

**Welcome**



**Case study for upgrading technology on circular economy for non-woven textile and garment industry**

**Edward Fong, Senior Consultant SMD**



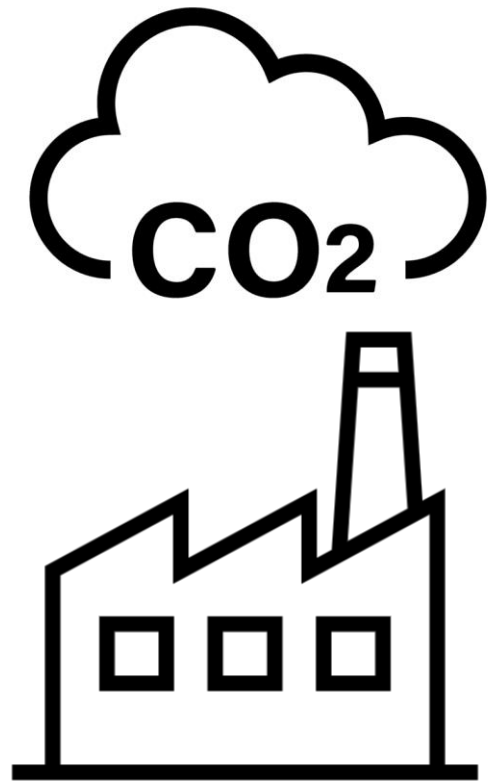
# Background

# Hong Kong Climate Action Plan 2050

- 《香港氣候行動藍圖2050》提出的**四大減碳策略**涵蓋以下目標和措施
- **一淨零發電**：二〇三五年或之前不再使用煤作日常發電，增加可再生能源在發電燃料組合中的比例至7.5%—10%，往後提升至15%；並試驗使用新能源和加強與鄰近區域合作，長遠達至二〇五〇年前淨零發電的目標。
- **一節能綠建**：通過推廣綠色建築、提高建築物能源效益和加強實行低碳生活，減少建築物的整體用電量。目標是在二〇五〇年或之前，商業樓宇用電量較二〇一五年減少三至四成，以及住宅樓宇用電量減少兩至三成；並在二〇三五年或之前能達到以上目標的一半。
- **一綠色運輸**：通過推動車輛和渡輪電動化、發展新能源交通工具及改善交通管理措施，長遠達至二〇五〇年前車輛零排放和運輸界別零碳排放的目標。政府會在二〇三五年或之前停止新登記燃油和混合動力私家車，亦於推廣電動巴士及商用車輛的同時，計劃在未來三年內，與專營巴士公司及其他持份者合作，試行氫燃料電池巴士及重型車輛。
- **一全民減廢**：為實現二〇五〇年前廢物處理達至碳中和的目標，政府會致力在二〇三五年或之前發展足夠的轉廢為能設施，以擺脫依賴堆填區處理生活垃圾。政府亦會加強推動減廢回收，預計在二〇二三年落實垃圾收費及二〇二五年起分階段管制即棄塑膠餐具。
- 未來15至20年，政府將投放約**2,400億元**，推行各項減緩和適應氣候變化的措施。環境局亦將成立新的氣候變化與碳中和辦公室，加強統籌和推動深度減碳工作，並成立應對氣候變化的專責諮詢委員會，鼓勵社會各界包括青年人積極參與氣候行動。

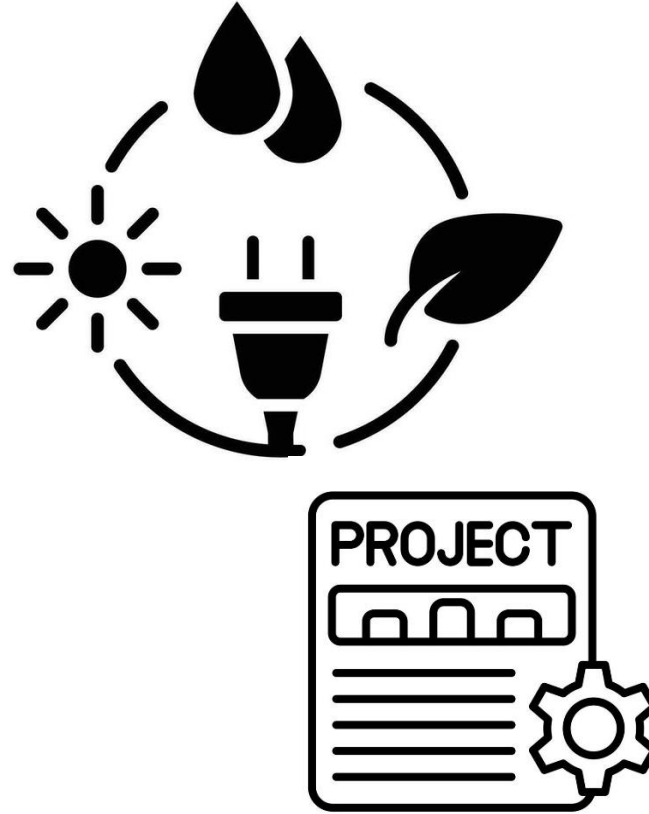


# What is Carbon Neutrality?



Emissions from factory

+



Offset project for  
emission elimination

=

0

Zero Emissions

# CBAM Carbon Adjustment Mechanism

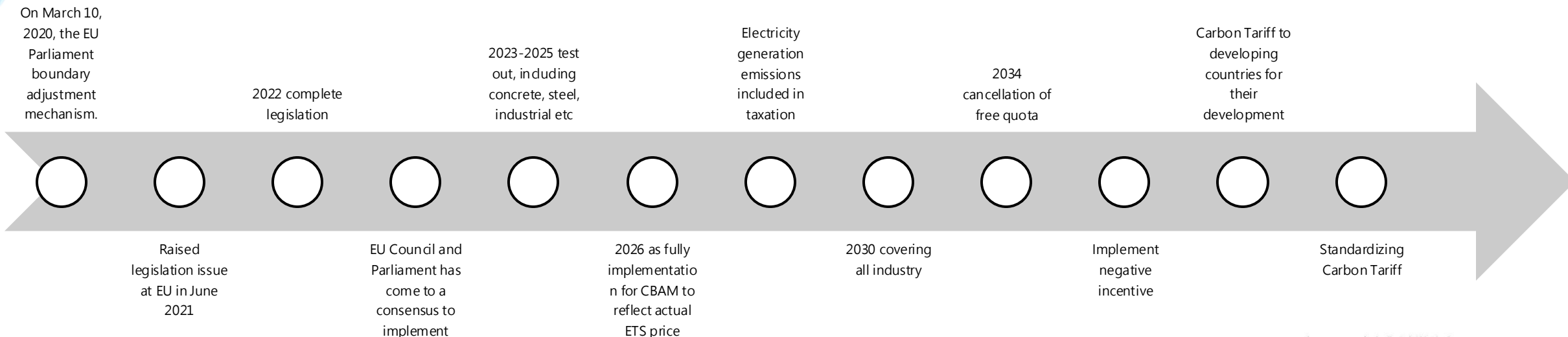
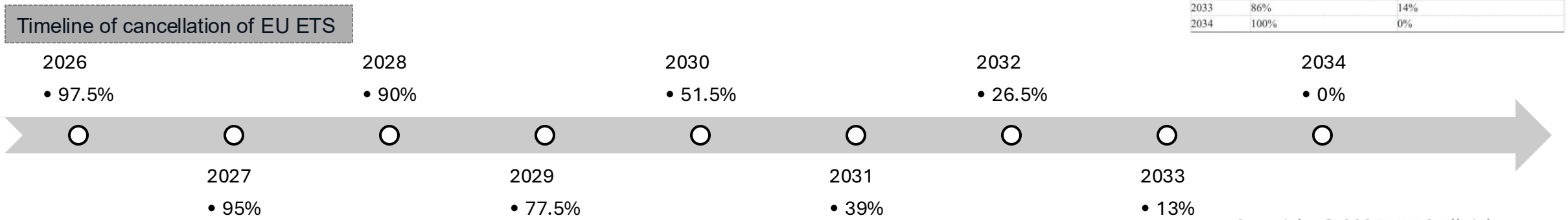


