申報及法律問題類型之諮詢服務，以提升每年服務43萬客戶（25萬通電話/年）之回復效率。

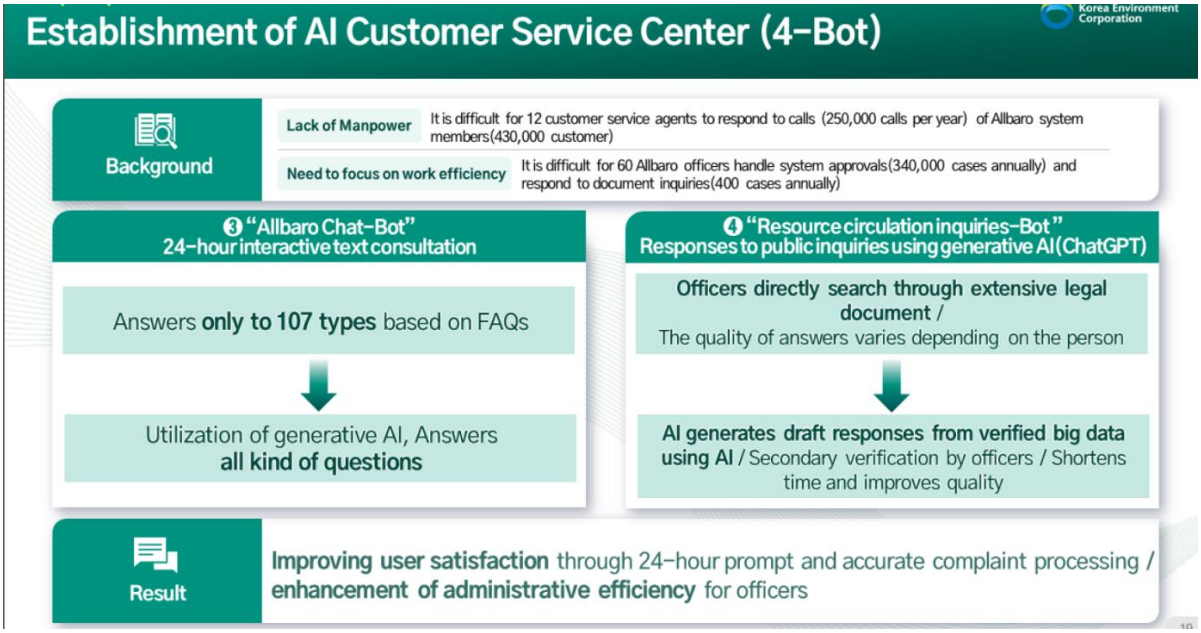


圖 21、生成式 AI 輔助客服功能

（四）參訪JFE Urban Recycle Corporation

本次日方安排參訪位於川崎市的JFE Urban Recycle Corporation。該廠主要進行冷氣、冰箱、洗衣機、電視機及PET塑膠回收工廠。

該廠廢家電拆解分為人工拆解和機器破碎分選，先以人工拆解分離金屬及回收冷媒，藉以提升回收利用價值及降低二次污染，最後再破碎分選出各類金屬及塑膠。該廠特別以機械手臂導入辨別式AI，協助分類不同廠牌之廢家電，加速人工拆解作業流程。

依據其提供之數據顯示，2023年該廠回收之冷氣再資源化率為99%，再商品化率94%；液晶螢幕再資源化率為90%，再商品化率90%；冰箱再資源化率為98%，再商品化率77%；洗衣機再資源化率為95%，再商品化率92%。[註1]

PET回收廠與臺灣回收流程相似，原料向公益財團法人日本容器包裝回收協會(The Japan Containers and Packaging Recycling Association,簡稱JCPRA)採購，經破碎、分選、清洗、脫水、乾燥等工序，生產出再生PET片 。後續再這些PET片將轉化為紡織品、塑膠粒或其他成型產品。

日本目前法令允許回收塑膠可用於食品包裝材料，如雞蛋盒或食物盤等等，於市面上亦有大量使用回收塑膠製程之食物托盤及食物餐盤。延伸搜尋資料得知，日本PET 瓶回收委員會(The Council for PET Bottle Recycling)推動，廢棄寶特瓶於2030年可100%有效利用，且期望於2030年實現寶特瓶B to B使用再生塑膠的比率提升至50%。

[1] 再資源化率：回收資源的百分比。
再商品化率：回收處理廢家電，轉移至可用零件或原料之比率。

圖 22、JFE Urban Recycle Corporation 簡介

圖 23、JFE Urban Recycle Corporation 回收物質組成介紹

圖 24、JFE Urban Recycle Corporation 運作狀況(1/2)

圖 25、JFE Urban Recycle Corporation 運作狀況(2/2)

圖 26、日本回收塑膠運用於食品容器案例(住宿飯店)

參、 心得與建議

（一）韓國近年積極導入AI技術及新型電子科技（如無人機等），運用系統所蒐集之大數據與外部連結之衛星影像資訊，進行非法廢棄物監控模式之建立，以及以服務為導向之AI客戶服務功能，來提升整體廢棄物管理、稽查及客服技術支援之量能，於現今人力缺乏，且智慧化蓬勃發展的時代，可作為借鏡，積極發展我國廢棄物管理、服務智慧化工具，本署亦正推動廢棄物申報及相關證明文件電子化、導入運用生成式AI輔助客服等工作，藉由與韓國交流過程瞭解辦理情形，值得本署後續推動規劃參考。

（二）日本於2024年8月發布第五次循環型社會形成推進基本計畫，將循環經濟納入國家戰略，推動資源循環並減少環境負擔，建立永續的循環型社會，環境部成立資源循環署亦朝推動資源循環方向前進，計畫策略與重點方針內容值得本署作為參考。

（三）韓國過去幾年的廢棄棄物管理政策，以源頭減量及提升再利用或能源回收，作為推動資源循環的策略，主要為訂定綠色設計及源頭減量規範，規定生產者及進口商促進產品循環或維修，以延長物品使用壽命，與我國管理政策方向相似，訂定內容值得本署作為參考。

（四）本次參訪日本PET回收廠與臺灣回收流程相似，日本目前法令允許回收塑膠可用於食品包裝材料，如雞蛋盒或食物盤等等，本次住宿飯店亦有提供100%回收PET製成之食物盤及托盤，顯見當地業者及民眾亦可接受使用再生塑膠產品，可作為塑膠回收推動參考。

（五）有別於其他國際會議辦理方式，通常為多項議題同時進行討論，其討論深度有限，且無法深入了解各自內涵。而臺日韓三國交流會議(Tripartite Network Meeting)是一個運行多年且成功及有效的模式，於會議召開前，各國互相討論該年度有興趣或正遭遇問題之議題，取得共識之後再訂定召開主題及議程，此種作業模式可針對單一議題深入探討，並了解各國所

面對的問題挑戰及因應方式，亦可了解失敗及成功經驗作為借鏡，建議持續進行交流深化，維持友誼交流讓亞洲三國之廢棄物管理繼續向前。

肆、 聯繫窗口

茲將本次參訪的聯繫窗口與資料彙整於表3。

表 3、本次會議與會人員名冊

代表	姓名	單位及職稱
臺灣	曾志評	環境部資源循環署/科長
	鄧丕信	環境部資源循環署/技正
	黃義芳	環資國際有限公司/董事長
	倪雅惠	環資國際有限公司/總經理
	陳緯豪	環資國際有限公司/經理
日本	Seki, Soichiro	日本公益財團法人-產業廢棄物處理振興協會 JW Center/ President
	Junso, Miyahara	日本公益財團法人-產業廢棄物處理振興協會 JW Center/ Managing Director
	Kasai, Satoshi	日本公益財團法人-產業廢棄物處理振興協會 JW Center/ Executive Director
	Sato, Hiroshi	日本公益財團法人-產業廢棄物處理振興協會 JW Center/ Executive Director
	Suga, Hiroko	日本公益財團法人-產業廢棄物處理振興協會 JW Center/ Secretary General
	Tsurushima, Toru	日本公益財團法人-產業廢棄物處理振興協會 JW Center/ Director
	Hamada, Yoshihisa	日本公益財團法人-產業廢棄物處理振興協會 JW Center/ Duputy Director
	Sasaki, Motoki	日本公益財團法人-產業廢棄物處理振興協會 JW Center/ Chief
	Yamamoto, Chiaki	日本公益財團法人-產業廢棄物處理振興協會 JW Center/ Assistant Chief
	Miyazaki, Naotaka	日本公益財團法人-產業廢棄物處理振興協會 JW Center/ Assistant Chief
	Nakanishi, Atsumi	日本公益財團法人-產業廢棄物處理振興協會 JW Center/ Staff
	Sasaki, Izumi	日本公益財團法人-產業廢棄物處理振興協會 JW Center/ Staff

代表	姓名	單位及職稱
韓國	Kim,Soon-ok	韓國環境協會 K-eco/ Director
	Han, Haeng-seok	韓國環境協會 K-eco/ General Manager
	Han, Hye-young	韓國環境協會 K-eco/ Duputy General Manager
	Lee, Seong-han	韓國環境協會 K-eco/ Assistant Manager
	Kim, Da-young	韓國環境協會 K-eco/ Assistant Manager
	Byun, Yu-jeong	韓國環境協會 K-eco/ Staff
	Kim, Ho-june	Interpreter

附件

JW Japan Industrial Waste Information Center

Development of Waste Management policies over the past 6 years

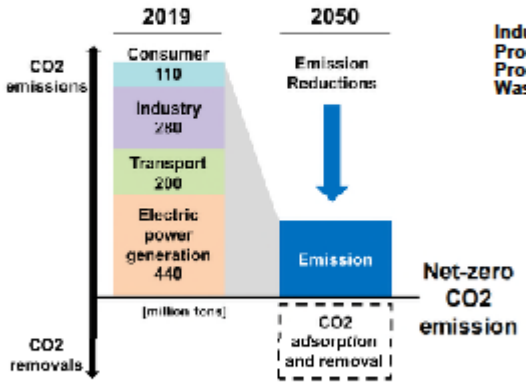
September 5, 2024

Izumi SASAKI
Research and Survey Division
Japan Industrial Waste Information Center, Japan

JW Japan Industrial Waste Information Center

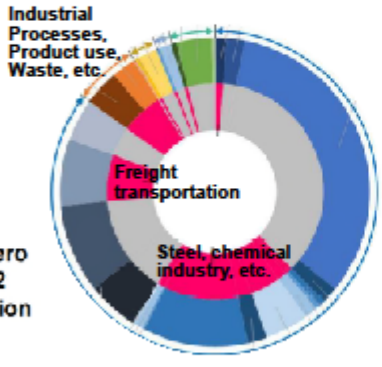
1. Transitioning to a circular economy

- Japan declared its goal of achieving carbon neutrality by 2050.



GHG (greenhouse gas) emissions generated in 2019 in Japan and GHG reduction targets for 2050[1)]

Figure based on "Japan's ENERGY (2022 EDITION)"(2022).



The total GHG emissions by Industry Sector in Japan (FY2019)

Ministry of the Environment, https://www.env.go.jp/content/000071596.pdf

Of the total GHG emissions in Japan, it is estimated that **36%** comes from sectors where **there is potential to contribute to emission reductions through resource circulation.**

1

Japan Industrial Waste Information Center

1. Transitioning to a circular economy

- **"The 5th Fundamental Plan for Establishing a Sound Material-Cycle Society"** was approved by the Cabinet on August 2, 2024.

Meeting Environmental Constraints	✔ Integrated measures with Net Zero and Nature Positive. ✔ **Ensure proper disposal of waste and Steadily promote measures against hazardous wastes.**
Economic Security and Industrial competitiveness	✔ **Expand use and supply of recycled materials through environmentally friendly design and advanced recycling.** ✔ Leading the formation of international rules for value chain recycling, etc. ✔ **Maximize recycling of imported minerals, food, and other resources.** ✔ **Reinforcement of integrated domestic and international resource recycling of minerals, etc.**
Local development and quality of life	✔ Establish a resource recycling system that takes advantage of local characteristics. ✔ Promote cooperation and collaboration among local governments. ✔ **Lifestyle change through products made from recycled materials, reuse and repair, reduction of food loss and fashion loss, etc.**

Ministry of the Environment,, https://www.env.go.jp/content/000243000.pdf

2

Japan Industrial Waste Information Center

1. Transitioning to a circular economy

- **"The 5th Fundamental Plan for Establishing a Sound Material-Cycle Society"** was approved by the Cabinet on August 2, 2024.

Priority resource categories that promote thorough resource recycling throughout the life cycle.

Plastics and waste oil	✔ Reduce cumulative emissions of one-way plastics and double the use of recycled plastics by 25% by 2030. ✔ Promote upcycling of waste solvents.
Biomass	✔ Thoroughly utilize unused thinned wood, livestock manure, sewage sludge, etc. as fertilizer and energy. ✔ **Replacing 10% of Japan's aviation fuel consumption with SAF (sustainable aviation fuel) by 2030.** ✔ Halve food loss by 2030.
Metals	✔ Doubling the amount of recycled metal feedstock processed by 2030.
Soil and construction materials	✔ Promote initiatives for thorough and sophisticated sorted demolition and recycling of buildings, etc. and for increasing demand. ✔ Promote the longevity of housing infrastructure.

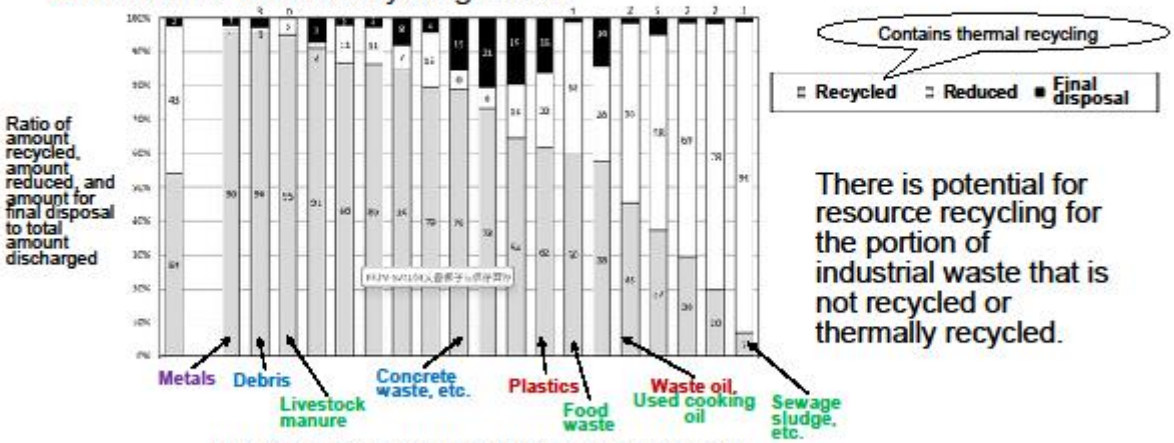
Ministry of the Environment,, https://www.env.go.jp/content/000242999.pdf

3

Japan Industrial Waste Information Center

1. Transitioning to a circular economy

- Industrial waste recycling status



Industrial waste recycling status by type (FY2021)

Ministry of the Environment, https://www.env.go.jp/content/000211701.pdf

There is potential for resource recycling for the portion of industrial waste that is not recycled or thermally recycled.

4

Japan Industrial Waste Information Center

2. Previous research by the JW Center

- Livestock manure recycling

- Most livestock manure is composted and recycled by livestock farmers.
- There are companies that use livestock waste as a raw material to produce energy through methane fermentation and direct combustion.

5

2. Previous research by the JW Center

Japan Industrial Waste Information Center

- Food waste recycling

- Composting.
- Fermentation of food waste to produce liquid feed and biogas.
- Make solid feed material by heat drying.

Compost

Liquid feed

Biogas utilization

Solid feed

6

2. Previous research by the JW Center

Japan Industrial Waste Information Center

- Used cooking oil recycling

- Used cooking oil is recycled as Livestock feed ingredients or Industrial raw material, BDF (Biodiesel fuel) raw material.

ANA. https://www.ana.co.jp/ja/jp/brand/ana-future-promise/co2-reduction/2022-12-28-01/

- Construction of a manufacturing facility for SAF (sustainable aviation fuel) is underway.
- Japan has a goal of replacing 10% of its aviation fuel consumption with SAF by 2030

7

2. Previous research by the JW Center

Japan Industrial Waste Information Center

- Waste oil (Mineral oil and waste solvent) recycling

Waste oil emulsion fuel production facility

Waste solvent distillation purification equipment

SANWAYUKA INDUSTRY CORPORATION.
https://www.sanwayuka.co.jp/business/reuse/organic/

- Of the GHG emissions generated by burning waste, the majority come from waste oil.
- Waste oil is recycled into recycled solvents or fuels.

8

2. Previous research by the JW Center

Japan Industrial Waste Information Center

- Sewage sludge recycling

Biogas station attached to a sewage sludge digestion facility

- Biogas is produced from sewage sludge through anaerobic digestion.
- Phosphorus resources are recovered through drying of dewatered sludge and phosphorus recovery.

Recovered phosphorus

Dried sludge

Kobe city. https://www.city.kobe.lg.jp/a78446/kurashi/sumai/sewage/shikumi/index.html

9

3. New Law

- **The Plastic Resource Circulation Act**
  (enforced: April 2022)
- **Law on Advancement of Recycling Businesses, for Promotion of Resource Recycling**
  (enacted: May 2024)

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3-1. The Plastic Resource Circulation Act

- **The importance of further promoting the resource circulation of plastics domestically has increased.**

✓The growing international concern over marine plastic pollution.

✓China has implemented a policy banning the import of plastic waste from foreign countries.

✓Efforts on the '3R + Renewable' approach for plastics are being demanded as a measure against climate change.

11

3-1. The Plastic Resource Circulation Act

"Choose, Reduce, and Recycle Plastics."

● Objective

Accelerate the transition to a circular **economy through "3R+Renewable"** throughout the entire lifecycle of plastics.

● How

Design and Manufacturing Stage

✔ Converting plastic product design to environmentally friendly.

Sales and offering stage

✔ Reduce disposable plastics.

Discharge and separation Stage

Collection and Recycling

✔ Collect and recycle all discharged plastics.

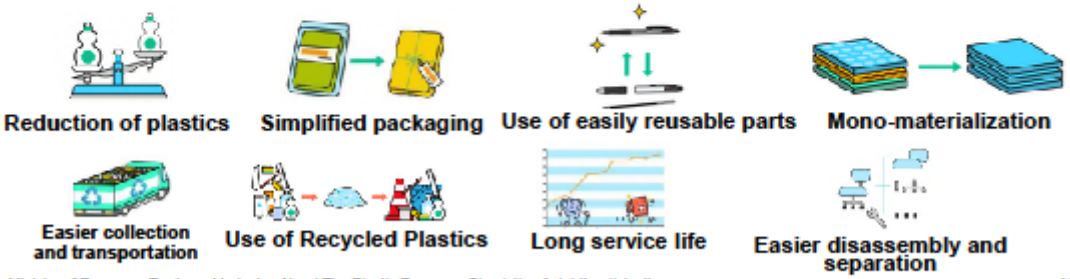
3-1. The Plastic Resource Circulation Act

Design and Manufacturing Stage

✔ **Reduction of plastic usage, reuse of parts, innovations to facilitate recycling, substitution of materials other than plastics, and use of recycled plastics and bioplastics.**

✔ **Establish guidelines that specify items to be addressed and considered** by designers and manufacturers of all plastic-using products.

✔ The government will establish a system to **certify particularly excellent designs** and **promote the use of certified products.**



Ministry of Economy, Trade and Industry. About The Plastic Resource Circulation Act, https://plastic-circulation.env.go.jp/wp-content/themes/plastic/assets/pdf/setsume(_siryou.pdf

3-1. The Plastic Resource Circulation Act

Japan Industrial Waste Information Center

Design and Manufacturing Stage

Case study 1-1:
Change from plastic package to paper package.

Case study 1-2:
Reducing plastic usage by refilling cosmetics.

Ministry of the Environment, Ministry of Agriculture, Forestry and Fisheries. , Collection of examples of initiatives that contribute to the recycling of plastic containers and packaging, https://www.env.go.jp/content/000121961.pdf

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3-1. The Plastic Resource Circulation Act

Japan Industrial Waste Information Center

Sales and offering stage

✔ **Retail and service businesses that provide specified plastic-using products** (plastic-using products provided free of charge to consumers in conjunction with the sale of goods or provision of services) are **required to rationalize their use by devising the method of provision and the products to be provided.**

Case study 2-1:
Ask customers if they need a spoon or fork at a convenience store.

