



# Facility Analysis

Facility analysis for rPET factory: Site analysis, technology overview, feedstock recovery, legal and regulatory framework, environmental compliance

**Post-Consumer Resin Market Development Partnership**  
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# 1. Objectives

This 'practitioner's guide' aims to provide an overview of required considerations to implement large scale (PET) recycling projects in Vietnam with a regional focus on HCMC. Besides outlining the legal and regulatory framework, this compendium goes beyond the theoretical framework and provides applicable real life analysis of location, collaboration options, acquisition targets, technology, feedstock potential as well as a general implementation plan.

# 2. Methodology

Most data used in this report has been obtained by exclusive primary and secondary research, including but not limited to stakeholder interviews, site visits, surveys and literature review. Raw data was analysed and interpreted leveraging existing experience and networks for further qualification of individual statements. Results were then summarized on this report for comprehension along the outlined agenda.

## **Verification of draft report findings with relevant stakeholders:**

A draft version of this report was used as a discussion base for a comprehensive 3 day conference with relevant stakeholders (outlined in **Appendix 2**) and presented to conference participants two key findings presentations. The feedback from the participants was subsequently incorporated into this report in pull out boxes (as below) to provide third party views on the research findings.

Please note that these are independent statements by representatives of the respective organizations and may include individual opinions and not necessarily reflect the organization's view on the context to the full extent. The value for this report lies in the diversity of the opinions to raise concerns, show alignment or misalignment and to provide different perspectives to the reader.

### 3. Legal and Regulatory Framework

Vietnam has gone through significant changes related to waste management in the past decade. Understanding those transitions helps to manage expectations and provides opportunities for early movers.

Most noteworthy is the continuous reorganization of responsibilities for general processes and specific waste streams, with currently six ministries directly involved in managing and instructing local authorities to handle waste in Vietnam. This overlap has created significant inefficiencies and Vietnam still lacks clear rules on sorting and recycling trash.

While this is about to change, according to Mr. Pham Hoang Hai from VCCI-VBCSD, this report is mainly focusing on the current framework but outlines expected changes below.

Vietnam authorities have realized that without synchronous and timely solutions, the negative impacts of plastic waste will cause serious and unpredictable consequences. The Ministry of Natural Resources and Environment (MONRE) has coordinated with other ministries and agencies to draft and submit to the Prime Minister the “Directive on strengthening the reduction, classification, collection, recycling and disposal of plastic waste”, which can be expected to be approved within 2020. Details are not yet confirmed but one of the key elements will be the recognition of plastic waste as “a part of daily life”, which will demand authorities to consider waste management within their master plans and can be expected to have a significant positive impact on the currently slow moving, intransparent and fragmented system.

#### **Key facts considered in proposed Directive**

- Ratio of plastic waste in landfills varies from 12-16% and ranks second after organic waste
- Many informal collection systems still engage in burying and burning practices with adverse environmental and health effects
- Vietnam is ranked 17th among 109 countries in terms of annual plastic emissions

Directive has 11 clauses, defining responsibilities of ministries, branches and localities in strengthening, minimizing, sorting, collecting, recycling and treating plastic waste.

#### **Summary of expected adjustments in the new laws:**

- Rearrangement and specification of responsibilities of Ministries, Governmental Agencies, People Committees of Provinces and Cities under the Central Government
- Instructions and plans on mitigation, classification, collection, recycling and disposal of plastic waste
- Requests state agencies and public non-business units to undertake a number of specific activities as follows:
  - Restrict use of disposable plastic products (incl. plastic bags)
  - Pioneer, exemplary classification of waste at the source at the workplace
  - Avoidance of plastic waste and other recyclable wastes to be mixed with organic waste
  - Encourage the development and implementation of best practice models to serve as a basis for replication

- Implement communication activities and trainings to raise awareness for officials and employees in the sector and localities on waste management and plastic waste minimization
- Coordinate with related organizations and individuals to encourage manufacturers not to produce and people to restrict or not use plastic bags, plastic containers, foam boxes, disposable plastic straws, etc. to protect the environment
- Give priority to selecting recycled and environmentally friendly products
- The Directive addresses a number of articles of the Law on Environmental Protection and proposes supplementing regulations on extended producer responsibility (ERP) to:
  - Treat waste and plastic waste as natural resources
  - Promote recycling of waste and plastic waste and build a circular economy
  - Implement the reduction and classification of waste at source
  - Develop technical manuals for implementation of source separation
  - Ban the production and consumption of disposable plastic items and ultra-thin, non-biodegradable plastic bags
  - Increase the responsibility of producers exporters, importers, trademark owners, distributors, retailers in waste recovery and recycling
- Study, propose and implement:
  - Public-private partnership models for solid and plastic waste treatment
  - Environmental technical barrier for products and goods containing micro-particles, plastic nanoparticles and plastic bags to prevent adverse impacts on human health and environment
- Additional suggestions include:
  - Review and continue to improve the law on eco-labelling for eco-friendly plastic bags and plastic products with a certain recycled content
  - Build and operate an International Center for Ocean Plastic Waste
  - Establish and operate a database of plastic and ocean plastic waste
  - Actively participate in setting global and regional cooperation policies and mechanisms to handle plastic and ocean plastic waste
  - Develop and effectively implement communication plans to raise public awareness about reducing, sorting, collecting, recycling and treating plastic waste
  - Building, deploying and operating a database for registration, declaration and management of the production and use of products containing plastic and creating plastic waste
  - Attract investment, transfer advanced technology in recycling and plastic waste treatment