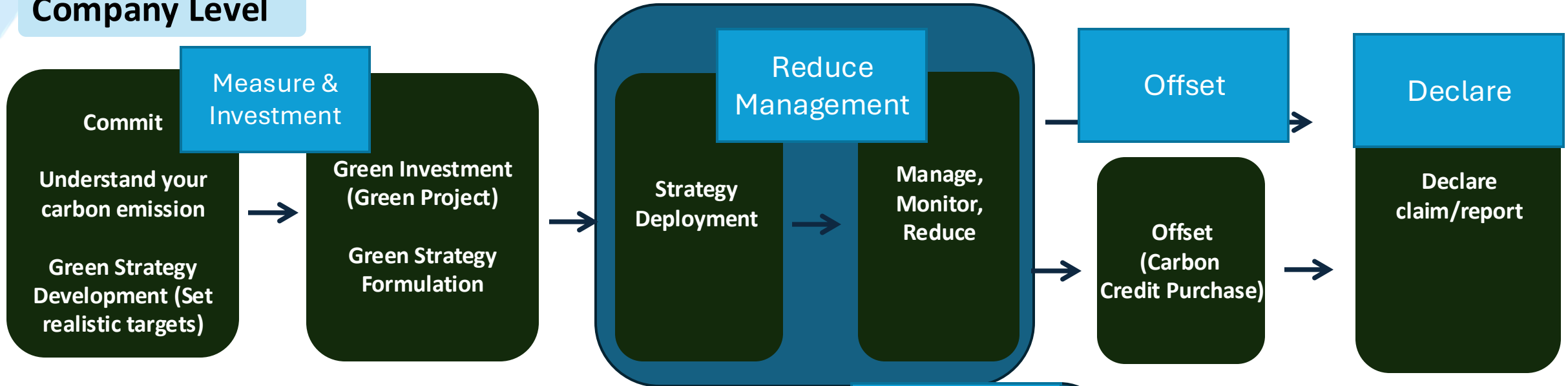
表 1 CBAM 与免费配额的关系

年份	进口产品的 CBAM 负担	EU ETS 免费配额
2026	2.5%	97.5%
2027	5%	95%
2028	10%	90%
2029	22.5%	77.5%
2030	48.5%	51.5%
2031	61%	39%
2032	73.5%	26.5%
2033	86%	14%
2034	100%	0%

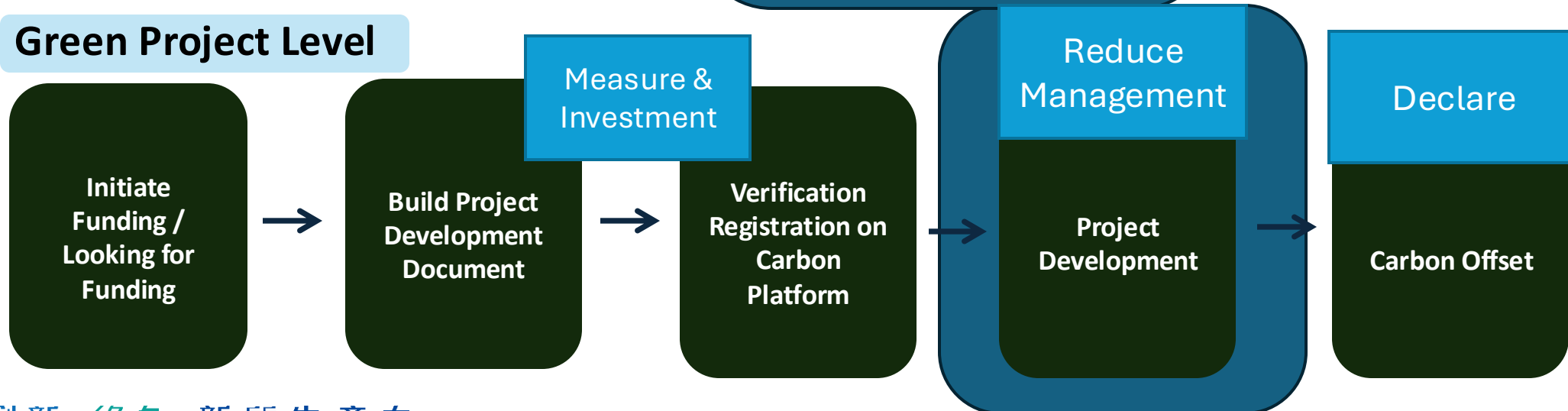


# Procedure to achieve Carbon Neutrality

## Company Level



## Green Project Level



# Case Study in Hong Kong

# Case Study - Destruction & Recycle Company

- Hong Kong **Environmental Protection Department** approved licensee
- Collecting, **sorting and recycling** of a variety of products
- Banks, luxury brands, semiconductor manufacturing companies, electronic equipment companies, telecommunication equipment companies, machinery manufacturers, optics manufacturers and original equipment manufacturers, etc.



**Wing Kai Destruction & Recycle Company**



# Luxury brands



BURBERRY



LOUIS VUITTON



GUCCI



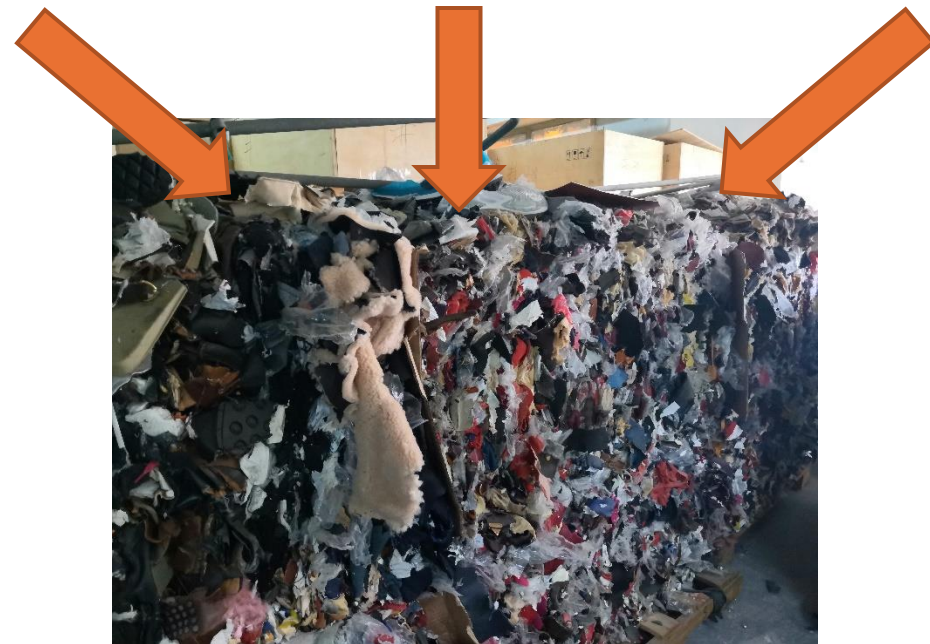
PRADA



Products with  
IP logos

Ageing  
inventory

Defects and  
returns



# Market

Source: 香港環境保護署

圖表 2.8 2019年於堆填區棄置的都市固體廢物成分  
- 按廢物種類劃分

成分	每日平均量(每日公噸數)及按重量計算的百分比		
	家居廢物	工商業廢物	都市固體廢物
	(a)	(b)	(c)=(a)+(b)
玻璃	162	91 (2.0%)	253 (2.3%)
金屬	126 (1.9%)	131 (2.9%)	256 (2.3%)
紙料	1,433 (21.9%)	1,271 (28.2%)	2,704 (24.5%)
塑料	1,247 (19.0%)	1,073 (23.8%)	2,320 (21.0%)
易腐爛的廢物	2,513 (38.3%)	1,143 (25.4%)	3,656 (33.1%)
紡織物	240 (3.7%)	99 (2.2%)	339 (3.1%)