Purchasing one bottle and 11 refill products reduces plastic use by about 80%.

Case study 2-2:
Shampoo, conditioner, and body wash sold by weight.

Ministry of the Environment, Ministry of Agriculture, Forestry and Fisheries. , Collection of examples of initiatives that contribute to the recycling of plastic containers and packaging, https://www.env.go.jp/content/000121961.pdf

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Japan Industrial Waste Information Center

3-1. The Plastic Resource Circulation Act

Discharge and separation Stage | **Collection and Recycling**

✓ **When a manufacturer, distributor, etc. prepares a plan to voluntarily collect and recycle products, and the competent minister certifies the plan**, the certified business operator is **not required to obtain a business license** under the Act on Waste Management and Public Cleaning.

Resource collection boxes installed in storefront

Recycled paper and plastic bottle collector

Installed in 368 locations nationwide (as of April 2023)

Donation-participating plastic bottle collector

Installed in 5 locations nationwide (as of June 2023)

Case study 3-1:
Resource collection boxes installed in each storefront by Japan's largest shopping mall.

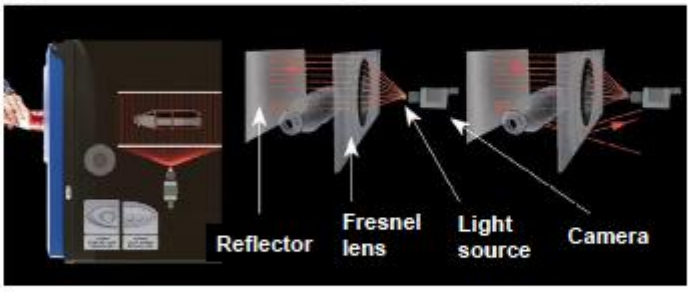
AEON co. ltd., Recource circulation, https://www.aeon.info/sustainability/environment/reuse/

Japan Industrial Waste Information Center

3-1. The Plastic Resource Circulation Act

Discharge and separation Stage | Collection and Recycling

Example of internal structure of the plastic bottle collecting machines.



Case study 3-2:
Installation of plastic bottle collecting machines at supermarkets.

Ministry of the Environment, circulation of plastic resources, https://plastic-circulation.env.go.jp/about/pro/recycle
Tomra Japan Ltd. https://to.tomra.co.jp/tomra-solutions/reverse-vending-machine/

3-1. The Plastic Resource Circulation Act

- **Milestones**

Reduce	✔ Reduce emissions of one-way by **25%** on a cumulative basis by **2030.**
Reuse and Recycle	✔ Design plastics to be technically easy to sort and reusable or recyclable by **2025.** ✔ Reuse and recycle **60%** of containers and packaging by **2030.** ✔ **100%** reuse and recycling of used plastics by **2035.**
Recycled and Biomass Plastics	✔ **Doubling the amount** of recycled plastic used by **2030.** ✔ Introduce **about 2 million tons** of biomass plastics by **2030.**

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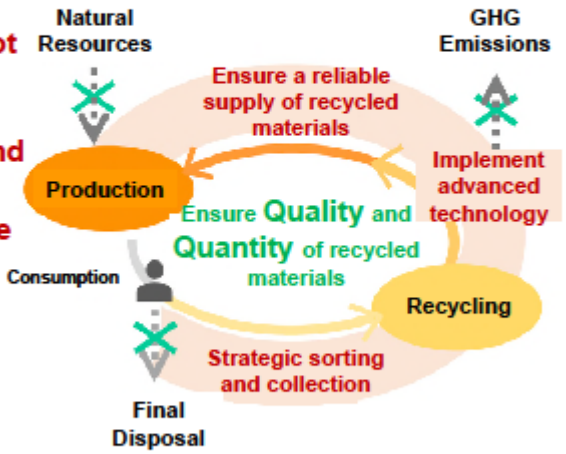
3-2. Law on Advancement of Recycling Businesses

- **Backgrounds**

✔ Resource recycling can **contribute not only to the realization of carbon neutrality**, but also to solving social issues such as **economic security and regional development**.

✔ **Growing trend in Europe to seek the use of recycled materials.**

✔ It is important for Japan to strengthen its industrial competitiveness in resource recycling by securing the **quality** and **quantity** of recycled materials.



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3-2. Law on Advancement of Recycling Businesses

Japan Industrial Waste Information Center

- **How**

✓ Require waste disposers to report and disclose the status of recycling.

Raise the level of the entire resource recycling industry.

✓ Establish a certification systems for advanced recycling business.

Promote sophistication of recycling business.

The "Act on Waste Management and Public Cleaning", which requires a permit for each local government, is quickly realized through a blanket authorization by the government.

Three certification systems

- Advanced Recycling Projects
- Advanced Separation and Recovery Business
- Upgrading the recycling process

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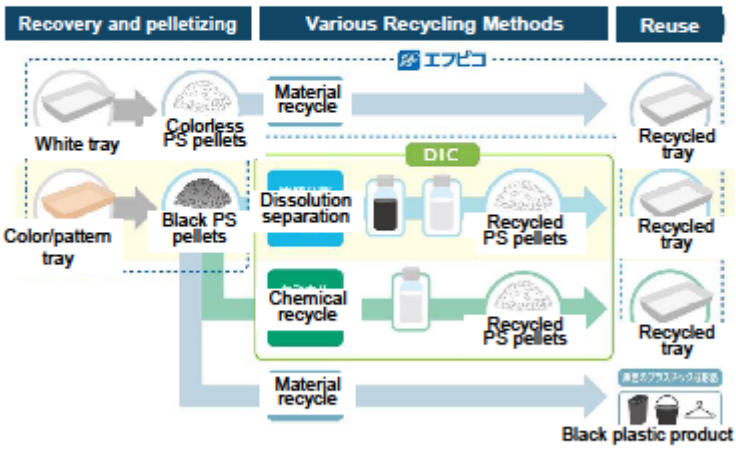
3-2. Law on Advancement of Recycling Businesses

Japan Industrial Waste Information Center

Advanced Recycling Projects



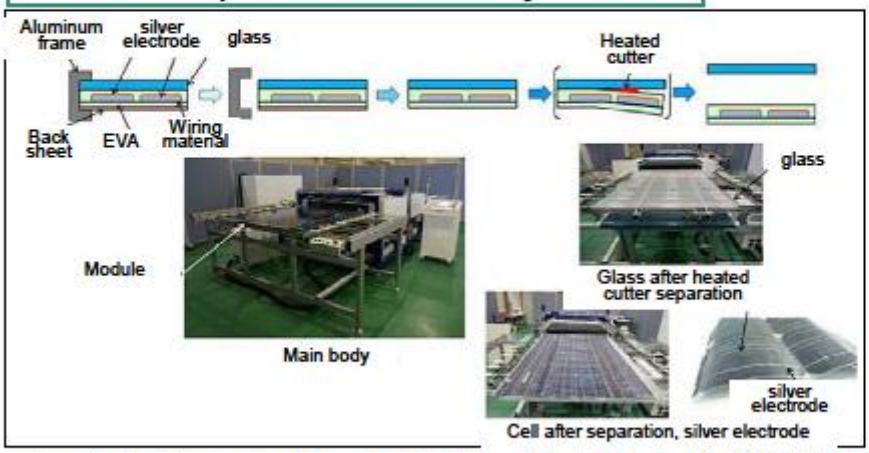
- Initiatives for complete recycling of polystyrene.
- Food tray to food tray.
- Method for removing colored components from black recycled pellets and feeding them into a polystyrene production plant.

DIC CORPORATION. https://www.dic-global.com/ja/news/2022/ir/20220802165225.html

Case study 1: Various Recycling Methods for Complete Circular Recycling of Plastic Food Trays. 21

3-2. Law on Advancement of Recycling Businesses

Advanced Separation and Recovery Business



- Solar Panel Recycling.
- Complete separation of glass and metal.

Ministry of the Environment . https://www.env.go.jp/content /900512721.pdf

Case study 2-1: Complete Glass-to-Metal Recycling Technology by Hot Knife Separation Method.

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Japan Industrial Waste Information Center

3-2. Law on Advancement of Recycling Businesses

Advanced Separation and Recovery Business

Case study 2-2: Sorting plastics by optical sorting equipment.

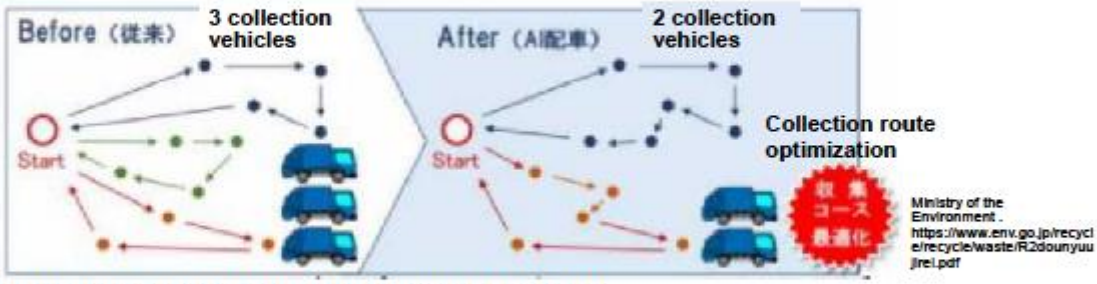
Case study 2-3: Pulp sheet production process from used diapers.

Ministry of the Environment . https://www.env.go.jp/content/900515346.pdf

23

3-2. Law on Advancement of Recycling Businesses

Advanced Separation and Recovery Business



Ministry of the Environment . https://www.env.go.jp/recycle/recycle/waste/R2dounyuujirei.pdf

Case study 2-4: Image of AI vehicle dispatch simulation

- AI calculates the optimal collection route from basic information related to waste collection.
- It assists with the task of setting collection routes for each collection vehicle and reviewing the routes, which was previously time-consuming for dispatchers.

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Japan Industrial Waste Information Center

3-2. Law on Advancement of Recycling Businesses

Upgrading the recycling process

Appearance of URANOS

Vertically Articulated Robot

- AI judges materials and shapes based on information obtained from near-infrared sensors and images.
- Vertical articulated robot and a parallel link robot sort the materials at a speed of 1 piece/second.

Case study 3: Highly efficient recycling equipment using AI

Ministry of the Environment . https://www.env.go.jp/recycle/recycle/waste/R2dounyuujirei.pdf

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4. Summary

The legal regime contributing to resource recycling has been strengthened over the past 6 years, accelerating the transition to a circular economy.

Japan aims to

- ✓ **Accelerate the transition to a circular economy through "3R+Renewable" of plastics.**
- ✓ **Promote thorough resource recycling throughout the life cycle of plastic and waste oil, biomass, metals, and construction materials.**
- ✓ **Strengthen its industrial competitiveness in resource recycling by securing the quality and quantity of recycled materials.**

JW Japan Industrial Waste Information Center

JW Center contributes to the realization of carbon neutrality by 2050 through using of electronic manifest data.

Thank you for listening.

Development of Waste Management policies over the past 6 years

Development and Policy of Resource Circulation in Taiwan

Chih-Ping Tseng, Section Chief

Resource Circulation Administration, Taiwan (R.O.C.)

5 Setepmber, 2024

Outline

- Current Status and Resource Circulation Policy
- The Resource Circulation Promotion Act
- Example-Circulation of plastic and textile
- Regulations governing the Import and Export of Waste in Taiwan
- Future outlook

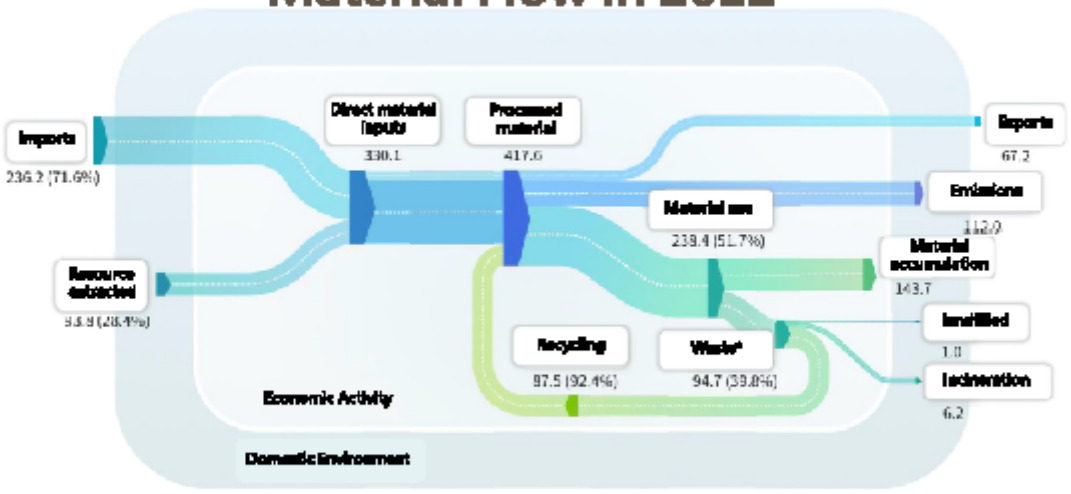
1

Current Status and Resource Circulation Policy

Sustainable Materials Management
-Build a Circular Society

- In response to the international trend of transitioning from waste management to SMM, the concept was introduced in 2013.
- Adopting global best practices like Japan, the Netherlands, Europe, and the OECD, SMM indicators have been established to measure resource efficiency and environmental impact.
- Establishing seven material flow indicators, including resource productivity and domestic material consumption.

Material Flow in 2022



*Waste 94.7 = General Waste 11.2 + Industrial Waste 21.1 + Others (Agricultural materials+ Recycling Paper + Construction Residual + Recovered steel slag) 62.4

Million tonnes

Material Consumption and Waste Generation

Material Consumption

- Material input more than 300M tonnes (Over 70% imported)
- DMC exceeded 200M tonnes in the past 10 years, DMC per capita approx. 11 tonnes of materials per year.

Waste Generation

- 30 million tonnes /year
- General waste recycling rate 59.5%
- Industrial waste recycling rate 85.4%

Toward zero emission
Resource Recycling and Zero Waste

- **Transformative thinking** — Maximize resource circulation, introduce the 5R concept, create a new circular business model.
- **Reduce carbon emissions** — 45% of carbon emissions are related to product manufacturing, apply resource recycling strategies to adopt reductions.
- **Establish resilience** — Promote resources circulation and decrease the dependence on import of key materials.
- **Proper Disposal** — Expand waste processing capacity, formulate special management laws, reduce illegal disposal.

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Taiwan's 2050 Net-Zero Transition

12 Key Strategies

7

Performance Indicators and Expected Benefits

- To understand domestic material usage and its association with economic development and environmental impact, resource productivity and per capita material consumption are used as overall performance indicators.
- Increase resource productivity and decrease domestic material consumption per capita

Overall Performance Indicators		2020	2025	2030
Resource productivity	NTD / kg	81.7	96.89	109.69
Domestic material consumption per capita[1]	tonne / capita	10.3	10.22	10.09
Cyclical Use Rate (waste base)[2]	%	73.15	74.73	80.34

Note : 1. RF is calculated using real GDP, which is not affected by inflation.
2. Excluding Construction Surplus Soil.

Expected Benefits of Key Actions				
Reduction rate of disposable plastic package	%	7	20	25
Ratio of chemical waste liquid circulation utilization	%	86.5	89	89.5
Ratio of recycled inorganic waste materials utilized in maritime engineering	%	-	8	19
Ratio of converting industrial waste into energy	%	47	67	84

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Main Policy Framework for Resource Circulation

Resource Circulation & Zero Waste

3 Major Circulation Strategies

Green Designs for Waste Reduction at Source
- Green designs
- Source reduction
- Extended Utilization
- Information disclosure
- Circular procurement

Resource Recycling & Reuse
- Recycling classification & diversion
- Financial incentives
- Recycling of 4 major resource types
- Circulation Management Platform & BART

Balance and Management of Treatment Capacity
- Maximize treatment capacity
- Recycling management
- Circulation of new and difficult-to-treat waste

Well-functioning circular network
- 4-in-1 resource recycling
- Circulation industrial network
- Industrial park & regional-based circular networks
- Communication and campaigns

Innovative technologies and systems
- Regulations & incentives
- Carbon reduction technologies
- Management and supervision of organizations & enterprises
- Resource Circulation Cloud

2 Key Facilitation Pillars

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The Resource Circulation Promotion Act

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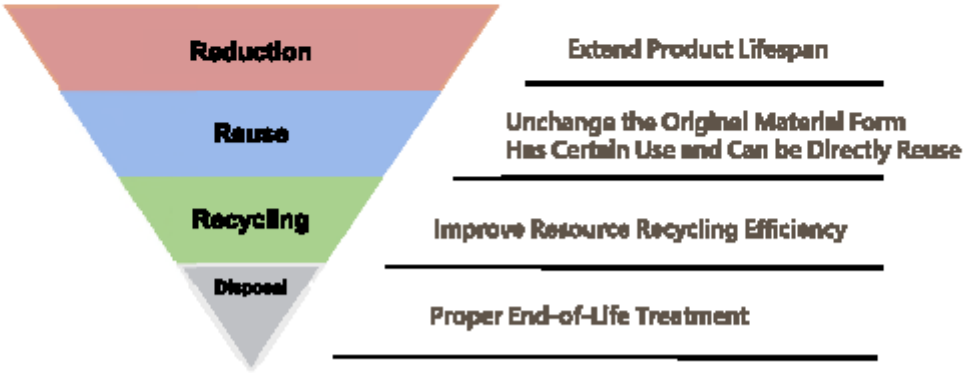
Enact a new law-Resource Circulation Promotion Act(1/2)

- Integrate the management spirit of Waste Disposal Act and Resource Recycling Act, in line with international management trends, pursue the maximization of resources and minimization of waste disposal, and build a circular society.
- Waste resources are used in the order of reuse, recycling and energy recovery to improve the efficiency of resource use.



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Enact a new law-Resource Circulation Promotion Act(2/2)

- Government units, industrial associations, clearance and disposal associations, and civil organizations were invited to communicate and collect opinions.
- The bill will be proposed when each institution, business and expert from each field reach consensus.

Transformative Thinking Promote Recycling	Waste resources should be used in a proper way.
Source Reduction of Consumer Products	Guide to change the concept of consumption and extend the service life of products.
Create a Favorable Environment for Promoting Industrial Circulation	Make good use of financial tools, scientific and technological governance, and build a complete industrial resource recycling network.
Uphold Environmental Justice	Uphold environmental justice and deter illegal disposal.

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Example-Circulation of plastic

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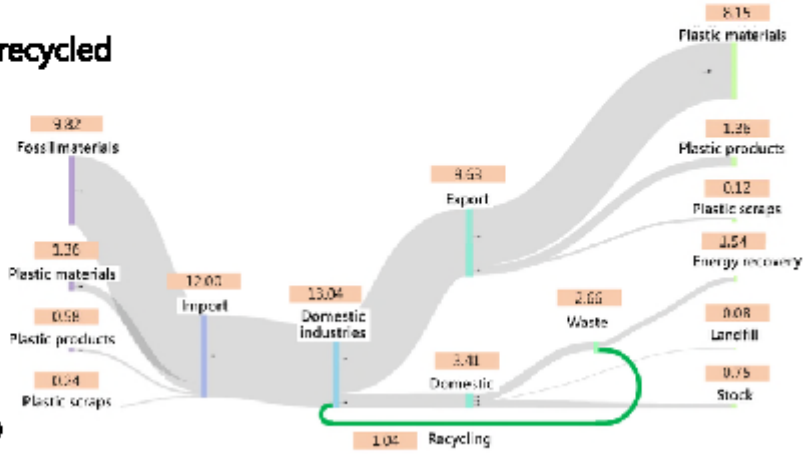
Overall plastic flow

- Plastic demand: 13.04 million ton/year
- Domestic use: 3.4 million ton/year, decline reached 40% pre-covid-19
  - About 40% are recycled



Data of 2022, unit: million tonnes/yr

(Data source : MOF - MOEA - MOENV)

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Restriction and recycling of plastics

- Amend regulations to achieve SDGs goals
- Promote reduction and green design to create circularity and sustainability
- Strengthen recycling system with preferential subsidies

- Design products with concept of plastic elimination, substitution and easy recycling
1. Design/produce products that are easily recyclable
2. Employ alternative materials
3. Unpackaged or reduced packing

- Promote source reduction with new business models
1. Innovative business models for reuse
2. Plastic restriction policies

- Create value-added recycled plastic
1. Create demand for recycled materials, such as packaging and container
2. Introduce innovative technologies to increase the potential for recycling and use of recycled materials

- Establish and optimize effective recycling methods
1. Establish effective recycling methods
2. Strengthen recycling infrastructure / sorting technology
3. Establish an integrated recycling system
4. Establish information platform of plastic resource material distribution

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Elimination and substitution

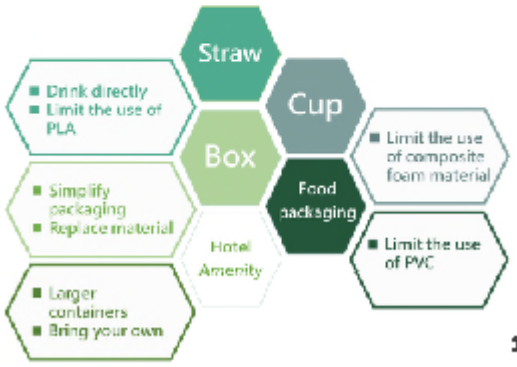
■Promote plastic reduction and easy recycling for product design

Economic incentives	• Establish differential rates for recycling fees to encourage using eco-friendly materials
Guideline	• Compile product design guidelines (online shopping packaging, retail industry)
Management of chemical	• Eliminate or reduce the use of toxic and chemical substances of concern

■Promote alternative practices based on the sustainability of material, renewable design, and process waste issues

■Unpackaged or reduced packing

■over-packaging and packaging for online shopping



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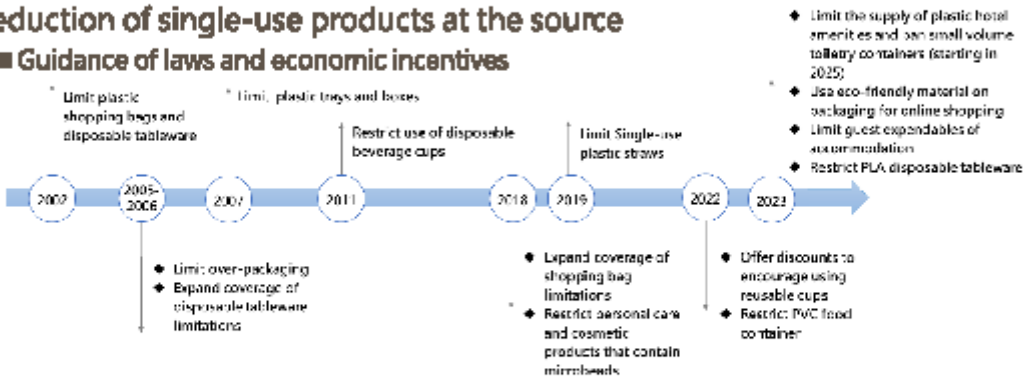
Source reduction

■Reduction of single-use products at the source

■Guidance of laws and economic incentives



■Promote source reduction with new business models

■Provide services of product reuse based on sharing economy

- Encouraging consumers to bring their own cups by offering discounts
  - For businesses that provide recycling cup services, the public's self-preparation rate is 17%

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Strengthen recycling

- Establish and optimize effective recycling methods
  - Provide incentives – differential recycling fee or subsidies
  - Technology aid - Develop spectral database/AI recognition model/ automatic sorting system
- Four-in-One recycling program
  - Implement EPR by recycling fund management and subsidies
  - Recycling rate of plastic containers reached 80.51% in 2022
- Integrate industries to establish circulation model
  - Origin: classification, volume reduction, collection
  - Recycling industries: determining recyclability and matching recyclers

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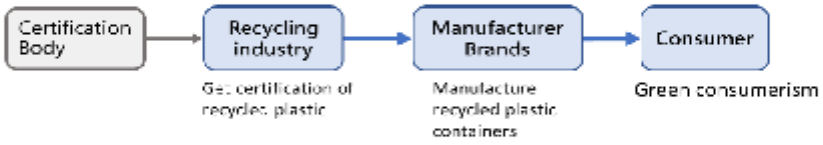
Circulation

- Create value-added recycled plastic
  - Set targets on using recycled plastic in products, 25% for 2025; 30% for 2030
  - Build a mechanism to verify recycled products
  - Establish incentives—apply differential rates of recycling and promote green procurement



- Introduce innovative technologies
  - Value-added recycling technologies (physical/chemical/ thermal recovery)
    - Example—recycling of aluminum-plastic composite material，the purity of recycled aluminum reaches 85-90%
  - Energy conversion

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Regulations governing the Import and Export of Waste in Taiwan

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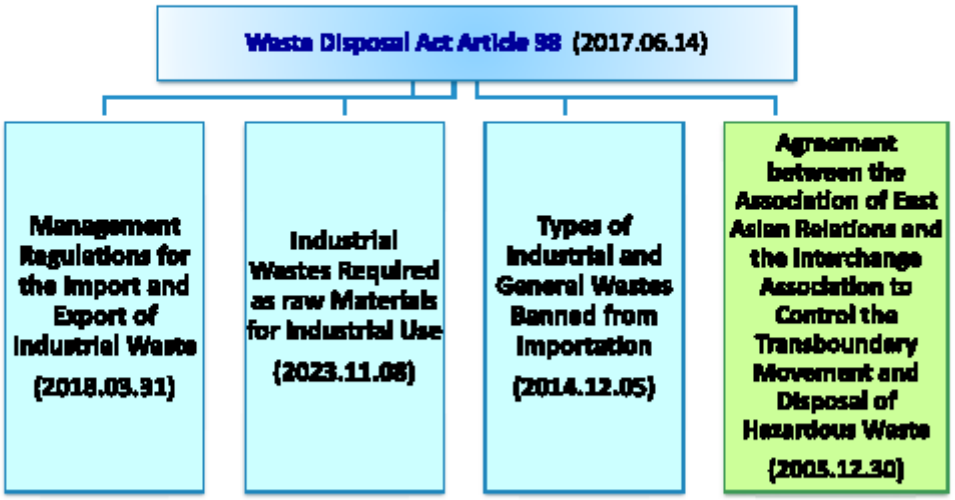
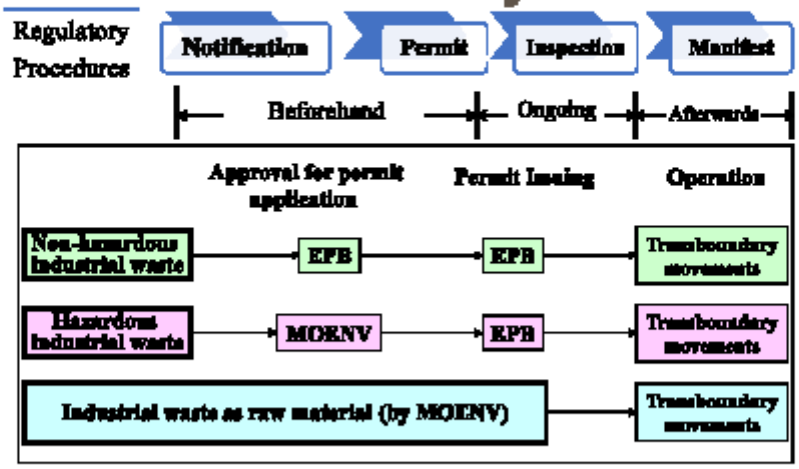
Legal Norms



21

Management Framework of Waste Transboundary Movements



Note : EPB is the responsible agency at the municipality and county(city) levels

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Types of Industrial and General Wastes Banned from Importation

1. Hazardous industrial waste, except the following:
   - Those that have been promulgated as required for industrial use.
   - Waste wires and cables not containing grease.
   - Those not listed in the Basel Convention, but excluding mixed scrap metals.
2. Waste leather peeling (not applicable to manufactured leather articles) and waste leather meal.
3. Garbage and incineration ash from general waste.
4. Waste edible oils and fats of animal or vegetable origin.

- E-waste is regarded as hazardous waste in Taiwan, such as waste electronics IT products and household appliances; therefore its importation into Taiwan is prohibited.

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Future outlook

- Focus on UN SDG 12, net-zero transition to improve resource efficiency and build a sustainable society
- Enact Resource Circulation Promotion Act (Draft) to transform waste management, and create incentives to promote resource utilization
- Build Resource Circulation Platform (Circular cloud), enhance technology and establish business models to create a circular environment
- Develop digital transformation and integrate services to improve efficiency, deepen recycling and strengthen cooperation
- Address public concerns, diversify measures and regulation to continue plastic reduction and achieve reduction goals

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Thank you for listening

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CONTENTS

01

Introduction to K-eco

Introduction to K-eco

Institution Type	Quasi-governmental organization	Competent Authority	Ministry of Environment
Institution Name	Korea Environment Corporation	HQ Location	Incheon, Korea
Number of Employees	3,316 Persons		

Vision

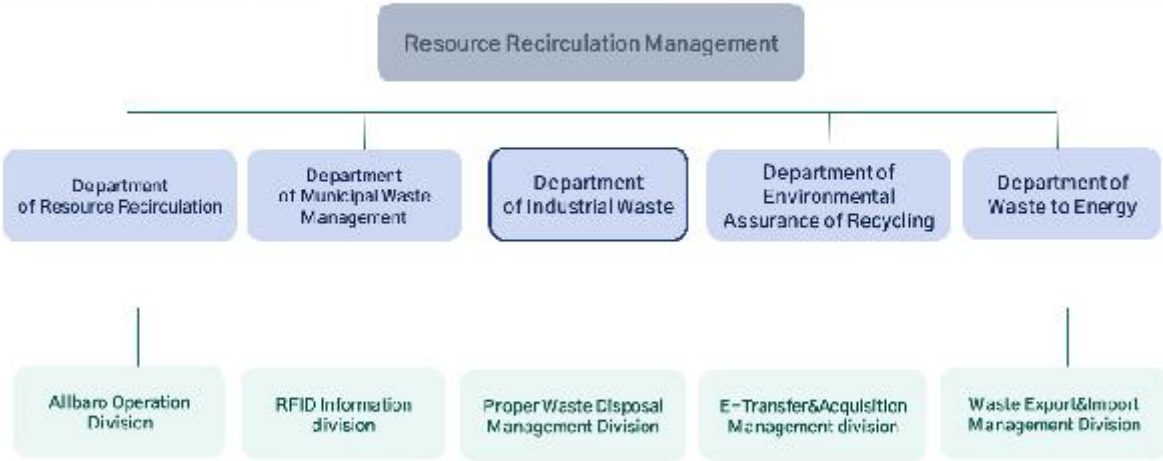
A Global Environmental Institution Leading the Carbon-Neutral Era

Core Business

- Climate and Clean Air
- Water and Soil
- Resource Recirculation
- Environmental Infrastructure
- Environmental Health

Introduction to K-eco

Introduction to K-eco



02

Waste Management Policy In Korea

Leading the Circular Economy

Vision and Strategy for Waste

- Reduction of waste production fundamentally
- Reuse of generated waste as energy, Disposal waste in an environmentally friendly manner

Circular Economy Process

Waste management Policy in Korea

Background

1. Changes in Resources Circulation Policy

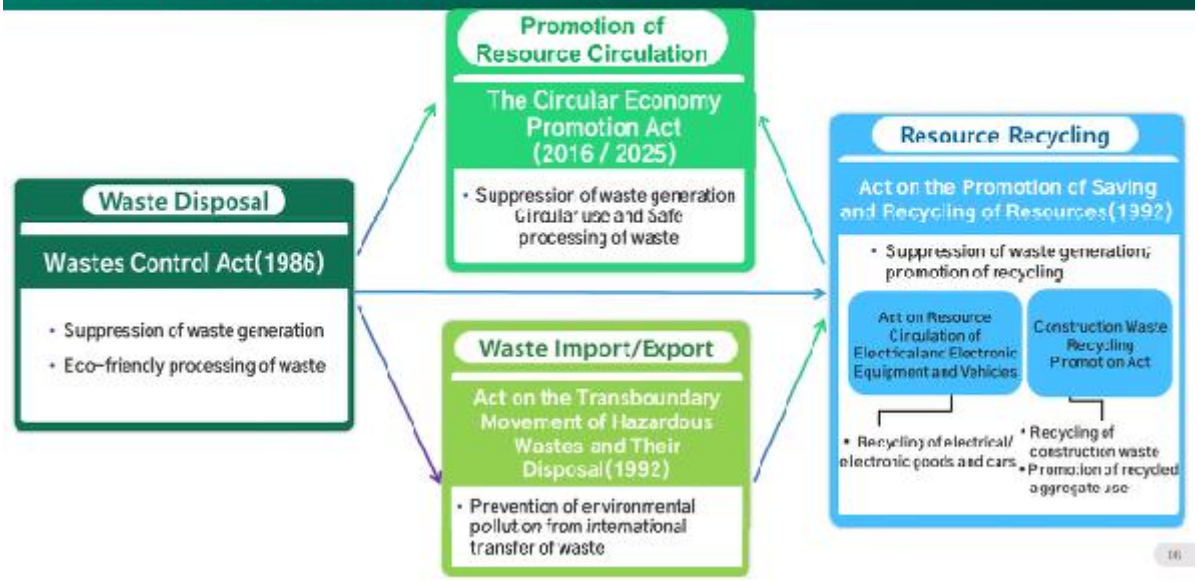
Safe Disposal → Enhancement of Recycling → Circular Economy

2. Socioeconomic structure based on mass production, consumption, and disposal is an issue

- ✓ Facing limits of sustainable growth
- ✓ Facing Environmental Issues such as Climate Change

3. Pursuing a Circular economy rather than just recycling waste

Waste management Policy in Korea



Waste management Policy in Korea

Key trend in Law Revisions

- An institutional basis for establishing a circular economy comprising all production, distribution and consumption processes
- "Act on Promotion of a Transition to a Circular Economy and Society"

Enforcement of the Circular Economy Promotion Act(2025.1.1)

- Resource Circulation Policy Transition (Sep. 28, 2020)
- Plan for De-plastification of Household Waste (Dec. 24, 2020)
- K-Circular Economy Implementation Plan (Nov. 2, 2021)
- Full Life Cycle Deplastification Plan (Oct. 20, 2022)
- Amendment in full of Act on Promotion of a Transition to a Circular Economy and Society (Dec. 31, 2022), Effective from Jan. 1, 2024
- Legislative notice for bill for amendment in full of Enforcement Decree and Enforcement Regulation of Act on Promotion of a Transition to a Circular Economy and Society (Definition of Terms and circular raw materials) (Jul. 31 to Sep. 11, 2023), Effective from Jan. 1, 2024
- Bill for amendment in full of Enforcement Decree and Enforcement Regulation of Act on Promotion of a Transition to a Circular Economy and Society (Circular availability, packaging materials for distribution, right to repair, etc. under preparation, Effective Jan. 1, 2025

07

Waste management Policy in Korea

Key trend in Law Revisions

Content of the Circular Economy Promotion Act

- Definitions (Draft Article 2) and basic principles (Draft Article 3)
  - ○ Definitions of terms such as circular economy, circular raw materials and circular use)
  - ○ Prescription of basic principle for priority consideration for circular use upon expected occurrence of waste, and maximum circular use of already-generated waste
- Establishment of circular economy objectives and circular economy progress management (Articles 13 through15)
  - ○ Waste reduction defined as circular economy indicators in addition to indicators following generation of waste
    - · Setting of phased national medium to long term objectives to this end
- Promoting circular use in the production, distribution, and consumption of products (Articles 16 to 20)
  - ○ Circular availability evaluation for products whose circular use is expected to be difficult
  - ○ Prescription of efforts to promote circular use of products by producers and importers of products
  - → Prescription of matters relating to availability of product spare parts to guarantee sustainable use of products through appropriate repair (guarantee of right to repair)

Waste management Policy in Korea

Key trend in Law Revisions

Content of the Circular Economy Promotion Act

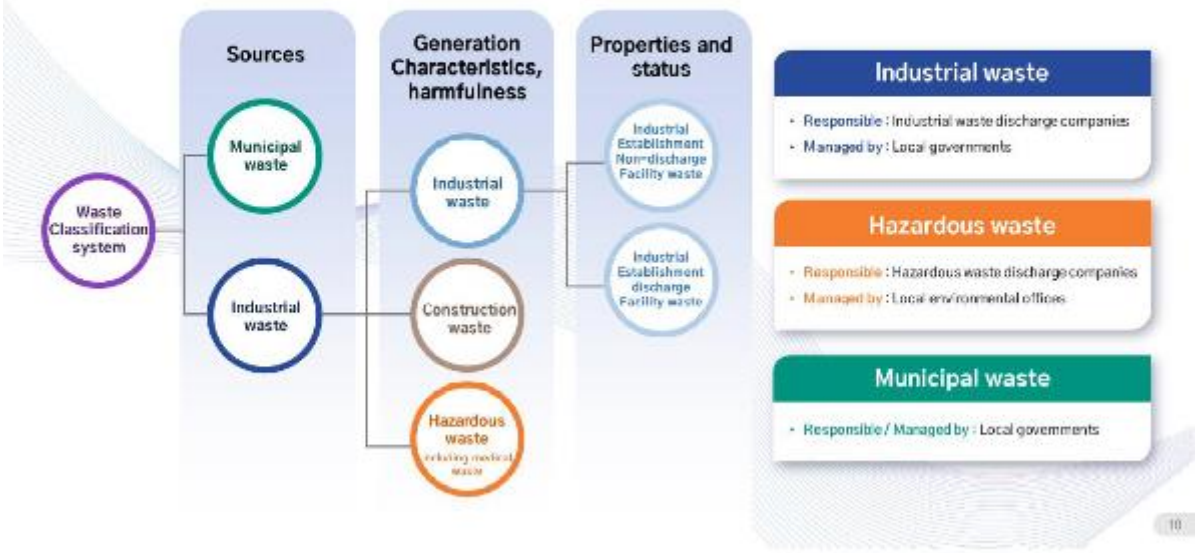
- Public notice of circular resources (Draft Article 23)
  - Designation and public notice of non-hazardous, high economic value substances or articles effective in promoting circular use as circular resources
- Adoption of regulatory sandbox to promote new technologies and services (Draft Articles 27 through 34)
  - Expedited regulatory verification (within 30 days), batch processing of permit applications in batches of 2 or more, regulatory exceptions and provisional permits for limited testing and technology proof-of-concept of new technologies and services
- Expansion of tax revenues for Special Circular Economy Account (Draft Article 38)
  - Added, to Special Circular Economy Account tax revenues of local governments: a percentage of Waste Disposal Facility Handling Charges prescribed by ordinance, and a percentage of proceeds from installation and operation of waste disposal facilities prescribed by ordinance

09

03

Industrial Waste Management System

Industrial Waste Management System



Industrial Waste Management System

Types of Industrial Waste

	Type	Criteria of discharge volume
Industrial waste	Waste generated in discharge facilities according to the Clean Air Conservation Act and the Water Environment Conservation Act and the like	100 kg a day or average
	Establishments with public waste water treatment facilities installed and operated	100 kg a day or average
	Human waste treatment facilities, livestock excretions public treatment facilities	100 kg a day or average
	General establishments	300 kg a day or average
	A series of construction and work	5 tons
Construction waste	Waste generated in construction works	5 tons
Hazardous waste (including medical waste)	Slime	500 kg a month on average
	Waste agricultural pesticides, slag, dust, etc.	[illegible]
	Waste synthetic high polymer compounds, waste acid, waste alkali, waste paint, etc.	[illegible]
	Waste asbestos	20 kg or more a month on average
	PCBs, waste hazardous substances, waste medical materials, etc.	-

■ The Waste that is not classified as industrial waste is considered municipal waste

Allbaro(www.allbaro.or.kr)

■ A total waste management system that transparently manages the whole processes of discharging, collecting, transporting, and treating industrial waste through the internet in real time.

■ Composed of various functions such as waste-related certificates, waste delivery information management using various methods such as the RFID/ARS/Internet (mobile)/EDI, waste register management, annual result report on waste generate / transportation / disposal, and waste information provision.