Used clothes



Leftovers



Defective



Recycle

Acoustic textiles

Carpet

Geotextiles

Insulation materials

Cleaning rags



# Recycling Industry

❖ GREEN MANUFACTURING

## Non-woven Fabrics Manufacturing System with Recycled Garment

Products with IP logos

Ageing inventory

Defects and returns



- ❖ Conduct Experiments on Different Sorting Criteria and Machine Processing Parameters
- ❖ Develop Operation Workflow for Sorting Process.



## Wing Kai Destruction & Recycle Company

Used clothes

Leftovers

Defective

Recycle





# Process Enhancement

# Research Focus

## Textile and Smart Wearable

### Processing

- "Quick learning" robotic application
- Soft materials handling
- Machine vision inspection with AI
- Advanced surface decoration e.g. laser



### Smartification

- Data monitoring and analysis for textile machinery and warehouse

### Testing

- Testing for conventional mechanical watch

### Current



### The Future

### Processing

- Upcycling and recycling for textile applications
- Flexible sensors

### Smartification

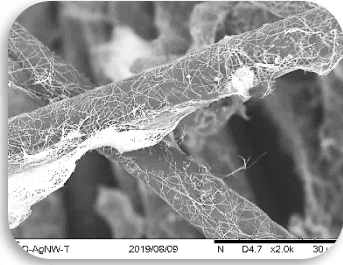
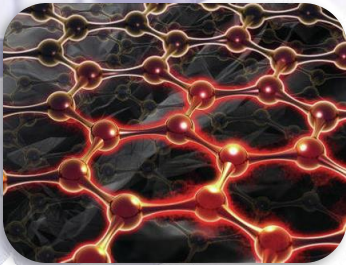
- Application of flexible circuit on textiles for multi-purposes
- Virtual showroom

### Testing

- Testing methodologies for smart wearable

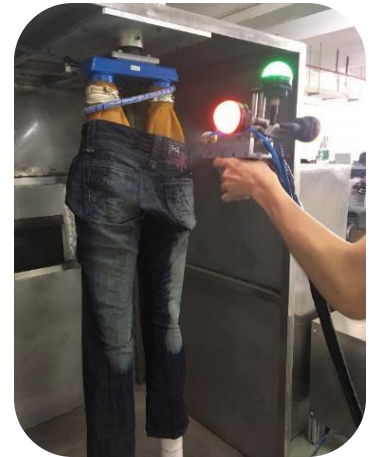
# Technology Development

## Material Innovation



R&D on Graphene Application in Heat Generation

## Manufacturing Process

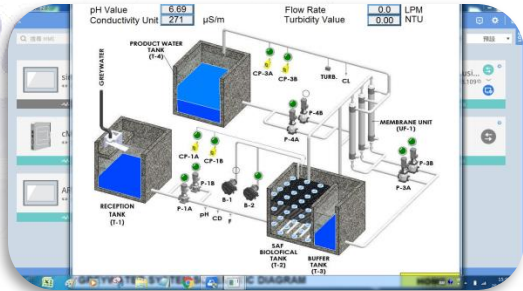


Quick Learning Automatic Spraying Cabinet

## Environmental Management & Sustainability



ESG Advisory



Remote Monitoring and Control System for Off-shore Waste Water Treatment Plant



Study on Sustainable Development of HK Fashion & Textile industry

One Stop Solution for Bra Cup Manufacturing Process



Bra Cup Aluminum Mold CNC Improvement Service



Roadmap Study for Fur Enterprises

# Technology Development

## Machinery Advancement



Laser Engraving Machine for Multi Decorative Finishing



Multi-functions Textile And Apparel Decoration Machine

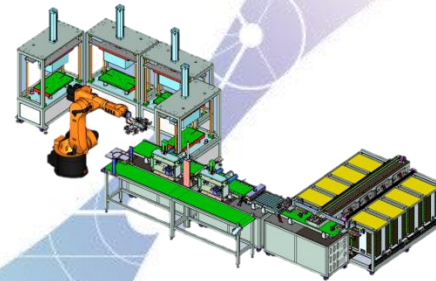


Knowledge-based 5-axis Plus-sized Bra Cup Plastic Shot Laser Cutting System

## Automation & Digitalisation



Digitalisation for Denim Manufacturing



One Stop Solution for Bra Cup Manufacturing Process



Real Time Data Capture for Elastic Tape Production

# Machinery Development

Intelligence Roll  
Textile Materials  
Cutting Machine

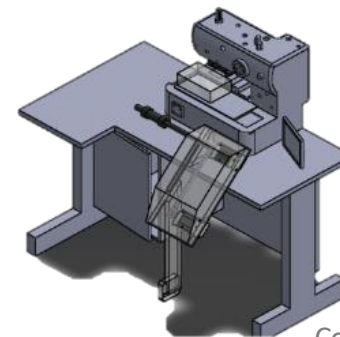
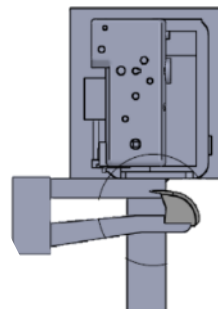
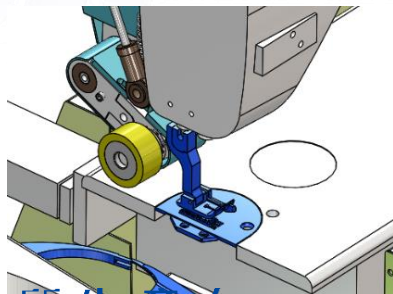
Circular Knit Collar  
Attaching Roller

Underwear  
Waistband  
Attachment Machine

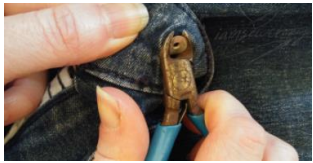
Knit Circular Bottom  
Hemming Roller

Side Seam  
Topstitching Machine

Smart Tape Attaching  
System with Cutter  
and Stacker



# Non Woven Fabrics - Way to process textile waste



Sorting of non-textile components  
硬件拆除 (拉鍊/鈕扣)