Implementation Progress

■ Total brand operation of the Allbaro System (2007)

■ Made an obligation to prepare the industrial waste electronic delivery note (2008)

■ Made an obligation to prepare the construction waste electronic delivery note (2010)

■ Expanded the target for obligation to **prepare the electronic register (2020)**

* Waste disposer, recycler, waste treatment reporter

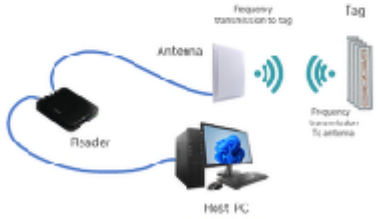
12

RFID Medical Waste Management

■ A system to manage the whole processes of discharging, collecting, transporting, and disposing **medical waste that can cause harm to the human body** such as infection, by using the RFID* method

RFID (Radio Frequency Identification)

A technology to identify the information on objects in real time by attaching an electronic tag with a semiconductor chip and antenna to the objects and using radio frequency



Implementation Progress

■ Established the RFID medical waste management system (2005)

■ Made it an obligation to prepare the "Allbaro system" electronic delivery note using the RFID. (2008)

■ Introduced the discharger authentication method using **Beacon tag (2022)**

■ Introduced **the warehousing method per tag** in the incineration plant (2023)

13

Export/Import Management

Purpose of the system

The purpose of waste import and export management system is to regulate the export and import of hazardous wastes in accordance with the Basel Convention and OECD requirements on the international transportation and treatment of hazardous wastes, in order to prevent environmental pollution caused by movement of wastes between the nations and to improve international cooperation.

Definition of the system

To prevent environmental pollution caused by movement between countries during waste disposal

Permission System	Control the import and export of waste related to the Basel Convention(88 hazardous waste items)
Reporting system	Reinforcement of management of wastes other than those subject to import and export permisson. (26 items other than the license list)

Additional commentary

In the case of exporting and importing waste, permission and reporting must be completed to the competent watershed (local) environmental office prior to customs clearance in accordance with the Inter-Country Waste Transfer Act.

✓ Wastes are imported and exported goods subject to customs office confirmation, and requirement confirmation is required

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Proper Waste Disposal Promotion Center

Operation Goals

- Inspection and guidance for the proper disposal of industrial waste
- Collection and provision of information regarding waste disposal operators, waste disposal facility installers, and waste disposal reporters

Establishment of Real-time Waste Processing Information System

	Before Enhancement (Allbaro System)	After Enhancement (Real-time Waste Processing Information System)
Target	Collection, transportation, recycling, and disposal companies	Collection, transportation, recycling, and disposal companies
Obligations	Obligations regarding the preparation of transfer and acceptance documents (E-manifest) through Allbaro	Obligation to input waste treatment site information (GPS, CCTV, Measurements)
Implementation timing	Industrial waste& Hazardous waste('08) Construction waste('10)	Hazardous waste('22. 10.) Construction waste('23. 10.) Industrial waste('24. 10.)

15

04

Introduction to Best Practices

(BP 1)

Establishment of an illegal waste monitoring system using cutting-edge technologies such as AI and drones

※ Winner of the 2023 Korean Government Innovation Competition, receiving the Prime Minister's Award (2nd place)

Background

Lack of environmental monitoring system	Continuous occurrence of cases involving illegal dumping and abandonment of waste and Lack of management personnel
Need to focus on work efficiency	Instead of manpower-oriented policies that crack down after an accident occurs, digital-based intelligent solutions are needed

- K-eco has been designated as the Proper Waste Disposal Promotion Center and has commenced operations('21.1~)
- Analyze big data from the Allbaro system to identify suspected companies involved in improper waste disposal.
  - After analyzing models of suspected companies by type* based on big data, select target companies for inspection with local governments
  - → 122 violator companies detected(Detection rate of 62%)

①Companies with a lot of errors in E-manifest
②Companies that have not prepared a recycling management book
③Companies with a significant discrepancy between the amount of waste received and the amount of waste disposed
④Companies that failed to handle residual waste

(BP 1)

Establishment of an illegal waste monitoring system using cutting-edge technologies such as AI and drones

※Winner of the 2023 Korean Government Innovation Competition, receiving the Prime Minister's Award (2nd place)

■ The drone patrol unit 'SKY PATROL' was established to set up an aerial monitoring system* for illegal waste

- Collaborate with civilian drone experts (14 teams, 75 members) to monitor abandoned or illegally disposed waste. ⇒ Reduction in patrol time compared to on-foot inspections (from 7 hours to 1 hour)

* ① Analyze data to identify suspected areas
② Utilize satellite imagery to verify illegal activities
③ Joint inspections and administrative guidance conducted with local governments and K-eco

■ Developed a 'Waste Anomaly Detection Model*' by analyzing waste treatment site data using artificial intelligence (AI)

* ① Failure to report and false reporting of waste generation, processing volume, and storage quantities ② Detection of route anomalies of waste transport vehicles ③ Analysis of suspicious transactions in waste generation, transportation, and disposal ETC.

Result

Establish a real-time monitoring system to create a living environment where the public can feel safe from inappropriate waste

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(BP 2)

Establishment of AI Customer Service Center (4-Bot)

Background

Lack of Manpower	It is difficult for 12 customer service agents to respond to calls (250,000 calls per year) of Allbaro system members (430,000 customer)
Need to focus on work efficiency	It is difficult for 60 Allbaro officers handle system approvals (340,000 cases annually) and respond to document inquiries (400 cases annually)

❶ "Allbaro Voice-Bot" 24-hour interactive voice consultation

customer service agents respond to customers **during working hours**

↓

The voice bot provides 24-hour consultation, and if unresolved, a customer service agents will handle the issue later

❷ "Administrative-Bot" Automate simple and repetitive tasks using RPA

Officers directly search through extensive legal document / The quality of answers varies depending on the person

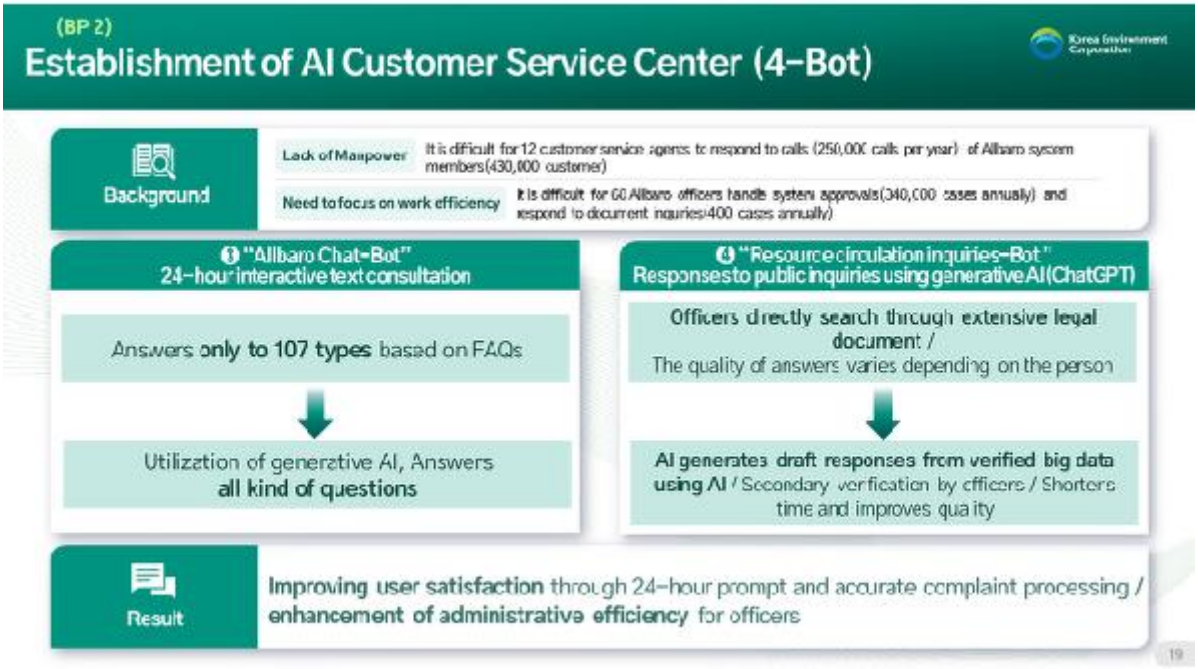
↓

AI generates draft responses from verified big data using AI / Secondary verification by officers / Shorters time and improves quality

Result

Improving user satisfaction through 24-hour prompt and accurate complaint processing / **enhancement of administrative efficiency** for officers

18


(BP 2)
Establishment of AI Customer Service Center (4-Bot)
Korea Environment Corporation
Background
Lack of Manpower
It is difficult for 12 customer service agents to respond to calls (250,000 calls per year) of Allbaro system members(430,800 customers)
Need to focus on work efficiency
It is difficult for 60 Allbaro officers handle system approvals(340,000 cases annually) and respond to document inquiries(400 cases annually)
① "Allbaro Chat-Bot"
24-hour interactive text consultation
Answers only to 107 types based on FAQs
Utilization of generative AI, Answers all kind of questions
② "Resource circulation inquiries-Bot"
Responses to public inquiries using generative AI(ChatGPT)
Officers directly search through extensive legal document /
The quality of answers varies depending on the person
AI generates draft responses from verified big data using AI / Secondary verification by officers / Shortens time and improves quality
Result
Improving user satisfaction through 24-hour prompt and accurate complaint processing / enhancement of administrative efficiency for officers
19


Korea Environment Corporation
CO2
THANK YOU
Ministry of Environment
Korea Environment Corporation
Allbaro

JW Japan Industrial Waste Information Center

JW Center's Activities for 6 years, Toward Accelerating Resource Recycling

2024/9/5
Hiroshi Sato

Japan Industrial Waste Information Center, Japan

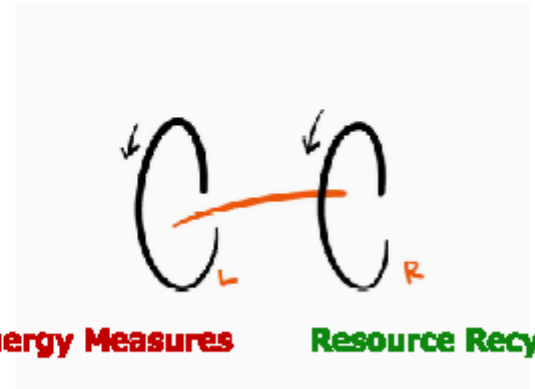
JW Japan Industrial Waste Information Center

I. About the Environment Surrounding Us
II. About our scenario

I. About the Environment Surrounding Us
II. About our scenario

Achieving net-zero GHG emissions by 2050

- **Energy measures and resource recycling are inseparable issues, like the two wheels of a car.**



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Toward net-zero GHG emissions by 2050

- **Shifting away from the use of fossil fuels and natural resources will be important.**

Transforming Energy Use

- ✓ From fossil fuels to non-fossil (renewable energy, etc.)
- ✓ Improvement of energy use efficiency

Transform waste and resource use

- ✓ Curbing Waste Incineration
- ✓ Shift from natural resources to recycled resources
- ✓ Improvement of resource use efficiency

→ **Economic Security**

4

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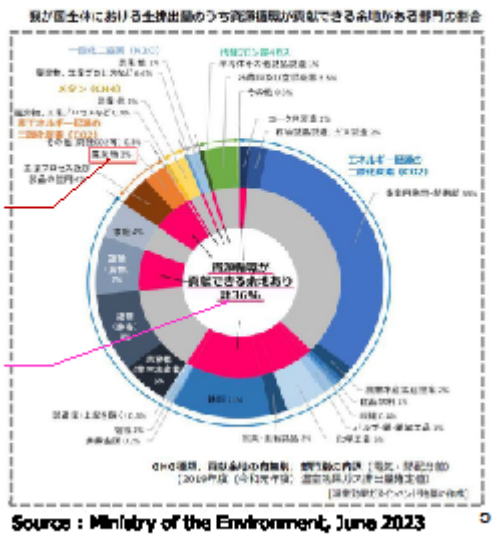
Resource Recycling Contribution

- **36% of businesses that emit GHG are expected to reducing GHG through recycling**

3% of GHG emissions (before electricity and heat allocation) from the waste sector.

Amount of waste from sectors with room for resource recycling contribution are estimated at 36%.
(413 million tons CO2 equivalent out of total emissions of 1,149 million tons CO2 equivalent in FY2020)



Source：Ministry of the Environment, June 2023

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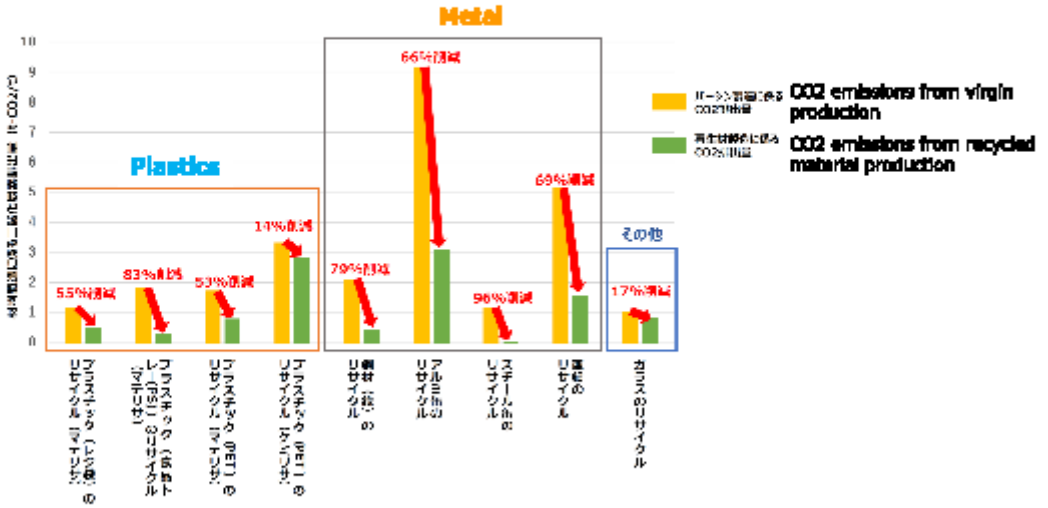
GHG Reduction Effects of Using Recycled Resources



Source : Ministry of Economy, Trade and Industry,
"Growth-Oriented Resource Autonomous Economy Design Study Group Report."

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How to realize

- **Three measures to accelerate resource recycling**
  1. Stimulation of demand:
     Formation and expansion of markets for recycled resources (arterial side)
  2. Increased supply:
     Increase in quantity and quality of recycled resources (Veins side)
  3. Information distribution:
     construction of a venous resource information platform (linkage of arteries and veins)

1. Stimulation of demand

- **Formation and expansion of markets for recycled resources (arterial side)**
  - ✓ ESG management is the key to corporate growth (market awareness is firmly established)
  - ✓ Mandatory disclosure of non-financial information such as supply chain emissions
  - ✓ Movement toward mandatory use of recycled resources

1.1 The Power of Capital Markets to Change Companies

ESG Investments in the Spotlight

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1.2 Unified disclosure of non-financial information

- The International Sustainability Standards Board (ISSB), established in November 2021, standardizes corporate sustainability-related information disclosure.
- After public comment in each country, the international standard for information disclosure was published on June 26, 2023.

- General Sustainability Disclosures (S1)
- Climate-related disclosures (S2)
  ⇒Supply chain emissions are also specified

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2. Increased supply

- **Increase in quantity and quality of recycled resources (Veins side)**
  - ✓Progress in recycling according to various recycling laws
  - ✓Advanced recycling business (technology) under the new law
    ⇒ Improvement of quantity and quality

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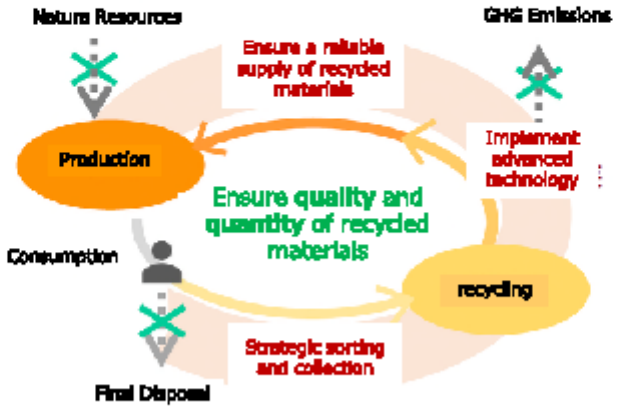
2.1 New Law

- **Law on Advancement of Recycling Businesses, for Promotion of Resource Recycling (enacted in May 2024)**



12

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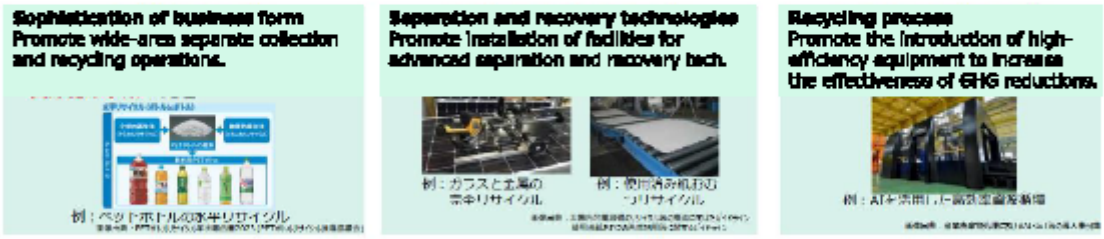
2.1 New Law

- **Take measures to promote sophistication of the process of waste collection, transportation, or disposal business for recycling.**



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3. Information distribution

- **Construction of a venous resource information platform (linkage of arteries and veins)**
  - ✓Linkages for each individual company
  - ✓Arterial and venous linkage in society as a whole:

    Develop the digital manifest system into a "venous resource information platform" and promote venous linkage throughout society through "visualization" of recycled resources.

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3.1 New Law: Supplementary Resolution

- **Environment Committee Supplementary Resolution in the House of Councillors : May 21, 2024**
  - The Government of Japan should take appropriate measures for the following matters in implementing the new law.
  - To promote resource recycling in terms of both quality and quantity, the arterial and venous industries, which are in a relationship of two wheels, should share information and cooperate with each other. In particular, in order to expand the use of recycled materials that can be used as parts or raw materials or other parts of products, information on recycling should be added to electronic manifests, and initiatives such as the establishment of a venous resource information platform should be promoted.

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I. About the Environment Surrounding Us

II. About our scenario

Paradigm Shift

- **Opportunity for the Industrial waste Industry to make the leap to a resource recycling industry**

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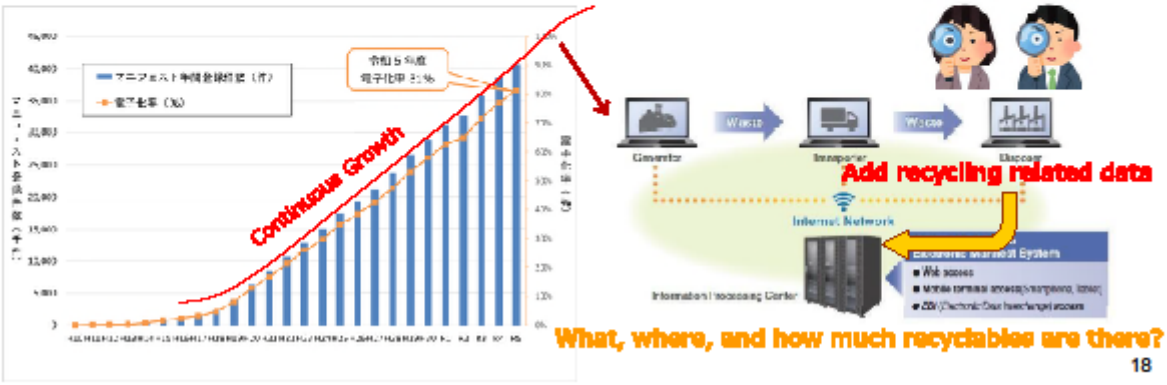
Move to promote waste recycling

- **Information distribution**
  - ✓ JWNET is ready to capture recycling data as share of Electronic Manifest registrations grows
  - ✓ Add data items related to recycling to the Electronic Manifest



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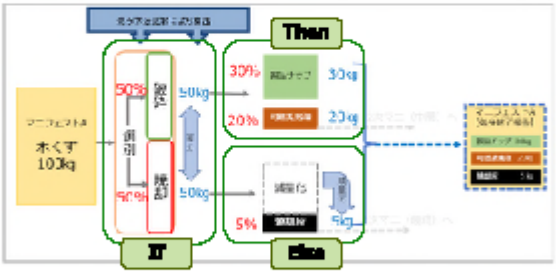
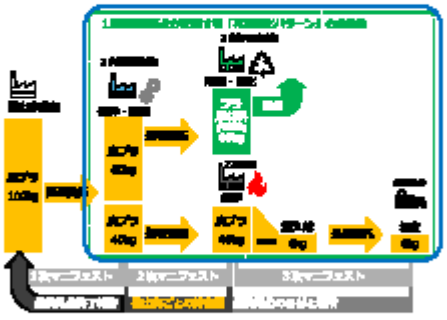
What information is needed?