Sorting of color  
物料分類/分色收料



Ozone消毒  
Sanitization



紫外線消毒



分切  
Cutting



纖維開鬆  
Opening



條子處理  
Carding /  
drawing



Rotor  
spinning  
轉杯紡



Doubling  
& Twisting  
併紗及倍捻

1

Non-woven  
不織布



2

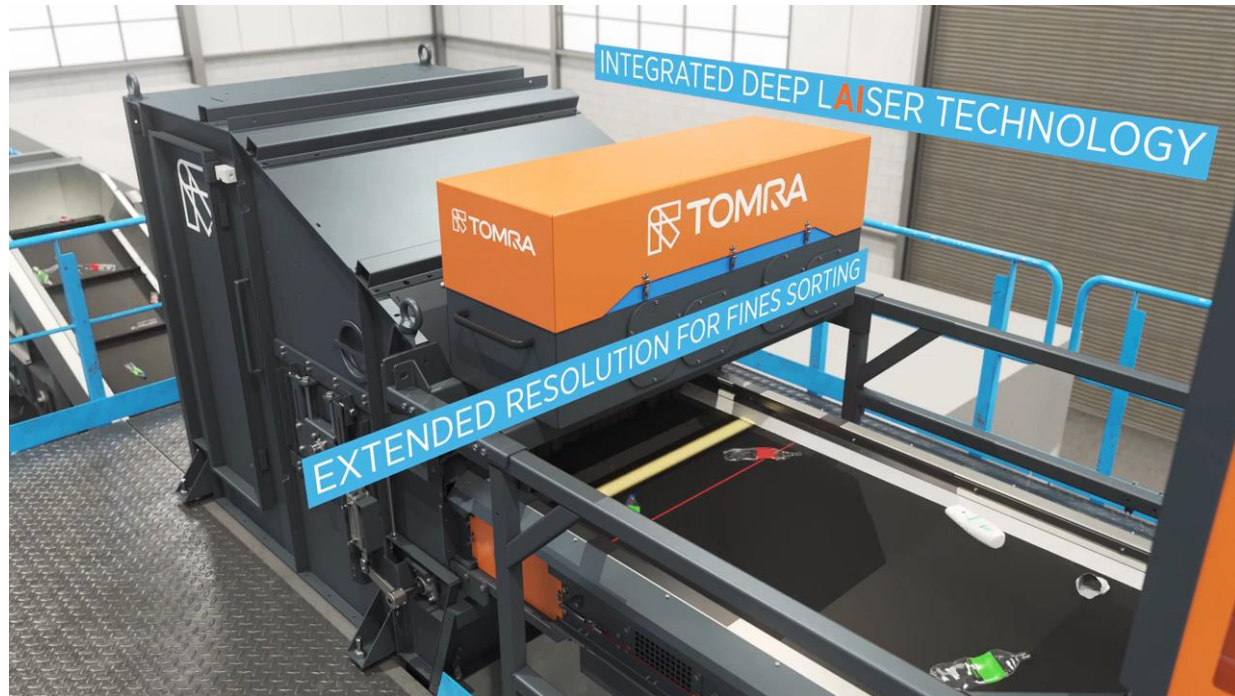
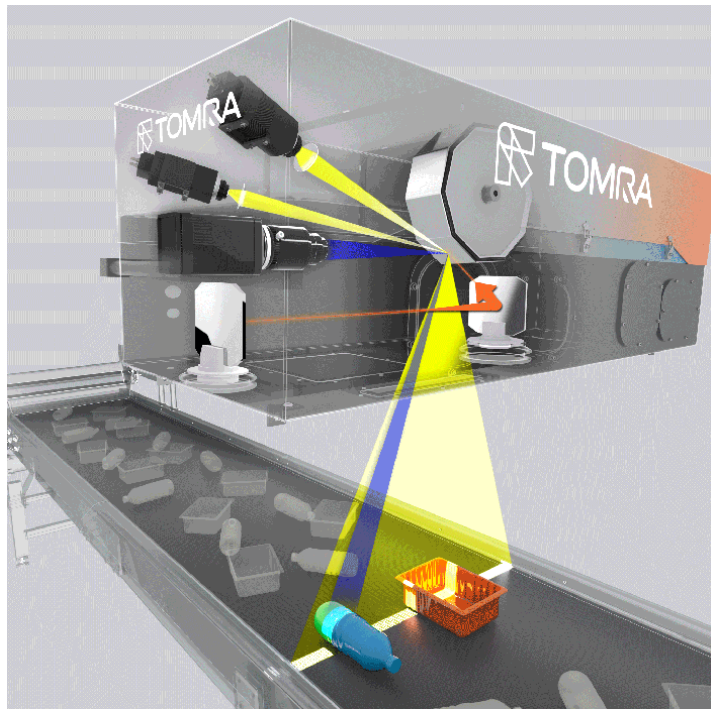


# Non Woven Fabrics – Operation Video



# Process – Near Infrared NIR Sorting

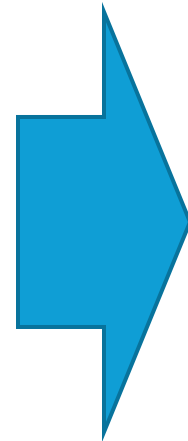
- Using **Near Infrared** to identify the material
- Sort the textiles using Infrared Camera (Heat) or Color
- Reject the scraps by pneumatic method



# Novel Process with IIoT & Critical Process Parameter Control System for Denim Product Innovation



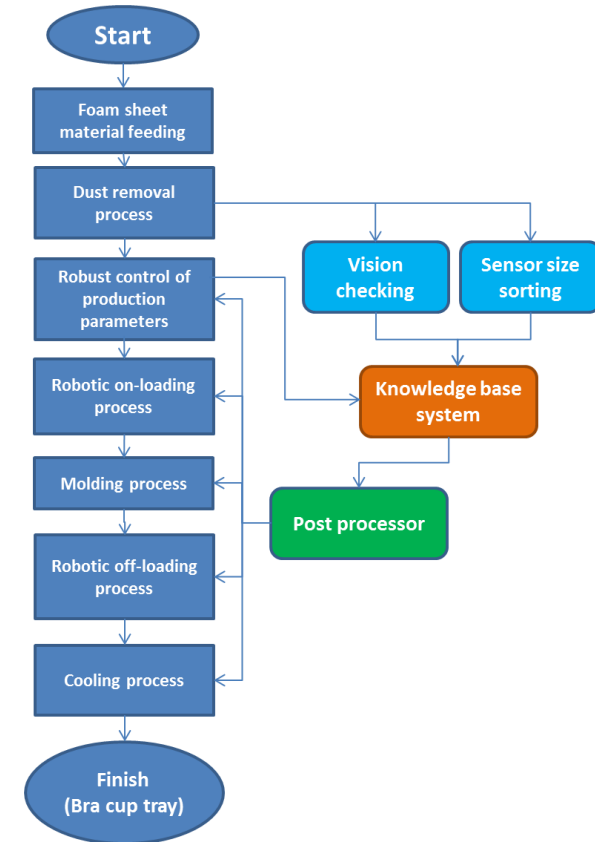
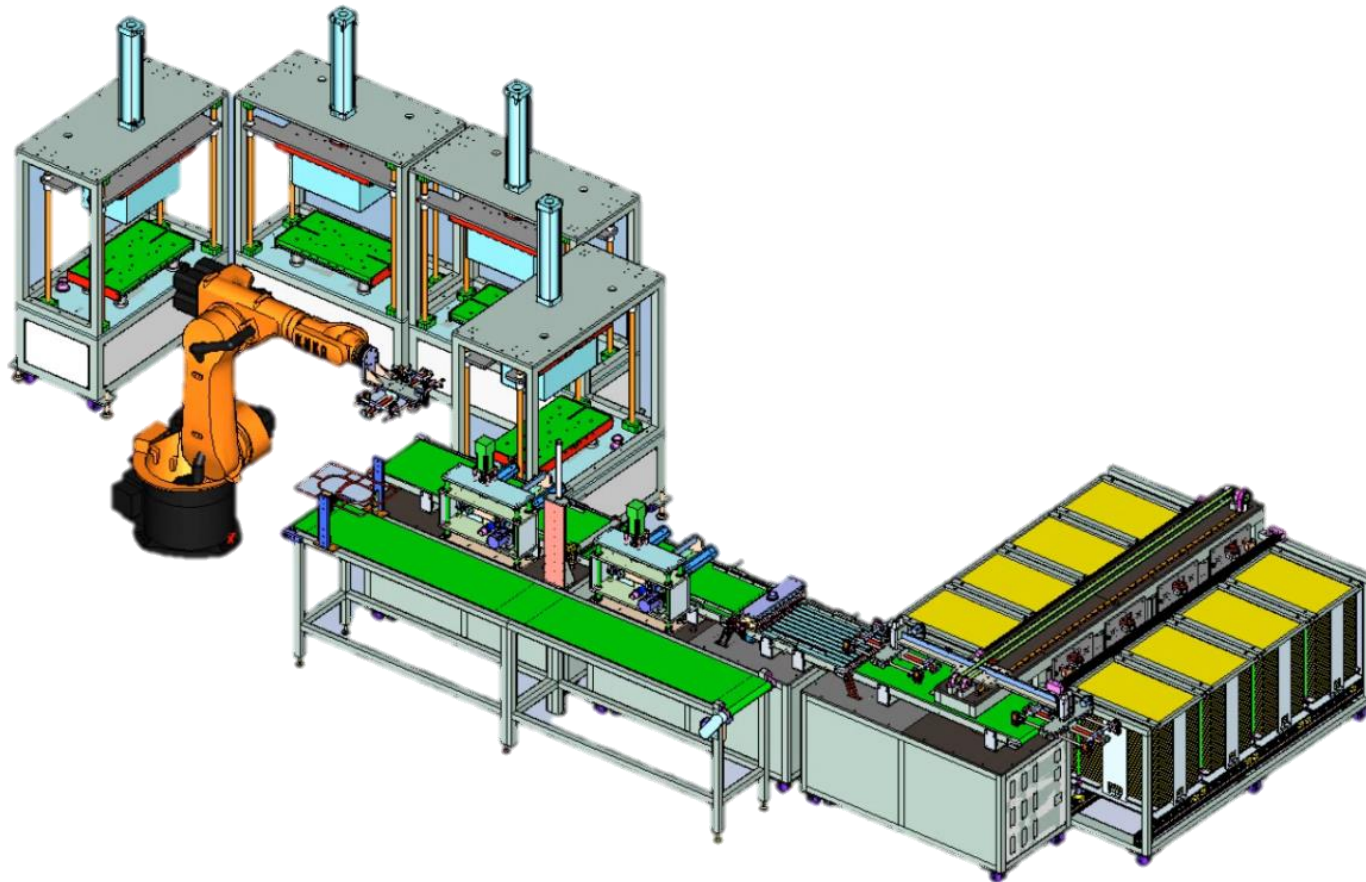
**Traditional Manual  
Processes** on Denim  
Washing and Whisker  
Making