- **Three elements to be grasped as Information**
- **Keep track of all dispositions**





If What kind of disposal method is used?

Then What kind of recyclables can be made?

Else How was the part that could not be recyclable?

To be understood by the primary processing contractor to the end of the process.

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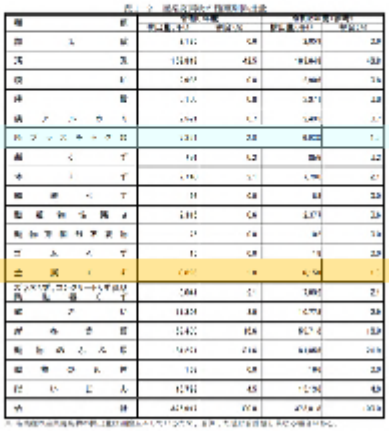
What do we know now about recycling industrial waste?

- **Statistics from the Ministry of the Environment**
  - ✓ Focus on the amount of Waste Plastics and Waste Metal from generator in FY2021, based on a survey



Amount of Industrial waste in FY2021

Waste Plastics	7,351Kt
Waste Metal	6,895Kt

20 types defined in Act on Waste Management and Public Cleaning.
Source : Industrial Waste Report in FY2023 by the Ministry of the Environment

20

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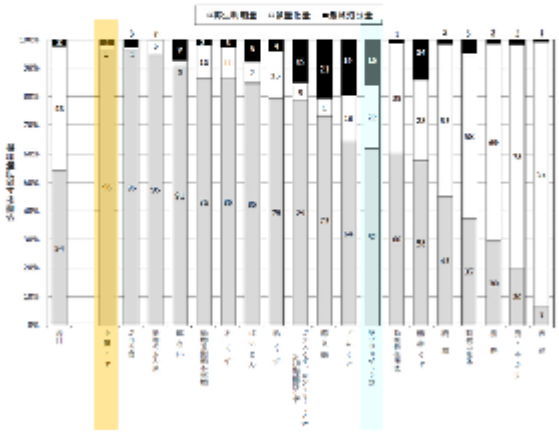

Amount Recycled in FY2021

Waste Plastics	7,351Kt x62%= 4,557Kt
Waste Metal	6,895Kt x96%= 6,619Kt

20 types defined in Act on Waste Management and Public Cleaning.
Source : Industrial Waste Report in FY2023 by the Ministry of the Environment

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Data currently available from JWNET

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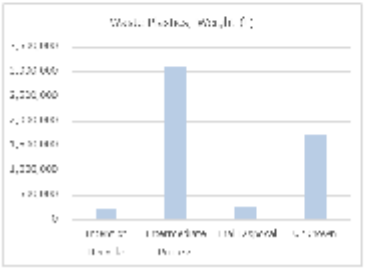
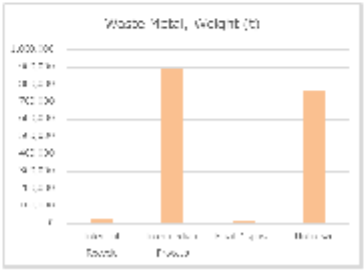
- **The data we can see using the dashboard of our BI Tool is**
  - ✓ Data values are different because the subject of the data is different.
  - ✓ Aggregation and Visualization are powerful from Electronic Manifest data through **BI Tool.**

Waste Plastics Disposal Method	Weight (t)
Intent to Recycle	225,510
Intermediate Process	1,120,884
Final Disposal	248,843
Unknown	1,713,765

Waste Metal Disposal Method	Weight (t)
Intent to Recycle	30,398
Intermediate Process	807,486
Final Disposal	14,249
Unknown	768,418





Intent to Recycle by Generator in FY2023

Waste Plastics	225.5Kt
Waste Metal	30.4Kt

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What is our BI Tool ?

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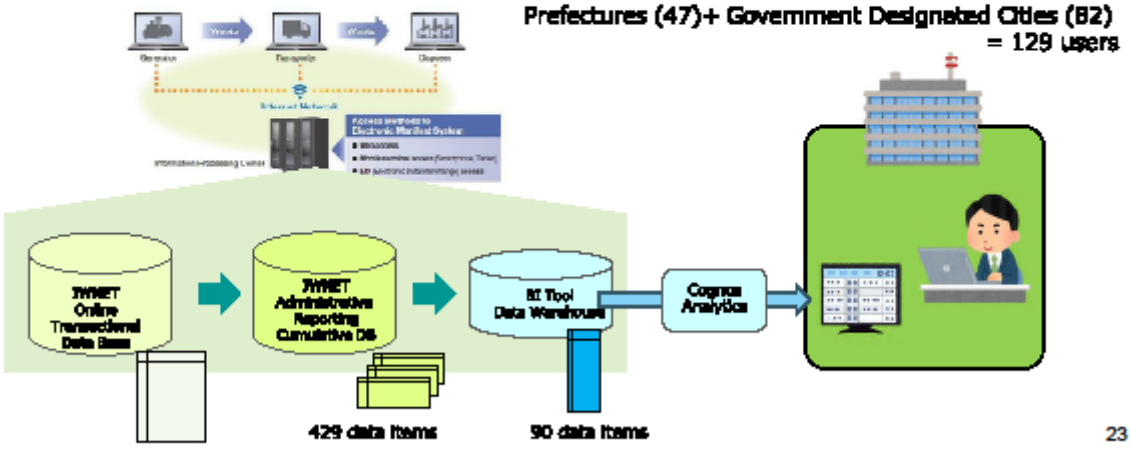
- **BI Tool was built to support Evidence-Based Policy Making for local governments**



Prefectures (47)+ Government Designated Cities (82) = 129 users

23

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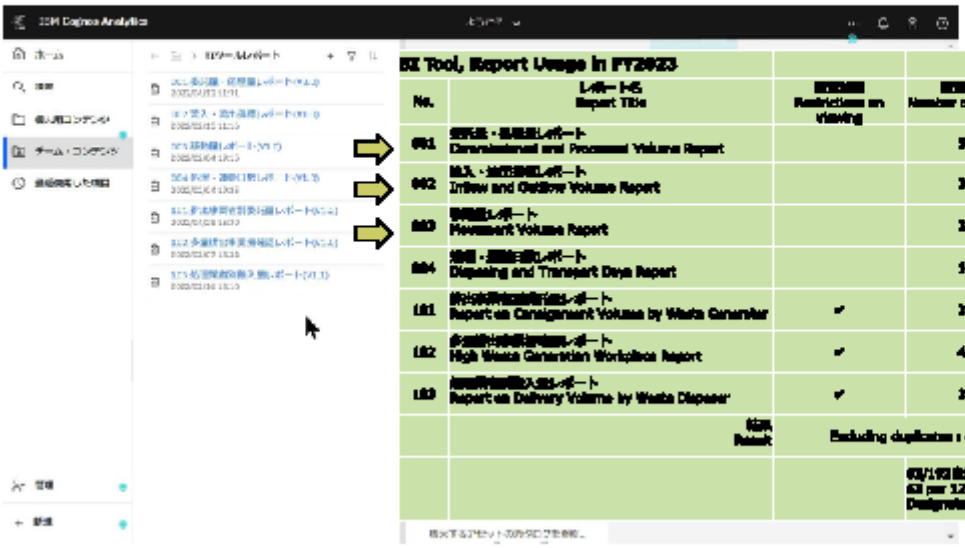
Introduction of the BI Tool, 7 reports are provided



BI Tool, Report Usage in FY2023

No.	レポート名 Report Title	閲覧制限 Restrictions on Viewing	閲覧者数 Number of Viewers	閲覧回数 Number of Views
001	受託・処理状況レポート Consignment and Processed Volume Report		94	1,380
002	搬入・搬出量レポート Inflow and Outflow Volume Report		30	710
003	移動量レポート Movement Volume Report		38	876
004	処理・運搬日数レポート Disposing and Transport Days Report		16	142
101	排出事業場別委託量レポート Report on Consignment Volume by Waste Generator	✔	32	3,880
102	多量排出事業場レポート High Waste Generation Workplace Report	✔	48	2,159
103	最終処分業者別搬入量レポート Report on Delivery Volume by Waste Disposer	✔	35	879
	延べ数 Total	Excluding duplicates : 48 (33%)		Sum : 9,784
			43 per 129 Prefectures and Ordinance Designated Cities	

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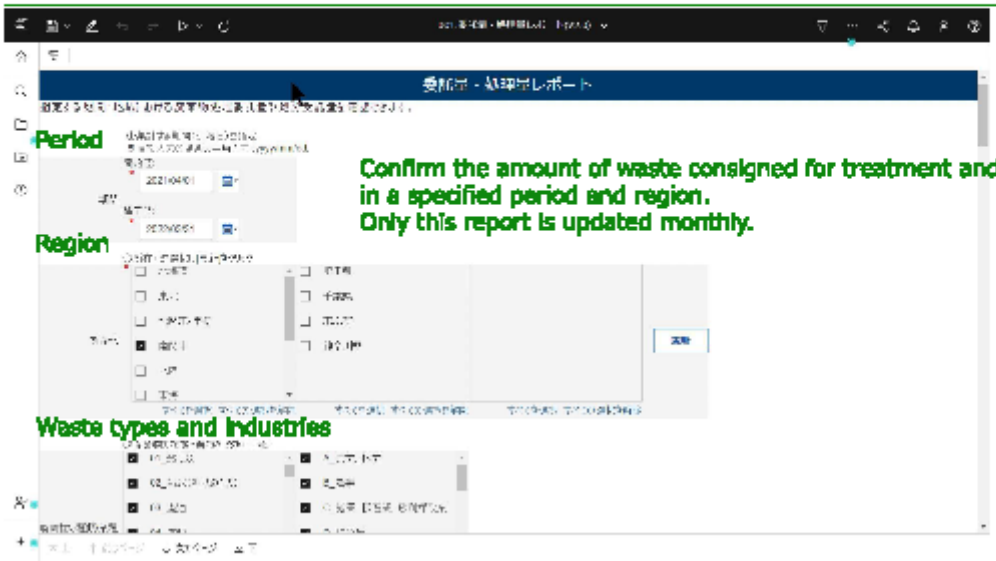
001 Amount of Waste Consigned/Disposed Report



Confirm the amount of waste consigned for treatment and disposal in a specified period and region.
Only this report is updated monthly.

25

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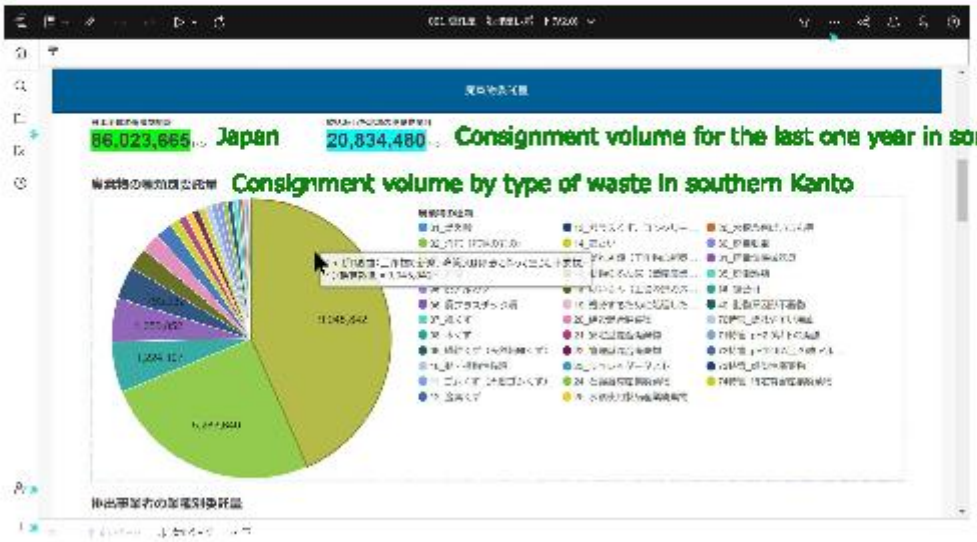
001 Amount of Waste Consigned/Disposed Report



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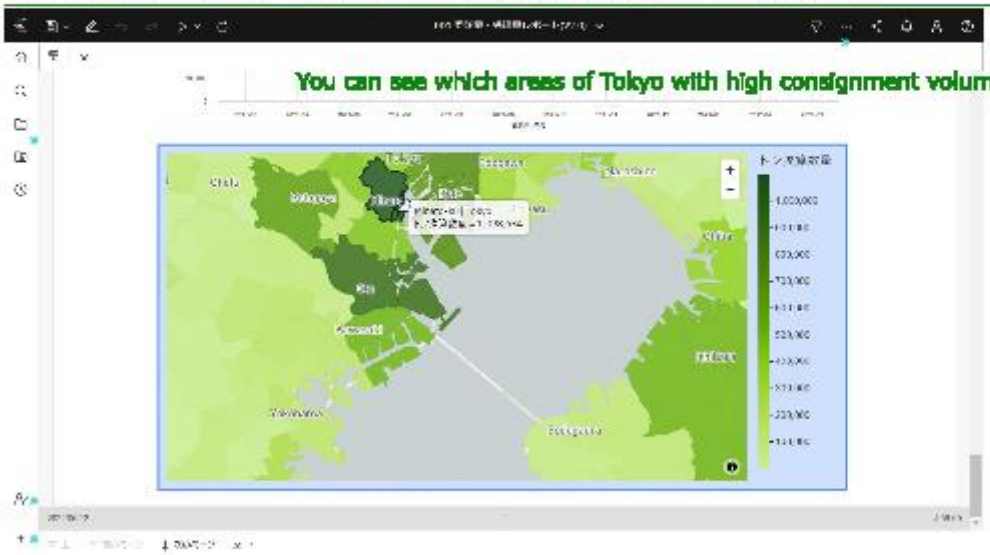
001 Amount of Waste Consigned/Disposed Report



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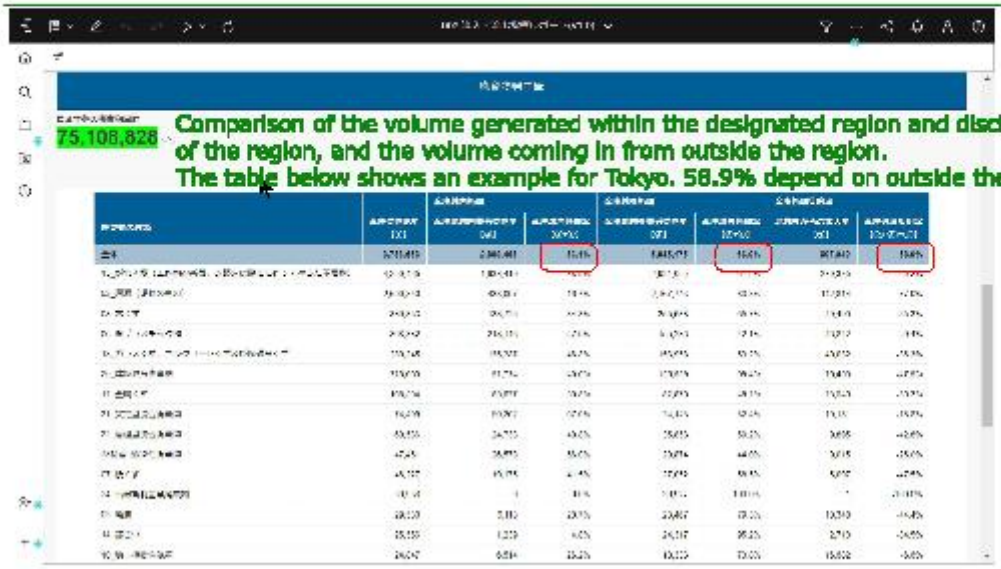
002 Waste Inflow and Outflow Report

Japan Industrial Waste Information Center

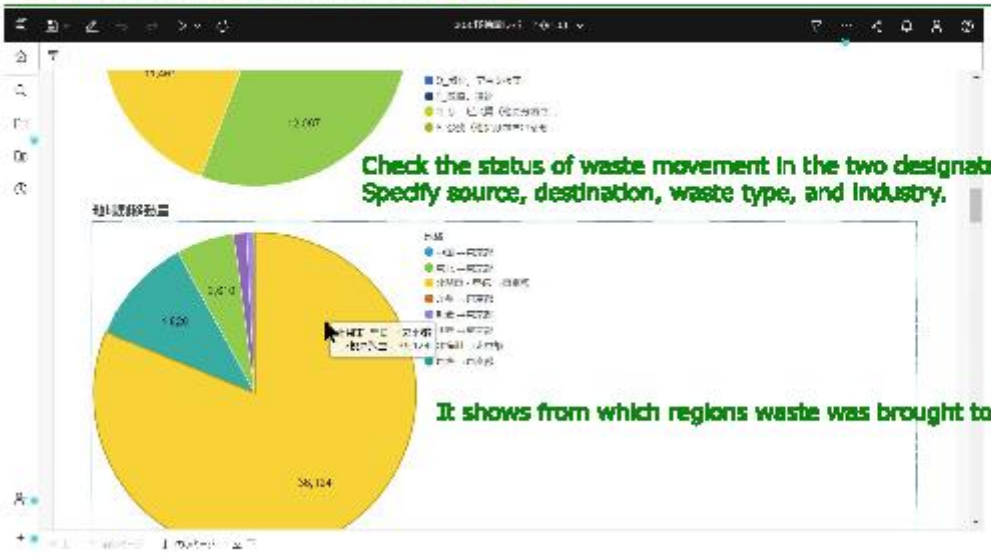


Comparison of the volume generated within the designated region and discharged out of the region, and the volume coming in from outside the region.
The table below shows an example for Tokyo. 58.9% depend on outside the region.

28

003 Waste Movement Report

Japan Industrial Waste Information Center



Check the status of waste movement in the two designated regions.
Specify source, destination, waste type, and industry.

It shows from which regions waste was brought to Tokyo.

29

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003 Waste Movement Report

The amount of waste brought in can be seen in which areas of Tokyo most of the waste is brought in.

30

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Finally

- **Information Distribution makes it possible to grow Resource Recycling**
- **JW Center is willing to contribute to our Society**

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Thank you for listening.

Taiwan: Current Situation and Transition of e-manifest System over the Past 6 Years

環境部資源循環署
Resource Circulation Administration
Ministry of Environment

5 September, 2024

Outline

- Introduction
- From Waste Management to Circular Society
- Review of Taiwan's Industrial Waste Management
  - Management Scheme
  - Industrial Waste Reporting System
  - Statistics of Total Industrial Waste Generation
  - Waste Flow Tracking Management
  - Air, Water, Waste and Toxic Substance Integrated Management Mechanism
- Future of AI: Our Latest System
  - LLM (large language model)
  - Decision Making Strategic dashboards
  - CAR3.0 e-manifest
- Future Vision

1

Introduction-Natural Resources Deficiency

Population: 23 millions

Area: 36,000 km²

Population density:
624 person/km²
(Urbanization: 78%)
(Taipei City: 9,956 person/km²)

Energy imported > 96%

Mineral imported > 80%

Food imported > 70%

2

Introduction

- **Review of Industrial Waste Management**

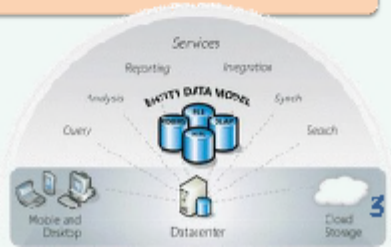
Approaches

Disposal	Reduction	Reuse and Recycling	Sustainable Materials Management; Circular Economy

Before 1990 → Mid-1990s → Mid-2000s → After 2010~

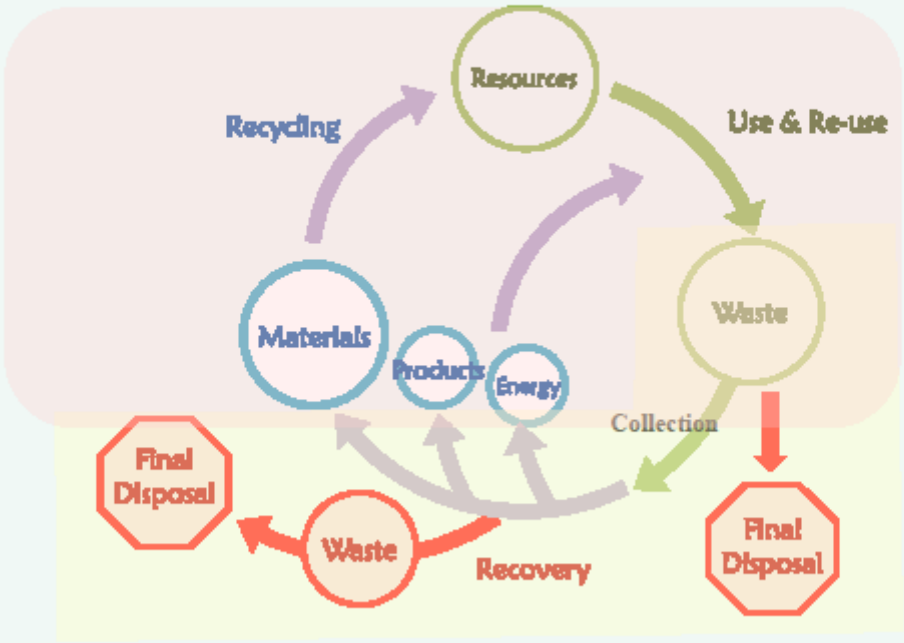
Management

Using paper for reporting	Establishing Industrial Waste Report and Management System



3

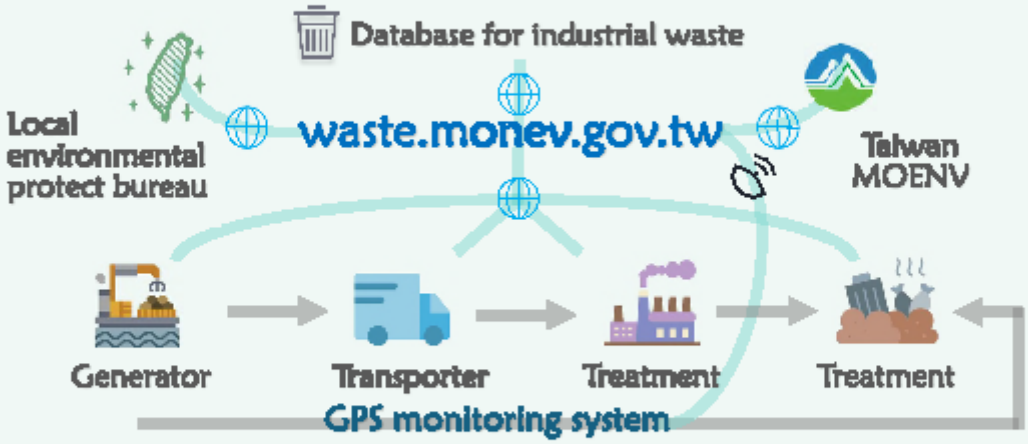
From Waste Management to Circular Society



4

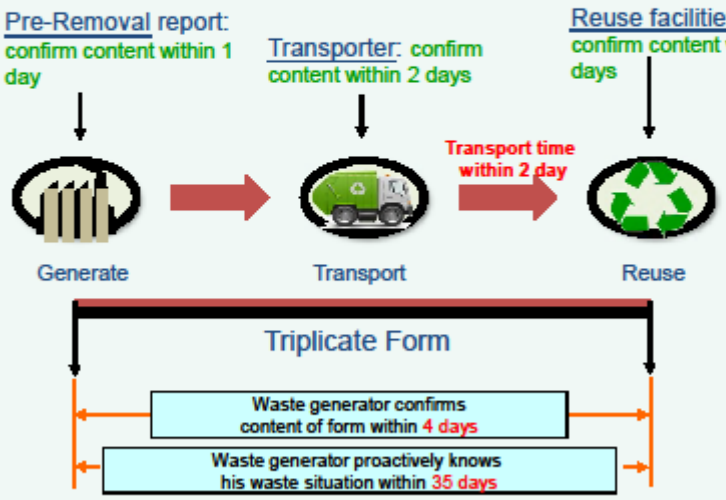
Management Scheme(1/4)

Flow Chart of Waste Disposal Tracking and Management



Management Scheme(2/4)

Use triplicate forms through IWR&MS to connect the generator, transporters, and reuse facilities.



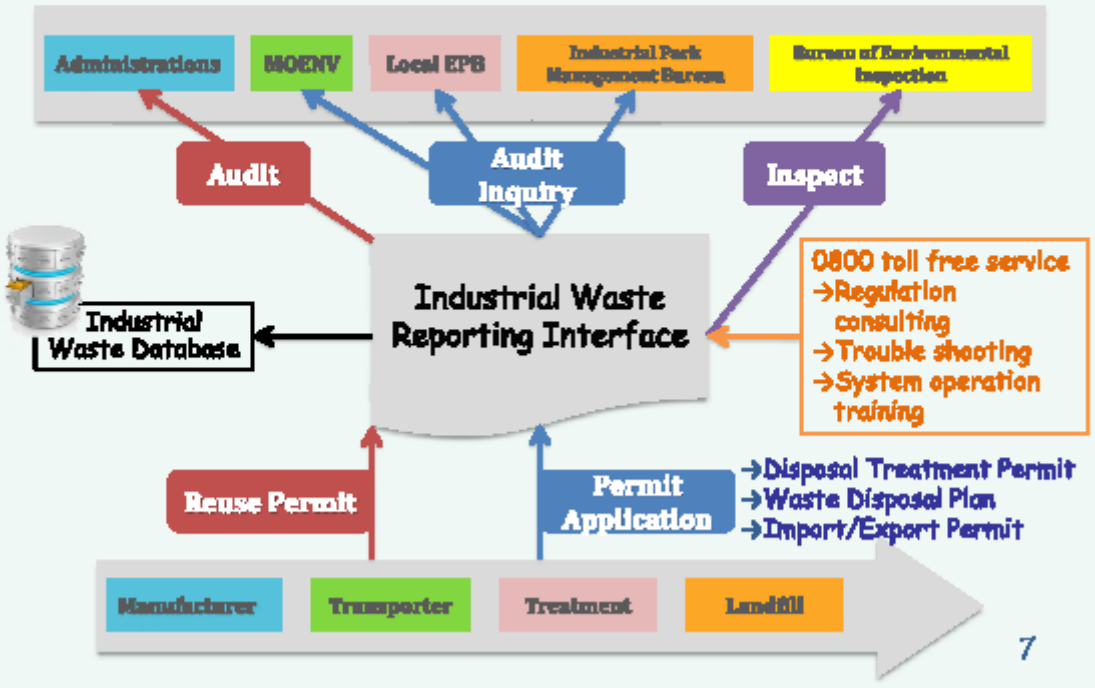
IWR&MS

Industrial Waste Report & Management System

6

Industrial Waste Reporting & Management System (IWR&MS)

- **The Function of IWR&MS**



7

Management Scheme(3/4)

- **Article 31 of the Waste Disposal Act**

Waste Generator (Manufacturer)

→Waste Disposal Plan—Raw Materials, Products, Waste Generation Process, Baseline Information

→Online Reporting

Transporter

→Permit for Transportation

→Disposal Permit

→Shipment Reporting GPS Tracking

→Operation Record Generators need not report online

Treatment or landfill

→Treatment Permit

→Treatment Report

→Operation Record

Recycling Facility -reuse

→Recycling Permit

→Recycling Report

Waste Export

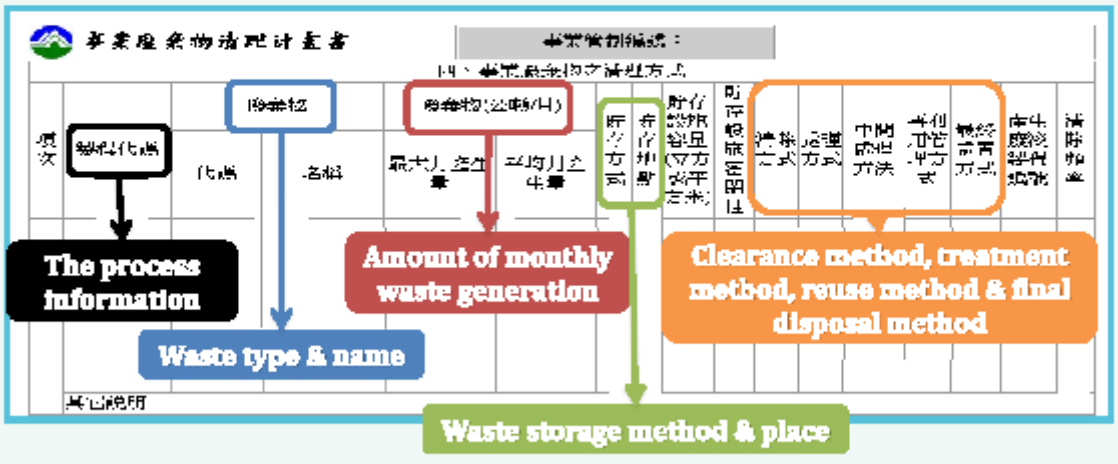
→Import/Export Permit

→Import/Export Report

8

Waste Disposal Plan Reporting

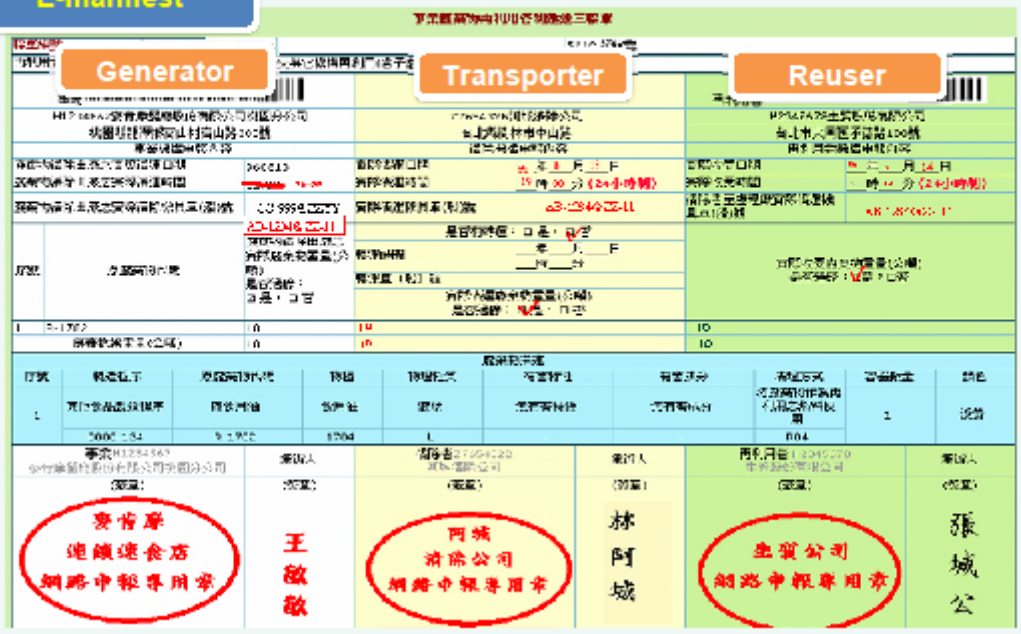
- **Waste Disposal Plan Reporting**
  - →Waste Disposal Plan



9

Reporting Waste Flow

E-manifest

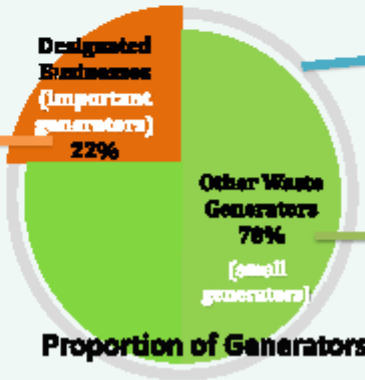


10

Management Scheme(4/4)

- **To know who the target to be controlled is**
  - → About 46,573 generators have been designated as major sources. They must submit waste disposal plans for approval before waste generation; monthly report: production capacity, amount of temporary storage, and amount of shipment.
  - → The other 20% of waste generation is from disposal facilities that make monthly reports on waste generation without manifest reporting.

E-manifest reporting indicates the information of 80% of the total waste generation. *(They produce larger quantity or hazardous waste)*

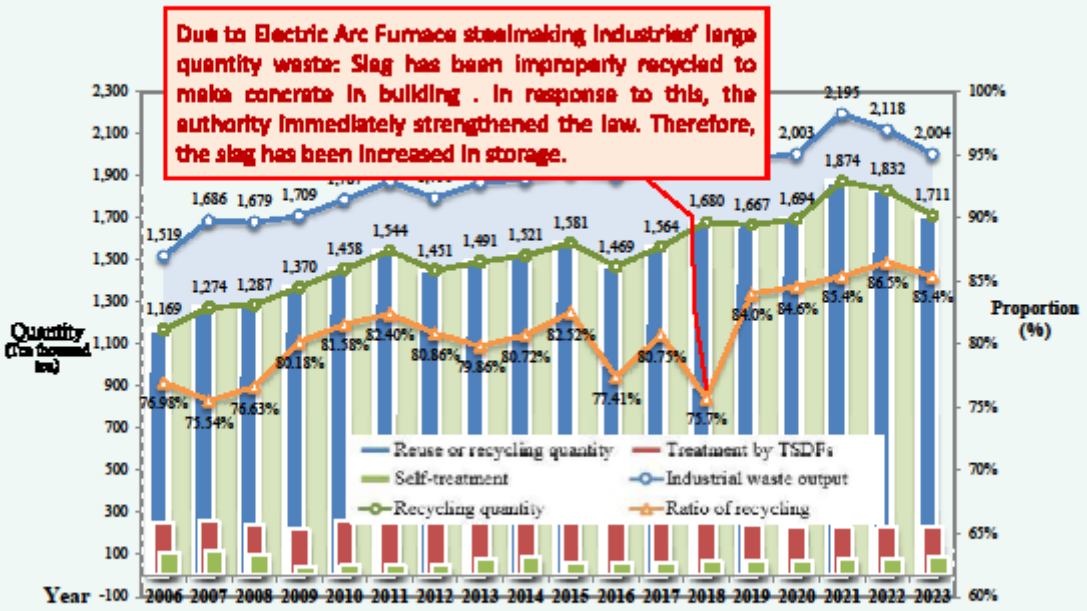


Total waste generation nationwide is controlled completely.

Operation Record indicates the information of the other 20% of the total waste generation.

11

Statistics of Total Industrial Waste Generation (1/8)

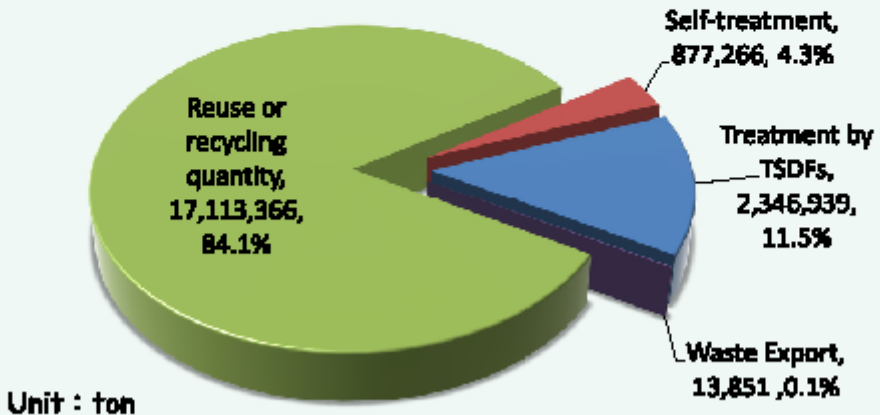


- *20.0 million tons of industrial waste was reported in 2023.*
- *Recycling rate: 85.4%*

12

Statistics of Total Industrial Waste Generation (2/8)

→ There were about 20.4 million tons of industrial waste reported online in 2023

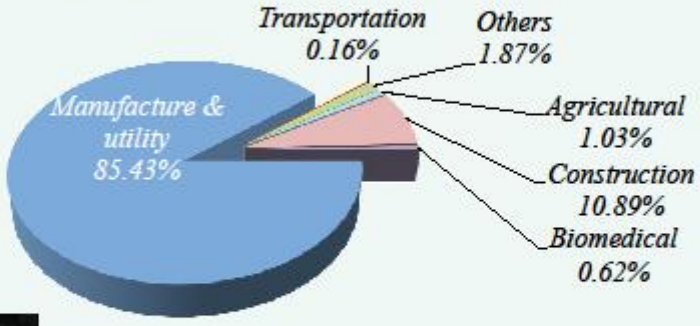


Unit : ton
Year : 2023

13

Statistics of Total Industrial Waste Generation (3/8)

- **Waste quantity by industries in 2023**



14

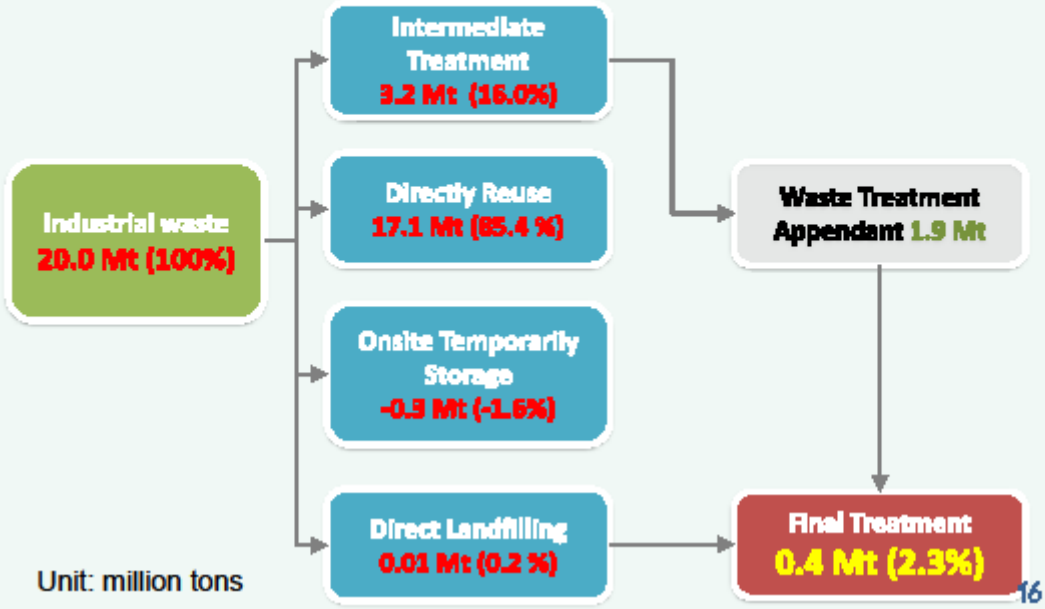
Statistics of Total Industrial Waste Generation (4/8)

Unit: million tons

15

Statistics of Total Industrial Waste Generation (5/8)