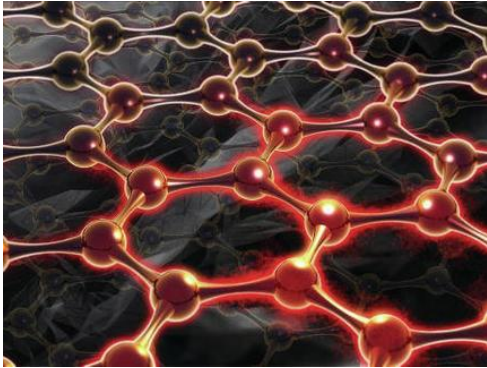
**Novel Smart Processes** for  
Denim Laser Marking, no  
Stone Washing & Drying.  
Laser whisker with  
development of smart  
machinery



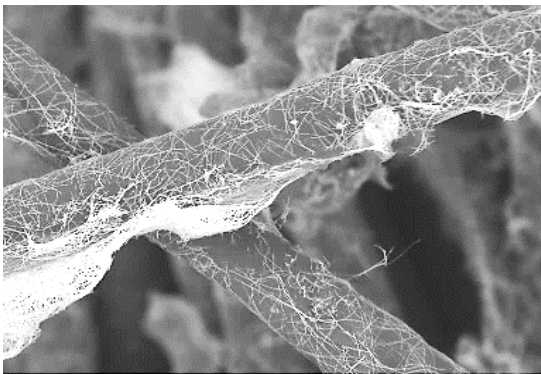
# i4.0 Bra Cup Production Development



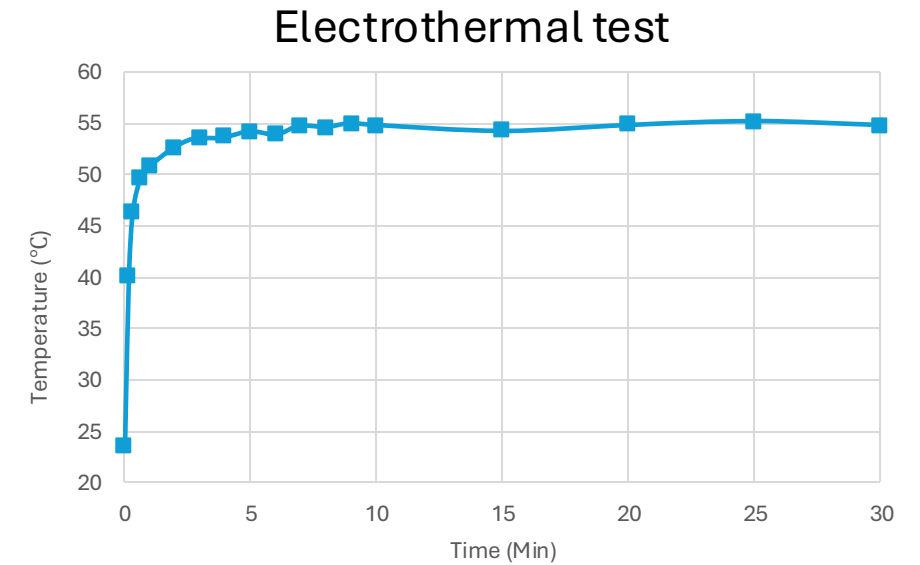
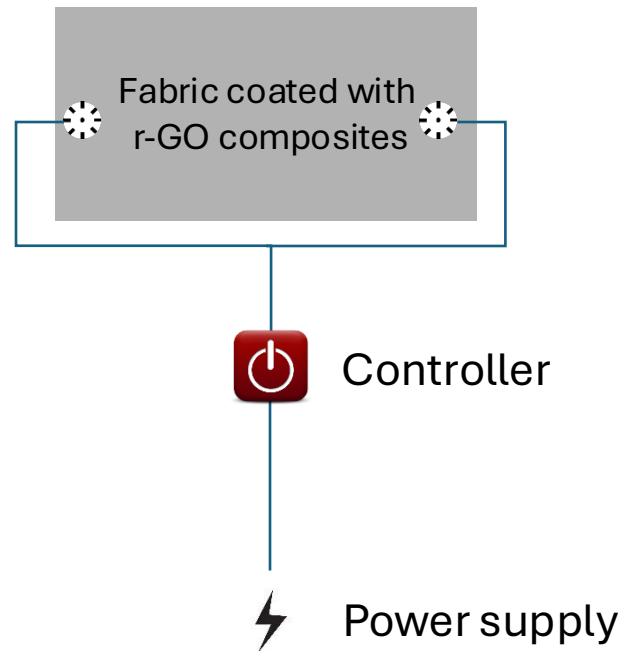
# R&D on Graphene Application in Heat Generation



High thermal conductivity



rGO-AgNW-T 2019/08/09 N D4.7 x2.0k 30 μm



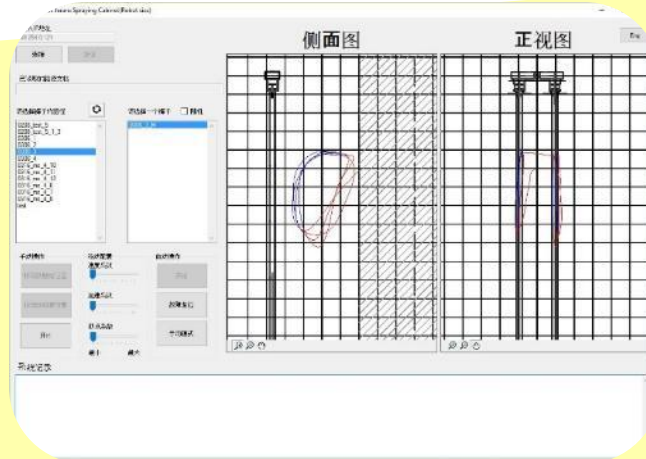
—■— r-GO composite ink coated Polyester 5V/1.1A

Polyester fabrics coated with reduced graphene oxide (r-GO) composites

# Quick Learning Automatic Spraying Cabinet

Reproduce the trajectory motions in manual production with a six-axis robotic arm

Capture



Preview and Modify

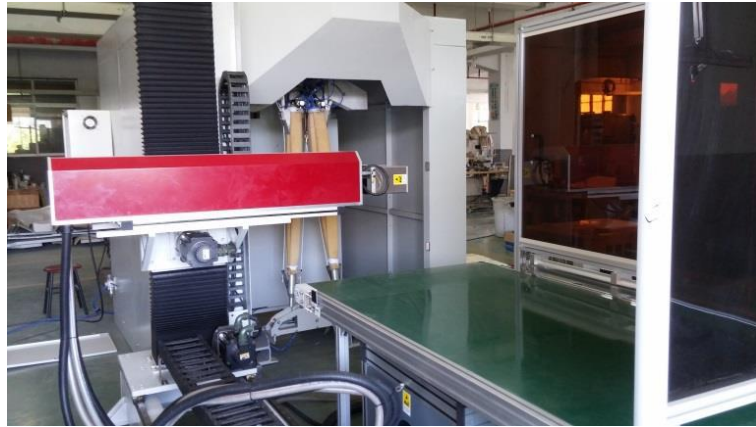


Paint



# Laser Engraving Machine for Multi Decorative Finishing

Provide various innovative decorative features on jeans including sand blasting effect, imitated-handmade pattern and colour pattern.



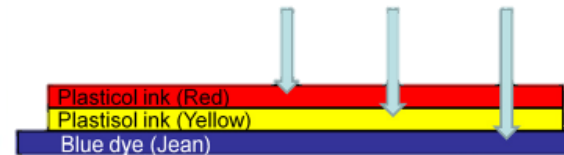
Sand wash



Whisker



Colour pattern



# Multi-functions Textile And Apparel Decoration Machine

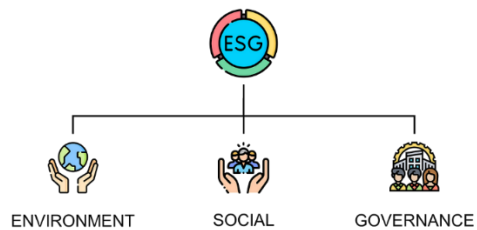
- Embroidery
- Printing
- Rhinestone apparel decoration
- Automatic fixture transfer system



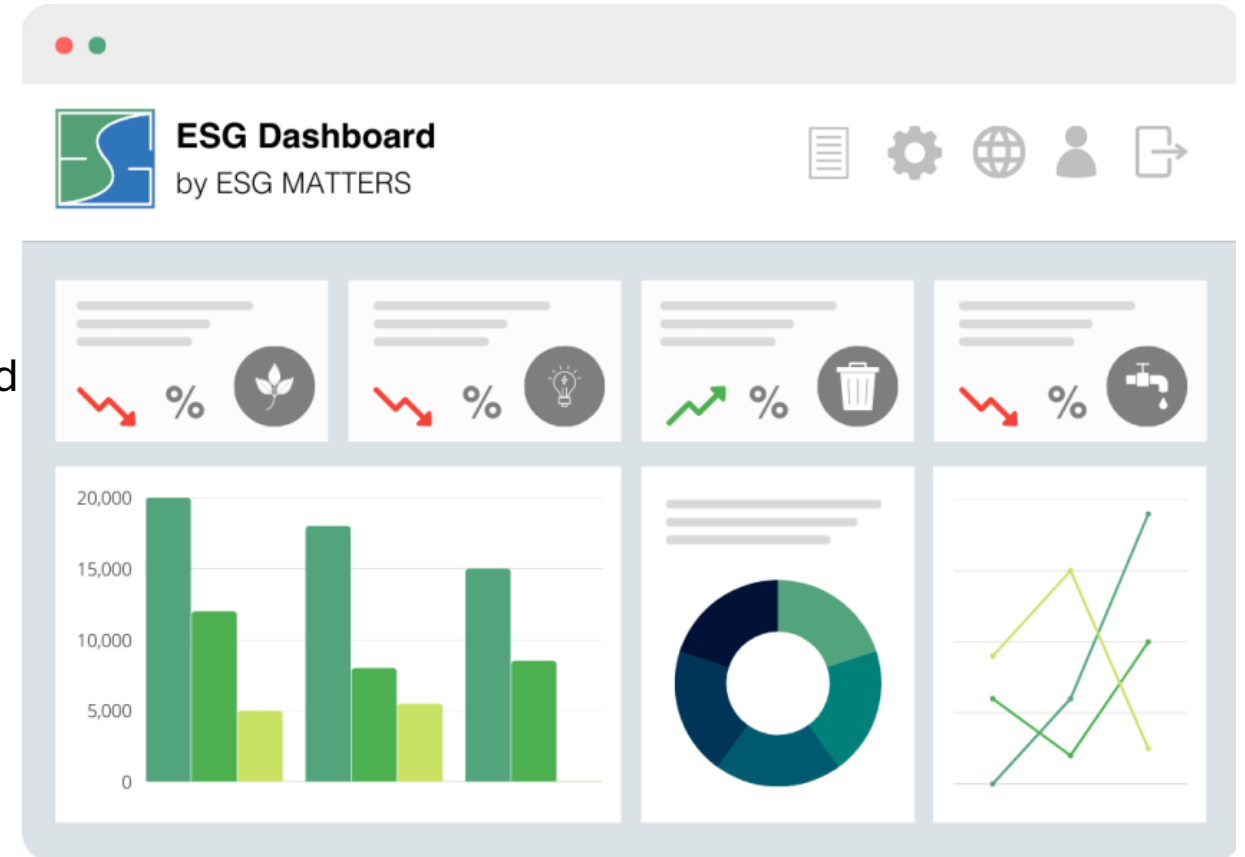
# Digitalization

# ESG System implementation

- Wing Kai currently faces the problem
  1. Client specifically request for the ESG Report
  2. Manual Input data
- A **need in standardizing** the ESG report with the aid of
  1. ESG system development via Internet of Things (IoT) and sensors
  2. ESG advisory service and Internal Auditing



ESG Advisory



# Digital ESG Reporting Solution

Objective: client can sign in a portal to view a dashboard of own waste activities and environmental impacts (e.g. waste, energy, carbon, etc.), and can choose to export results between certain dates to a PDF format report