Waste Flow in 2023

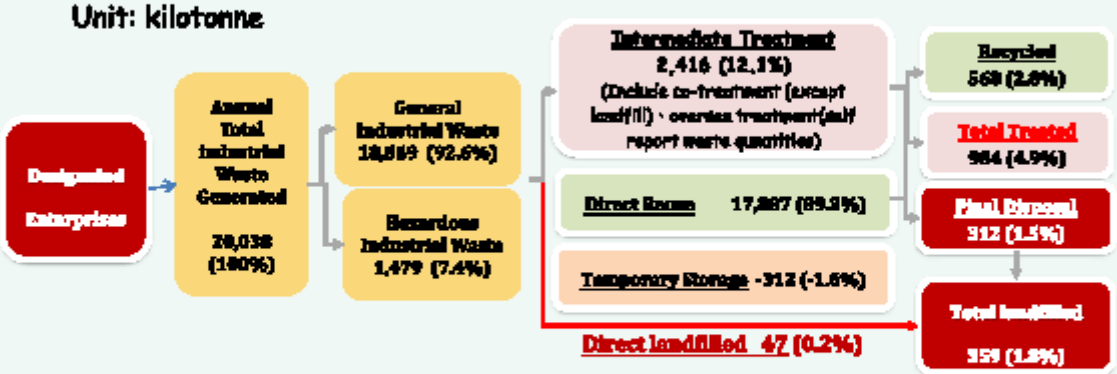


16

Statistics of Total Industrial Waste Generation (6/8)

Waste Flow in 2023

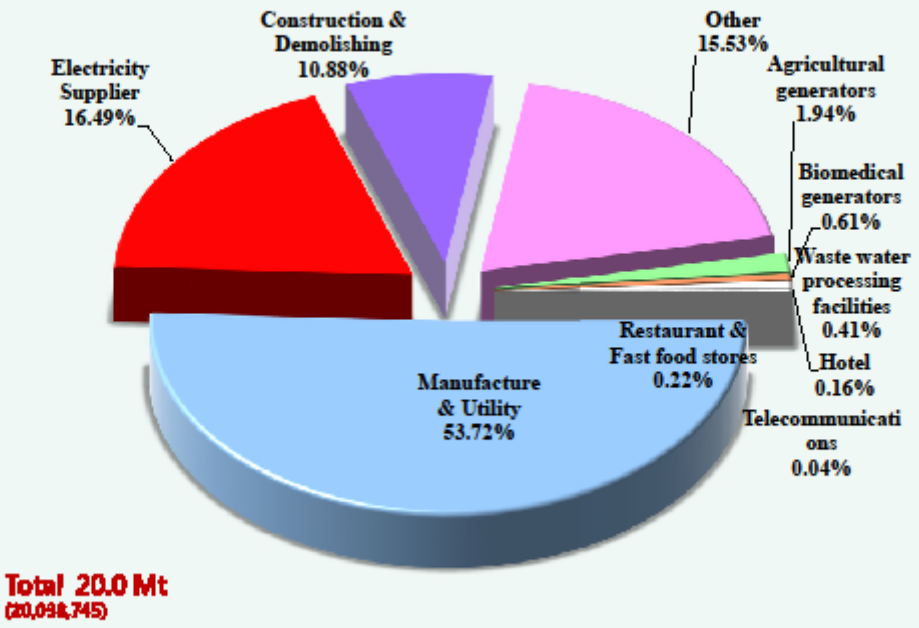
Unit: kilotonne



Unit: million tons

17

Statistics of Total Industrial Waste Generation (7/8)



18

Statistics of Total Industrial Waste Generation (8/8)

Statistics of online reports in 2023

- There were about 20.0 million tons of industrial waste in 2023.
- Currently there are about 46,573 generators, 5,186 transporters, and 230 TSDFs that are required to make online reports.
- Starting in 2002, more than 18,950 vehicles have been equipped with global positioning systems (GPS) for waste tracking, over 1,346 of which transport hazardous waste.

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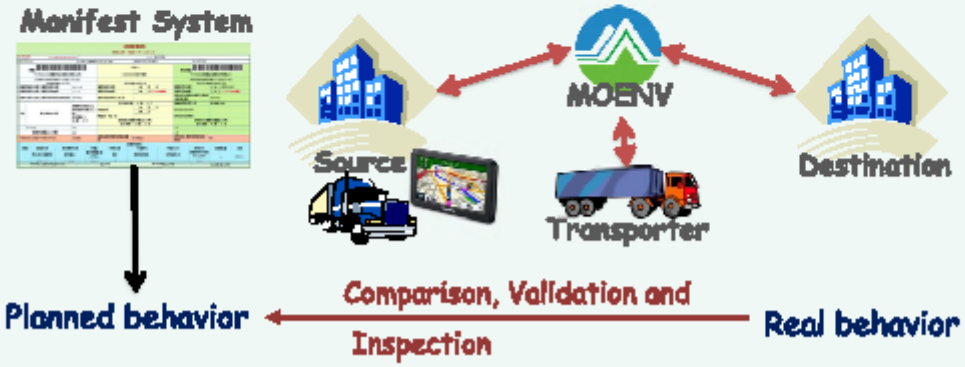
Waste Flow Tracking Management

- **Real-Time Tracking Systems Introduction**
  - → Article 31 of the Waste Disposal Act: Industrial waste clearance and transport machinery designated and officially announced by MOENV shall be installed with GPS systems, and they shall maintain normal operation.



20

Waste Flow Tracking Management

- **Real-Time Monitoring System/Alarm**
  - →Area Analysis-Integrated with Information System

When monitoring a dumping place, the government inspectors can designate a restricted area, and the GPS system will automatically monitor the area.

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Waste Flow Tracking Management

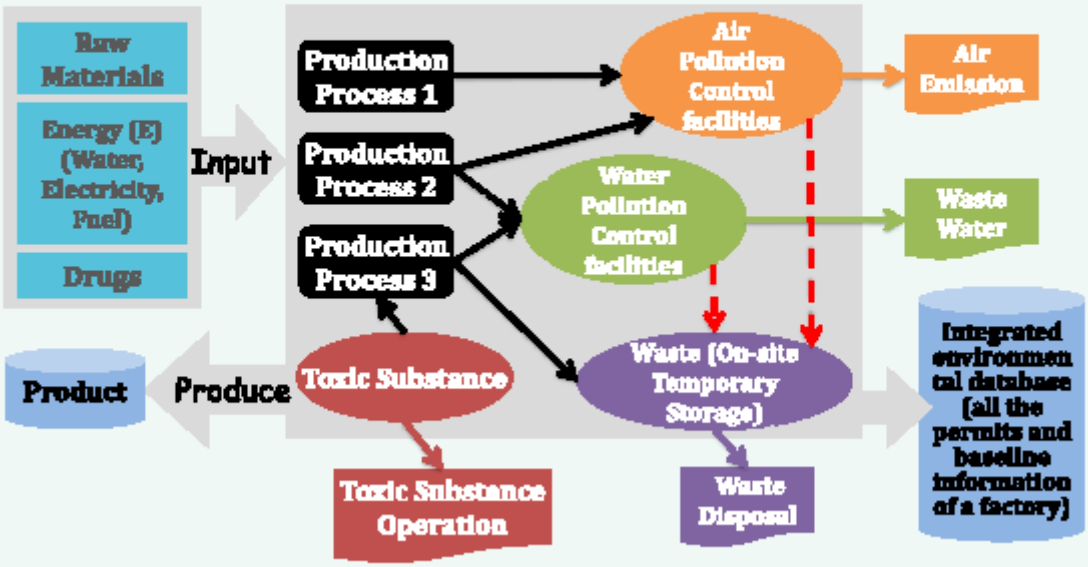
- **Paperless-Triplicate APP**

Replacing paper-based operations with mobile phones, utilizing the internet to instantly transmit release, transportation, and receipt information back to the industrial waste management system (IWMS).

Saving 360,000 sheets of paper for printing triplicate slips every year is estimated to reduce 6.48 metric tons of carbon emissions. Amount of carbon adsorbed at Meiji Jingu Shrine in 3 days

Air, Water, Waste and Toxic Substance Integrated Management Mechanism

- **Input = Pollutants + Products**



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Air, Water, Waste and Toxic Substance Integrated Management Mechanism

- **Environmental Management System (EMS) Mobile App**

24

Air, Water, Waste and Toxic Substance Integrated Management Mechanism

- **Environmental Management System (EMS) Mobile App**
  - → **EMS is able to inquire 12 permits and 7 kinds of documents.**
  - → **Functions included: GPS, map measuring, etc.**

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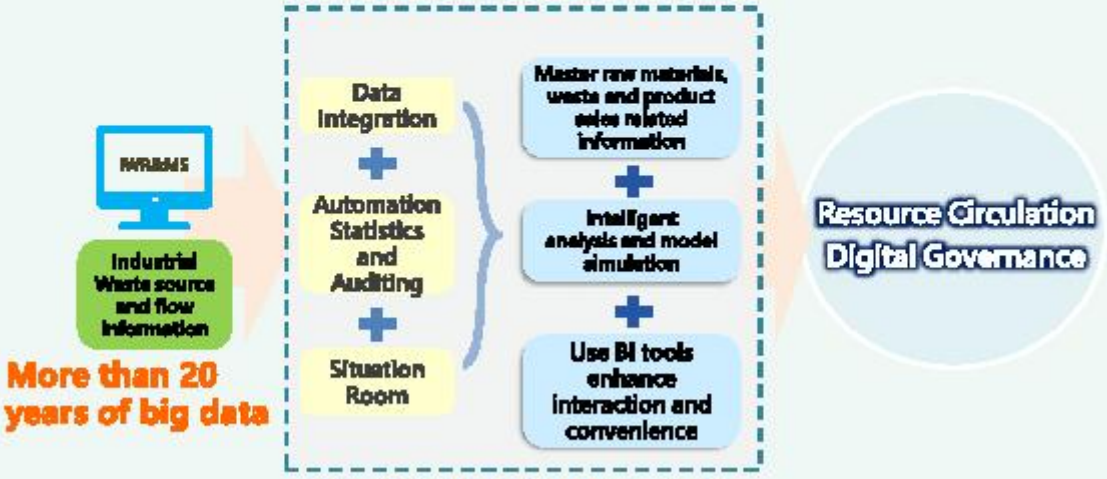
Future of AI: Our Latest System

26

Future of AI: Our Latest System

- **IWAS leverages 20 years of data for efficient resource circulation, integrating key data with real-time monitoring and smart analysis. It's a benchmark in digital governance.**



Industrial Waste Report Analysists System(IWAS)

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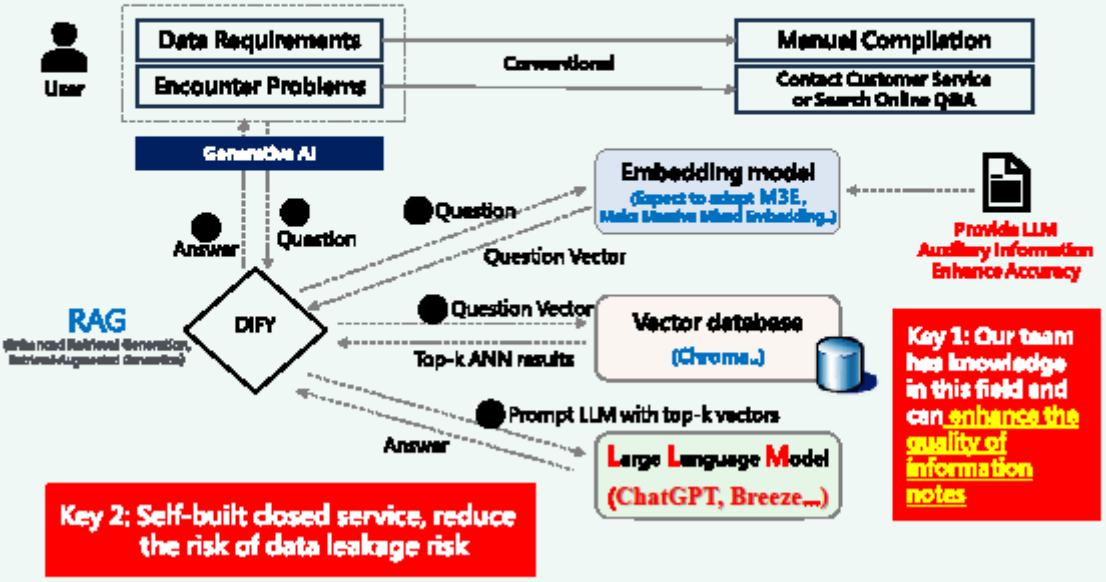
Introduction of Generative AI to Enhance User Consultation Services

Innovative Application :
Introduction of LLM (large language model)

Enhancement Effectiveness :
Consultation Not Limited to Office Hours (8hr) and Text Format



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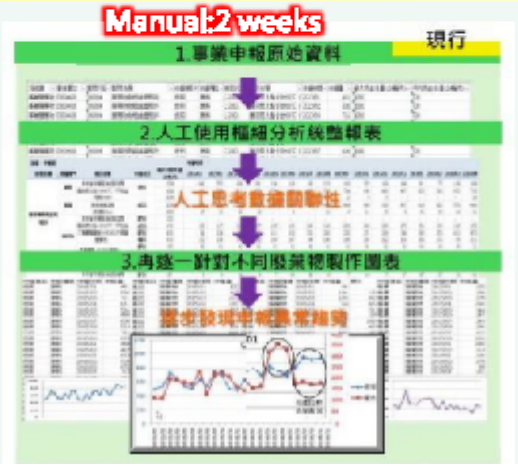
Decision Making Strategic dashboards(1/5)

- **We've cut analysis time from 2 weeks to 3 minutes, prioritized 271 companies using key factors, and improved our emergency response for sudden factory shutdowns.**

- Completed "8 Analysis Models"
- Achieved automated analysis functionality
- Adopted R language for significantly shorter analysis time



Decision Making Strategic dashboards (2/5)

- Analyzed "17 Characteristic Factors "
- Based on different application materials,Provide priority audit list

Prioritized Reviewer List

30

Decision Making Strategic dashboards (3/5)

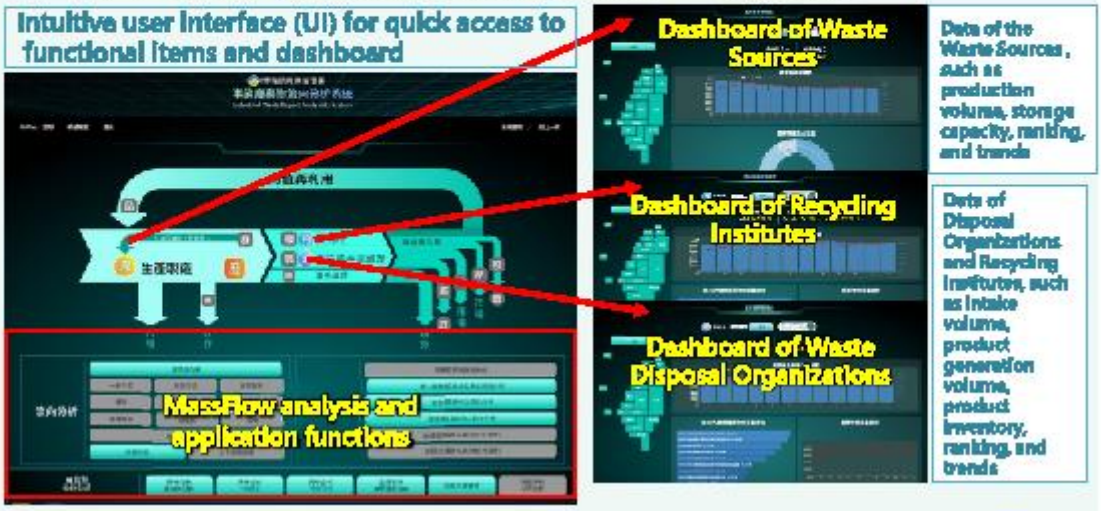
Simulate emergency detoxification response plan

Emergency decontamination configuration during simulated factory shutdown

31

Decision Making Strategic dashboards (4/5)

- **IWAS features an intuitive interface for quick access to dashboards on waste sources, recycling institutes, and disposal organizations. It provides essential data like production, storage, and trends, along with flow analysis tools for better waste management**



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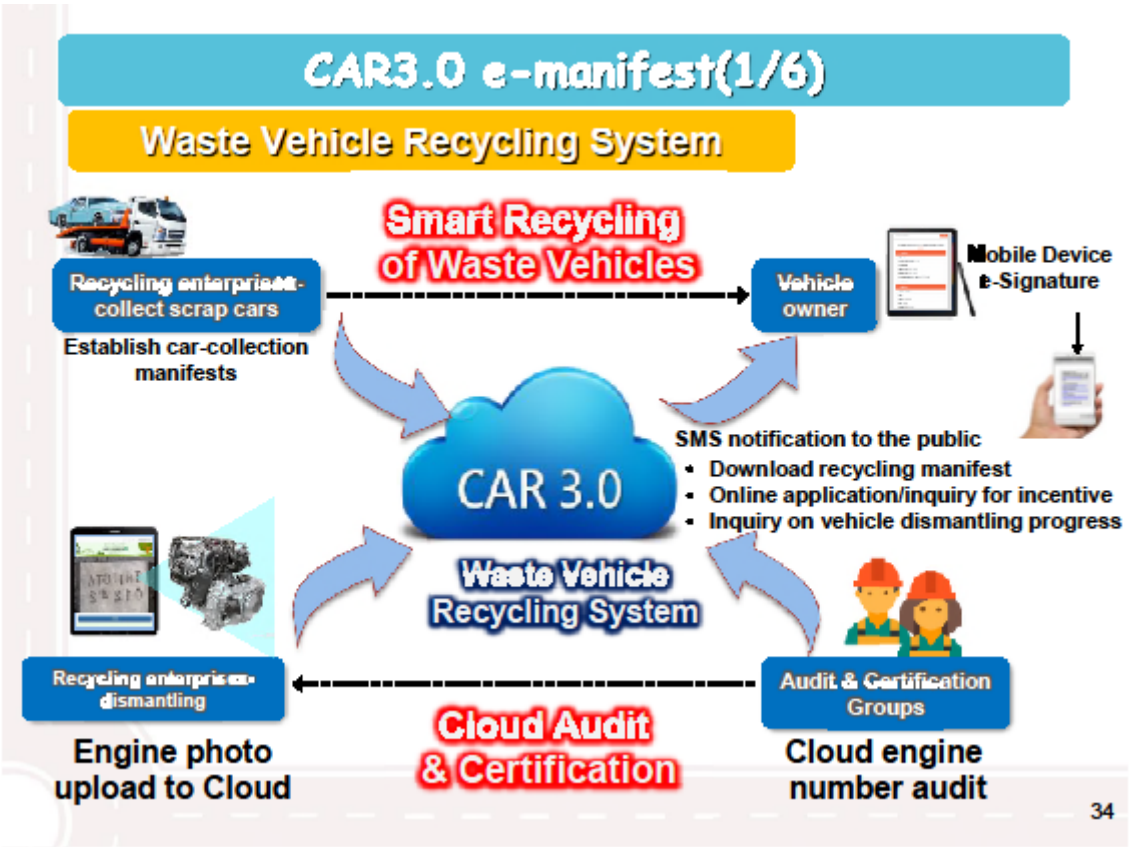
Decision Making Strategic dashboards (5/5)

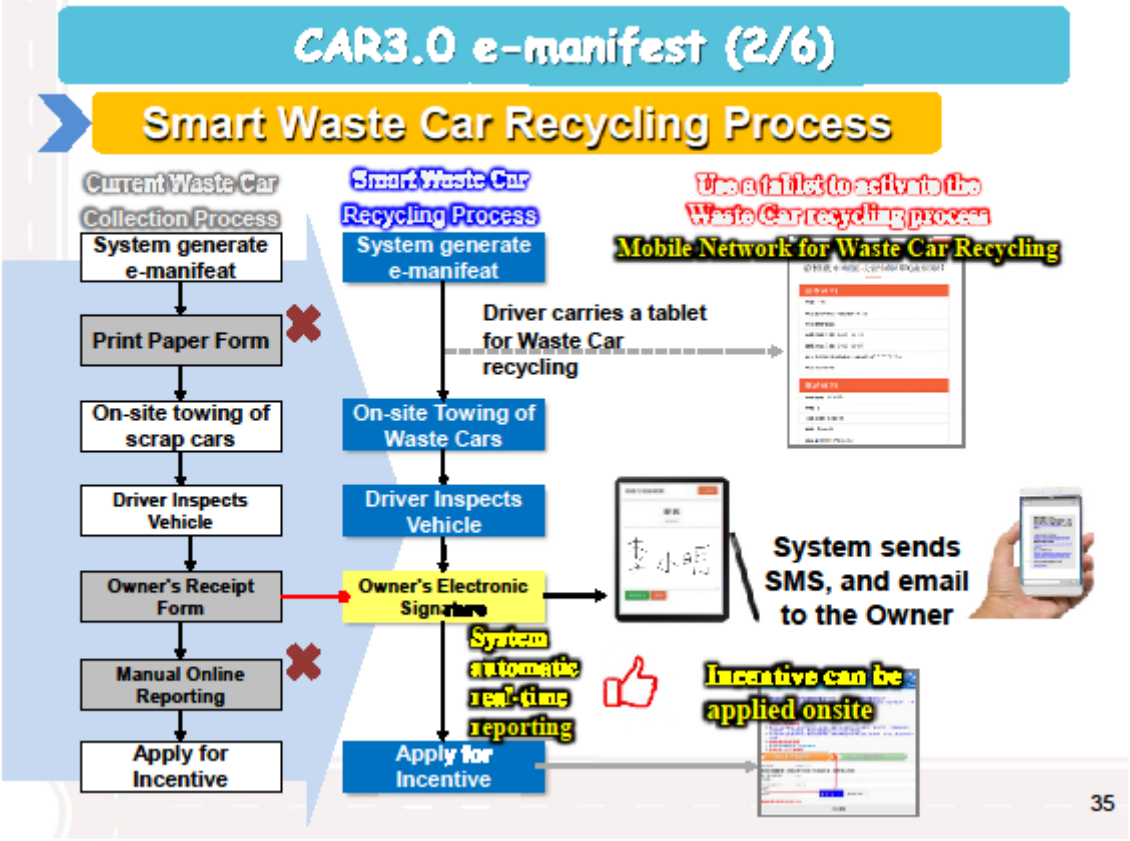
Resources Recycle DashBoard (RRDB)

- **Fully monitor resource recycling processes**
- **Including data on manufacturing, usage, Disposal, Recycling, and Reuse**

Functional Features:

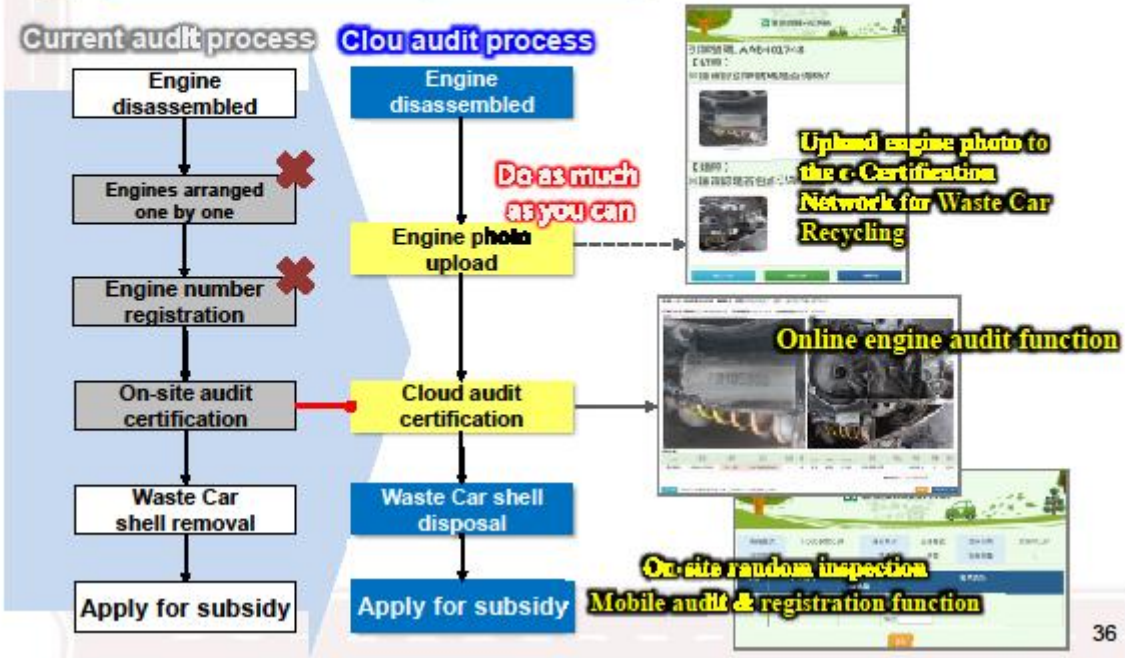
Presenting recycling issues with a playground diagram, drilling down from macro to micro levels


CAR3.0 e-manifest(1/6)
Waste Vehicle Recycling System
Smart Recycling of Waste Vehicles
Recycling enterprises-collect scrap cars
Establish car-collection manifests
Vehicle owner
Mobile Device e-Signature
SMS notification to the public
Download recycling manifest
Online application/inquiry for incentive
Inquiry on vehicle dismantling progress
CAR 3.0
Waste Vehicle Recycling System
Recycling enterprises-dismantling
Audit & Certification Groups
Engine photo upload to Cloud
Cloud Audit & Certification
Cloud engine number audit
34


CAR3.0 e-manifest (2/6)
Smart Waste Car Recycling Process
Current Waste Car Collection Process
System generate e-manifeat
Print Paper Form
On-site towing of scrap cars
Driver Inspects Vehicle
Owner's Receipt Form
Manual Online Reporting
Apply for Incentive
Smart Waste Car Recycling Process
System generate e-manifeat
Use a tablet to activate the Waste Car recycling process
Mobile Network for Waste Car Recycling
Driver carries a tablet for Waste Car recycling
On-site Towing of Waste Cars
Driver Inspects Vehicle
Owner's Electronic Signature
System sends SMS, and email to the Owner
System automatic real-time reporting
Incentive can be applied onsite
Apply for Incentive
35

CAR3.0 e-manifest (3/6)

Cloud audit process



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Performance of CAR3.0 (4/6)

Save overall costs by NT$41.93 million/yr, reduce 33,000 kg of CO_2 emissions

Recycling enterprises

- Save Audit Certification Manpower: 23%
- Shorten Engine Storage Time: 1~2 Months→3 Days
- Increase Engine Storage Space Utilization: 80%
- Save Paper Usage:
- About 1.84 million sheets/yr (save 220 trees from being cut down)

Public

- Early incentive application: 3~5 Days→Immediate
- Provide incentive application service simultaneously with car collection

Audit & certification groups

- Save Audit Travel Time: 35 hr/month
- Advance Audit & Certification: 1~2 Months→3 Days

MOENV

- Save audit & certification costs: NT$4 million per year

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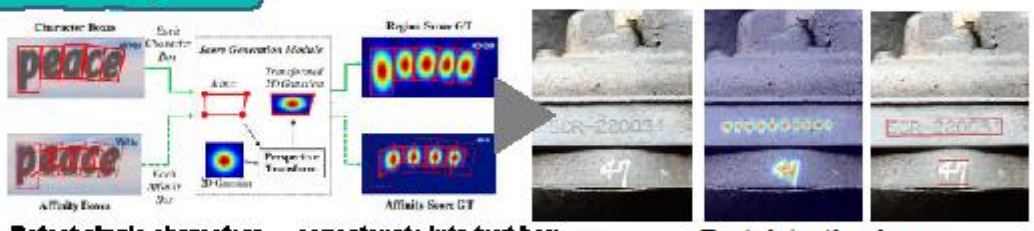
Train and Test Smart Discriminative AI to recognize engine numbers (5/6)

- Its core technology is a two-stage algorithm, first detecting the text box, then recognizing the text

Detection algorithm



Detect single characters → concatenate into text box

Text detection box

Discriminative algorithm

Correct text box → ..... →Decoder

Recognize text 5CR-220031

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Automatic Engine Number Recognition Module (6/6)

1

Enhance number positioning accuracy

Cut longer engine numbers into two groups of text to ensure all text can be fully recognized

Before cutting 55% and after 55%

2

Complete comparison of vehicle body number

Use local recognition results for comparison If all characters match, it is deemed as passed

Local recognition results match the correct engine number

The accuracy reached 99.5%, now AI-based recognition can be the primary method, with human assistance as a supplement, and adjustments should be made according to the manual.

39

Future Vision

- Develop digital transformation and integrate services to improve efficiency, deepen recycling and strengthen cooperation
- As of now the total amount of data in our database is 200 million. It is substantial enough to be considered Big Data. We have developed the OLAP system for over 20 years, and we developed a new infographic, interactive, statistical system(A powerful AI tool) for better decision making.
- We are riding the wave of AI, and we are also in the transition period of a new era. Taiwan is committed to the development of various digital and intelligent applications and continues to move towards net zero and a better life.

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Thank you for your kind attention

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Industrial Waste
Management System
Ministry of Environment
Korea Environment Corporation
Allbaro


CONTENTS
01 Industrial Waste Management System of Korea
02 Industrial Waste management system "Allbaro"
03 Real-time Waste Processing Information System "Siren System"
04 Siren system effect

01

Industrial Waste Management System of Korea

Industrial Waste Management System of Korea

Industrial Waste Management System "Allbaro" (www.allbaro.or.kr)

A system that transparently manages the whole processes of generating, transporting, disposing industrial waste through the Internet in real-time

Hazardous / Industrial / Construction / Medical / Ex-Imported Waste

Livestock excretions electronic delivery management system (www.lers.or.kr)

A system for managing in real time the whole process of discharge, transportation, and disposal of livestock excreta or liquid manure by using the eletronic note and the vehicle installation verification equipment, and of inducing the proper treatment

livestock excretion

Real-time Waste Processing Information System "Siren" (www.allbaro.or.kr/siren)

A system that automatically collects and uploads real-time waste processing information (GPS, Waste Weight, CCTV)

Hazardous / Industrial / Construction / Ex-Imported Waste

RFID Food Waste Management System (www.citywaste.or.kr)

RFID food waste management system which is able to measure the discharged volumn and manage the information

Food Waste

02

Industrial Waste management system “Allbaro System”

Allbaro

Current state of progress

Allsuro

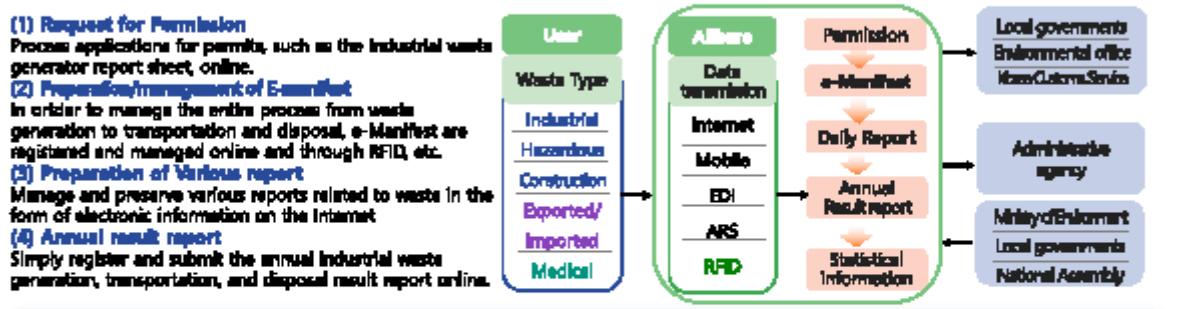
System cofiguration

(1) Request for Permission
Process applications for permits, such as the industrial waste generator report sheet, online.

(2) Preparation/management of E-manifest
In order to manage the entire process from waste generation to transportation and disposal, e-Manifest are registered and managed online and through RFID, etc.

(3) Preparation of Various report
Manage and preserve various reports related to waste in the form of electronic information on the Internet

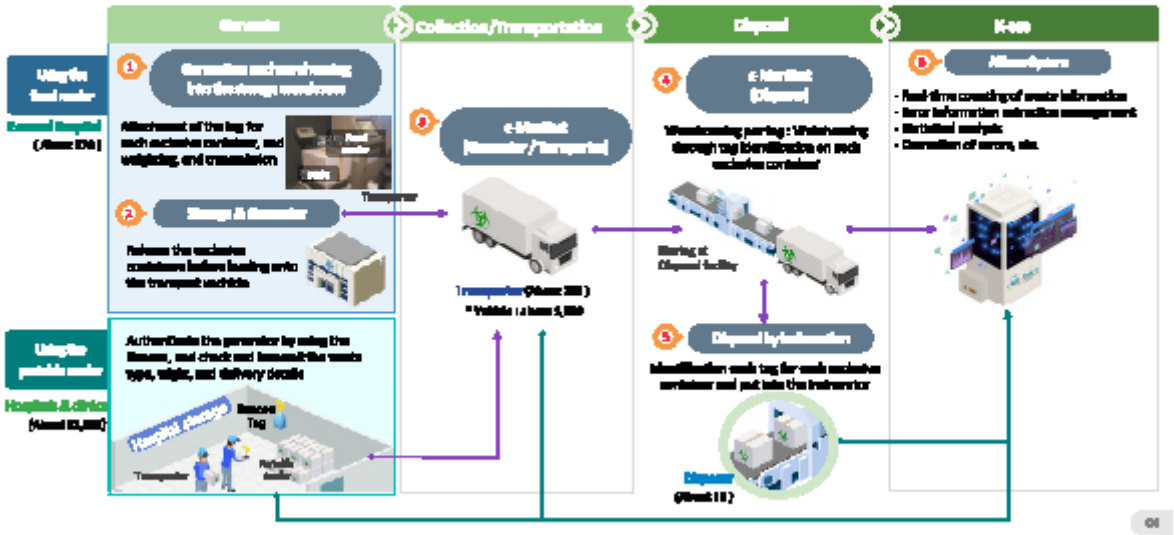
(4) Annual result report
Simply register and submit the annual industrial waste generation, transportation, and disposal result report online.



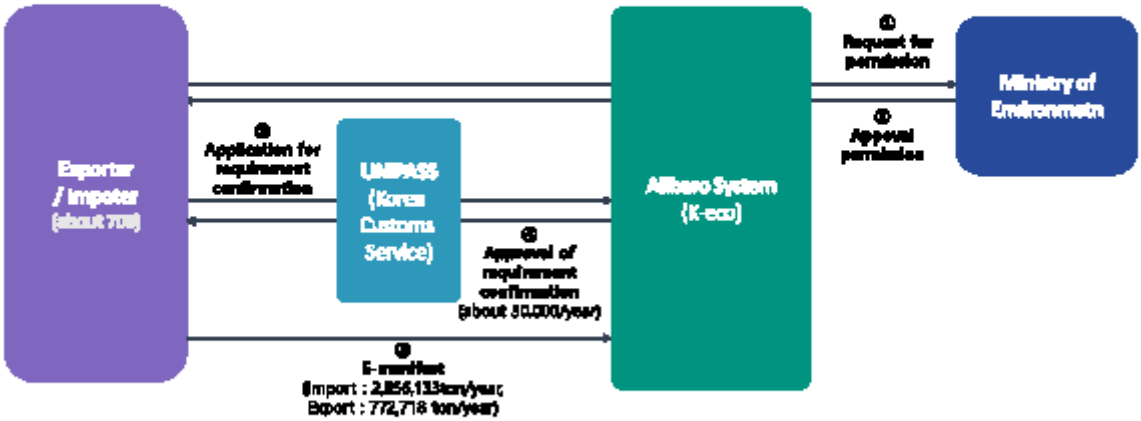
e-Manifest Flow

Allsuro

The Process of Medical Waste Management(RFID medical system)



The Process of Exported/Imported waste Permission



03

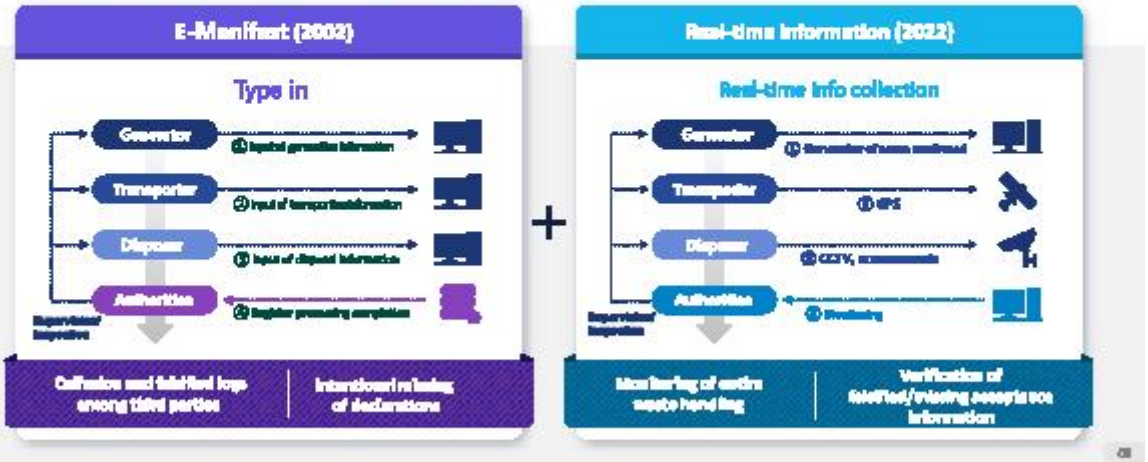
Real-time Waste Processing Information System "Siren System"

Siren System

Background to System Adoption

e-Manifest is not sufficient to prevent intentional illegal waste handling.

→ A system of real-time monitoring of waste generation, transport, and disposal is required.



Siren System

What is Siren System?

Automated collection and upload of real-time waste processing information

Siren System

How Siren system Will Be Used - ① Verfication of e-Manifest

Siren System

How Siren system Will Be Used - ② Illegal detection with AI

Siren System

How Siren system Will Be Used - ② illegal detection with AI

Analysis of suspicious transport behavior (delays, night transport, stops)

Analysis of transport vehicles' routes and stops to detect infringements

Analytical model

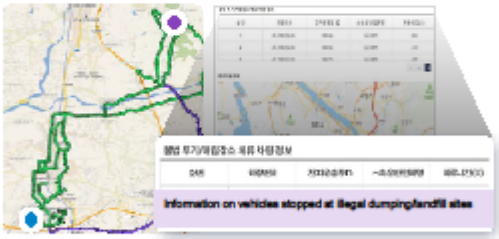
- Recognition of stopped vehicles
- Recognition of differences between normal routes and actual routes taken

Suspicious routes and stops of individual transport vehicles are identified to be analyzed

Detection of transport vehicles in illegal dumping/landfill sites

Analytical model

- Marking of illegal dumping/landfill sites
- Identification of routes and vehicle stops within marked sites



Listing of illegal dumping/landfill sites in different regions and visual data on vehicles making stops at such sites

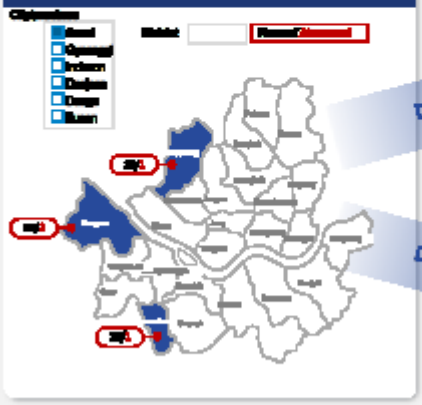
Siren System

How Siren system Will Be Used - ③ Information Sharing

Sharing of analyzed data with local governments and the competent agencies

Provision of real-time monitoring of waste handling

Control monitoring system – dashboard



Drilldown

Drilldown

Management of issues

City/province	District	Operator	Terminal ID	Status
[illegible]	[illegible]	[illegible]	[illegible]	Normal
[illegible]	[illegible]	[illegible]	[illegible]	Abnormal

Status | Authentication | Communication | Infringement management | Failure management

Uploaded processor data

Acceptance date	Operator	Vehicle No.	Declared weight	Measured weight	Status
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	match
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	mismatch

Uploaded data | Real-time management of uploaded data | Real-time management of measured data | Management of normal data | Management of abnormal data

04

Siren System Effects

Anticipated Effects

Siren system Effect

Detection of abnormal transport routes,
such as via areas suspected of illegal waste dumping

Prevention of waste processing information errors and falsifications

Prevent illegal activities
such as preventing ilegal transport of waste using unlicensed vechicles

External	Internal
No more blind spots in waste management	**Simplified** monitoring of waste management
Improved reliability for safer waste management	**Improved utility** of waste management data


The beautiful environment and healthy future created by "Allbaro"
THANK YOU
Dayoung Kim | kimdy527@keco.or.kr
Ministry of Environment
Korea Environment Corporation
Allbaro
Allbaro system https://allbaro.or.kr
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