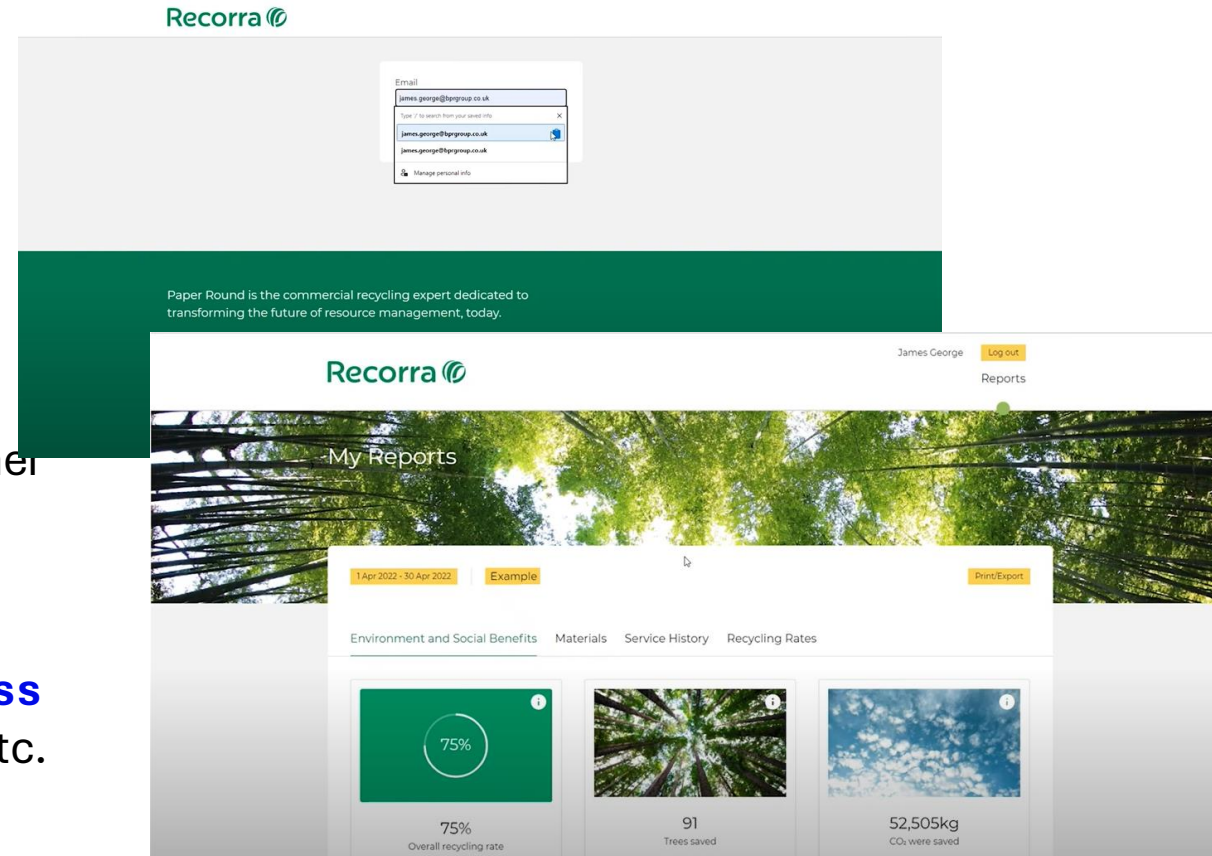
Technical reference:

Hong Kong government's carbon audit guidelines

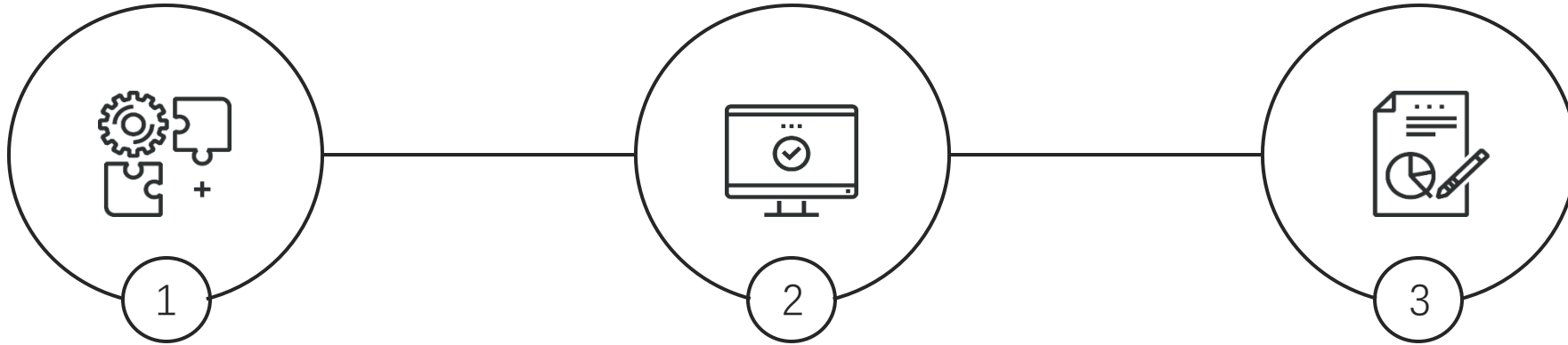
HKEX ESG reporting guide

ESG data to collect from IoT and site visits, including:

- Client information
- Tracking information, e.g. work order / date / batch
- Location information, e.g. pick up and drop off, and further waste processing destination if applicable
- Transport - vehicle type
- Transport - fuel consumption
- Factory – **waste weight changes throughout the process**
- Factory - **energy consumption**, e.g. electricity, diesel, etc.
- Factory - water usage
- Factory - general information relating to social and governance, e.g. policy relating to health and safety, governance structure, etc.



# Digital ESG Reporting Solution (Deliverables)



## ESG Data Collection

Through IoT and site assessment:

- Client information
- Factory information
- Location information
- Vehicle type
- Fuel consumption
- Waste weight
- Energy consumption
- Water usage
- Other relevant social and governance information

## UI Development

Develop a portal for the input and calculation of collected data, as well as the generation of summary reports for each client.

(Reference:

Recorra

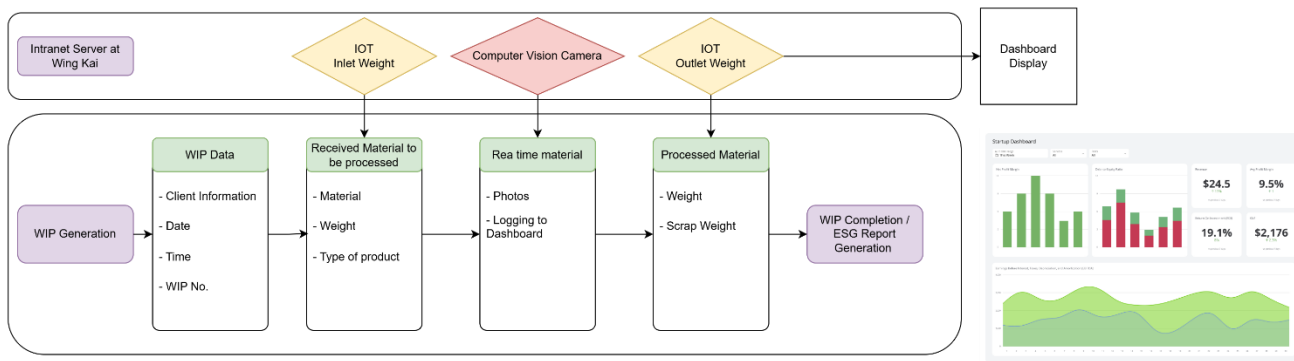
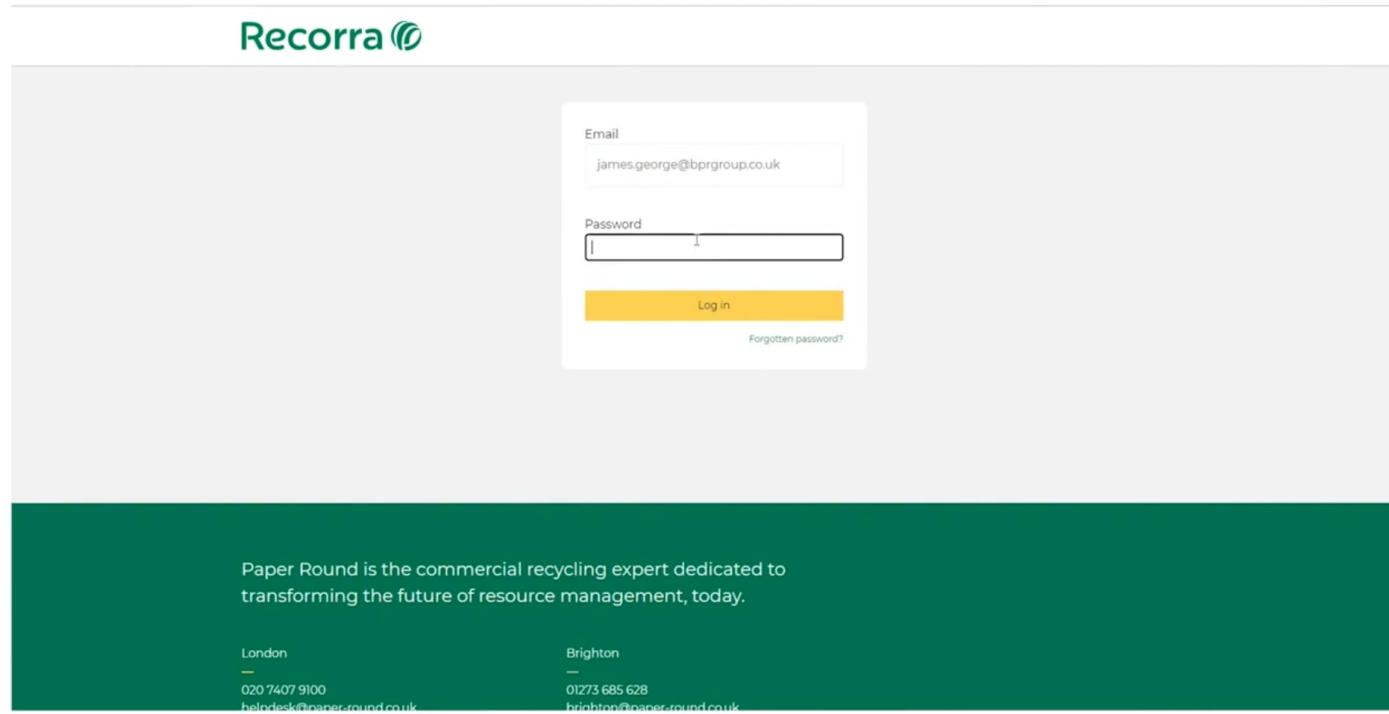
[https://youtu.be/N\\_7WRmXtCQI?si=XKMmdnR8cwlpUBS0](https://youtu.be/N_7WRmXtCQI?si=XKMmdnR8cwlpUBS0))

## Report / Data Review

Design template, calculate based on input data, to generate summary reports accordingly.

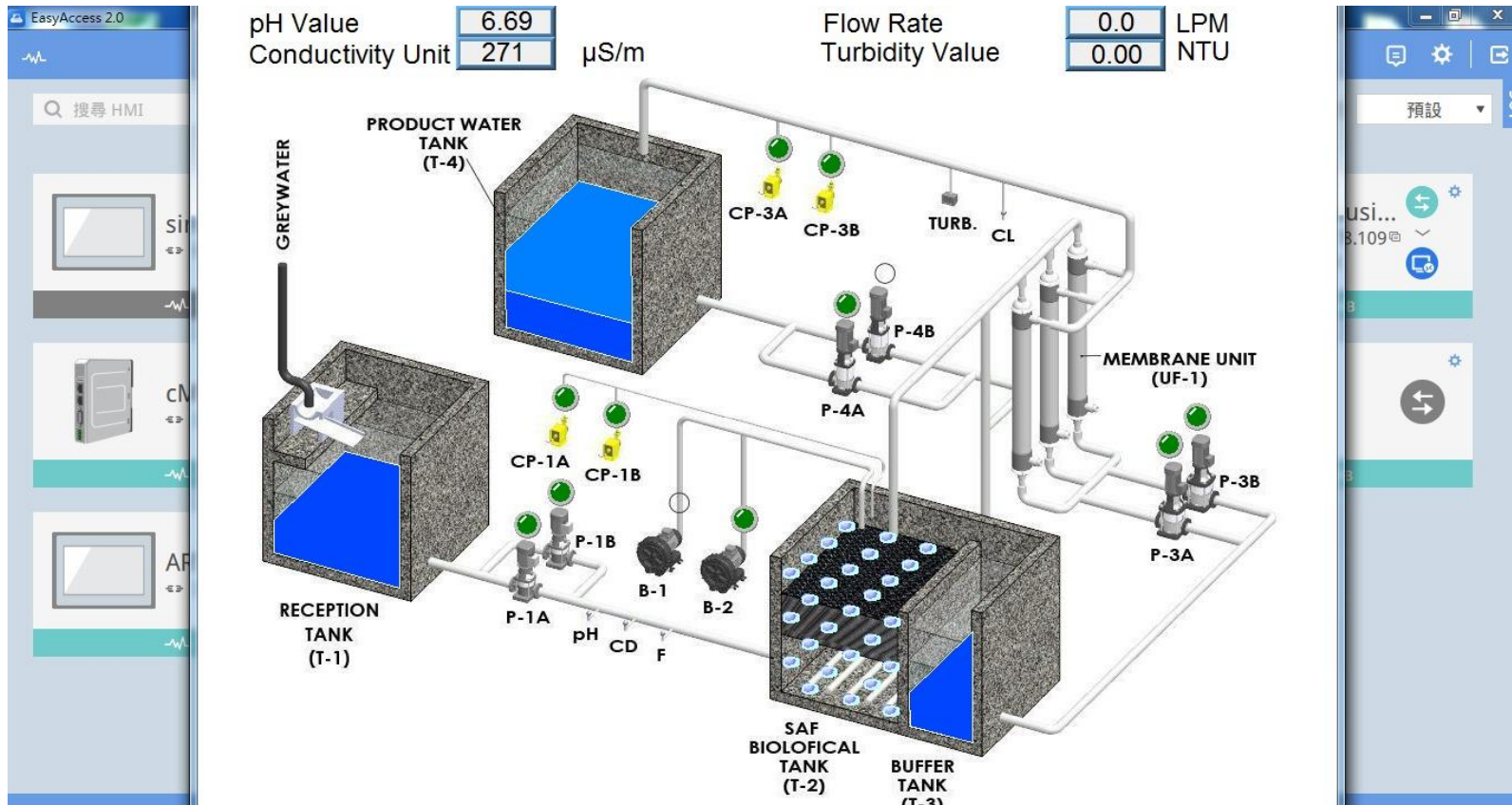
Conduct trial run and sample review of the summary reports to ensure the inclusion of all required information and data, and present in a professional manner.

# Proposed Data Extraction Work flow



- The general data through recycling process would be logged via IoT Weight and Camera
- The remaining data mentioned previously would be generated via HKPC auditing

# Implementation - Remote Monitoring and Control System for Off-shore Waste Water Treatment Plant

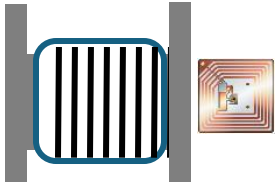


Through IoT and site assessment:

- pH Value of water
- Flow Rate
- Visualization of the operation
- Energy consumption
- Water usage
- Other relevant social and governance information etc

# i4.0 Digitalisation of Elastic Tape Production

## [Real time data capture + network]





# Thank You

**Hong Kong Productivity Council**  
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