*For more details, please refer to: <http://www.monre.gov.vn/Pages/trinh-thu-tuong-chinh-phu-du-thao-chi-thi-ve-tang-cuong-giam-thieu.-phan-loai.-thu-gom.-tai-che-va-xu-ly-chat-thai-nhua.aspx> or to the summary by MONRE, presented at the annual conference of PRO Vietnam in June 2020 in Hoi An: EPR WS (VN) [https://drive.google.com/drive/folders/1zXrRUWbSISStCYcFKUvx\\_xTb811CzsRh?usp=sharing](https://drive.google.com/drive/folders/1zXrRUWbSISStCYcFKUvx_xTb811CzsRh?usp=sharing) EPR WS (EN) <https://drive.google.com/drive/folders/1heFUOGhu2--INkp-b8dM67CD5IMEJC5?usp=sharing>*

For current projects and projects initiated prior to the approval of proposed adjustments, the proposed changes coming into effect may lead to stronger commitments from municipalities, increased

transparency and clear responsibilities. However, certain assumptions made at the beginning of the project planning phase may have to be adjusted during the implementation, which is not uncommon but maybe accelerated during this time. Timing wise, it can be expected to take 6-12 months for laws to be adopted into new master plans but initial effects can be expected to be seen earlier.

Some experts expect Extended Producer Responsibility (ERP) to become a vital part of the new system in addressing some of the most pressing challenges through increased recovery and recycling, but this can only take place if the framework for obtaining required permits and locations adequately matches such regulations and the local authorities understand how to implement the new framework. Currently, in-transparencies and fragmentations can cause indecisiveness for new projects.

As this report is primarily focused on the current regulatory framework, the following legal procedures are not considering potential changes.

**For detailed Investment procedures for recycling project, please refer to the table below:**

No.	Approvals, Licenses and Permits	Description	Authority in charge
	<b>Pre-Development Phase</b>		
1	Conduct a survey, research to identify the location/ province where the project to be located	<p>The company should first consider geographic location. This involves research into the advantages and disadvantages of locations inside or outside the industrial parks (IPs) considered. <u>However, for both options, the zone planning (in Vietnamese: quy hoạch vùng) of the IPs or the area whether the land lot outside IPs considered has been approved for waste recycling is essential.</u></p> <p><b>For the locations outside the IPs</b> To build and run a recycling factory, the company needs to lease land from the State. As such, the decision on the investment policy from the local people's committees (PC) is required (as discussed in the below stage).</p> <p>Note that there is an option that the company as the 100% local company can lease land from third parties. However, the leased land must have land use purpose as for business/production, which is a quite rare circumstance.</p> <p><b>For the locations in the IPs</b> The IPs possess land use rights from the State</p>	Local People's Committee ("PC")

		<p>and essentially sublease their land and existing factories to tenants for a period of up to fifty years, depending on when the industrial zone was established.</p> <p>The investment projects implemented in an IPs in conformity with the master plan approved by the authority (i.e. approved for waste recycling) shall not be required to be submitted to the provincial people's committee for its decision on the investment policy. However, the company needs to sign the land reservation agreement with the developer of the IP before signing the land lease agreement and investment procedure.</p> <p>It is recommended to check with some IPs to know if their master plan has included the 'waste recycling' or not. This has been done in this study for HCMC based IPs and only very few would be willing to consider recycling activities (more details below).</p>	
	<b>Development Phase</b>		
2	Decision on the investment policy (only applicable to the project location outside of IPs)	The PC to issue a decision on the investment policy which sets out the core project parameters including the capacity of the project, project location, land use area, total investment capital, investors etc.	PC
3	Investment Registration Certificate (if required)	<p>This is not compulsory under the law as the company is 100% local company.</p> <p>The company will be allowed to implement the investment project after obtaining the decision on the investment policy (in case of the location outside of IPs).</p> <p>However, in case the project is in IPs, as a practice, the company is required to obtain the investment registration certificate.</p>	PC or the IPs Management Board
4	Branch Registration Certificate	The company to obtain the branch registration certificate from the local Department of Planning and Investment	DPI
5	Land Lease Agreement	<b>For the locations outside the IPs</b>	Department of

		<p>Upon the decision on investment policy, the company needs to apply for land resumption and clearance in case the land is occupied by the land users. This procedure can take time and effort.</p> <p>Upon the completion of land resumption and clearance, the PC will issue the land lease decision and enter into the land lease agreement with the company.</p> <p><b>For the locations in the IPs</b> Upon the issuance of the IRC, if required, the company and the developer of IPs will enter into the land lease agreement.</p>	Natural Resources and Environment (“DONRE”) or the IPs Management Board
6	Land Use Right Certificate, if necessary	After the land lease agreement is executed, the company shall apply for the land use rights certificate. Under the Land Law, the land use rights certificate shall be issued within 30 days from the date that a complete application is submitted.	PC
7	Environmental Impact Assessment Report (EIA)	By law, all recycling projects, regardless of investment scale, are required to have the environmental impact assessment report and the environment protection works are subject to the confirmation from DONRE upon the completion. For large projects, processes may be handled directly by the Ministry (MONRE)	DONRE/ MONRE
8	Requirements for fire safety and firefighting	Depending on the area, scale of the project/factory, the factory may subject to the fire safety and firefighting plan or its fire safety design is approved by fire departments	The local fire department
9	Construction permit	DOC to issue the construction permit for the project to confirm the project design and construction requirements and to allow the construction of the project to proceed	DOC
10	Updating Certificate of land use rights and ownership of houses and other land-attached assets (LURC)	30 days from the receipt of the sufficient dossier, subject to the assistance of the infrastructure developer of industrial park	DONRE



The timing of the outlined procedures cannot be estimated without knowing detailed parameters, but experience shows that 1-3 years for the full procedure is most common. As some of the required steps outside IPs can be avoided through selecting a location within IPs, it can be beneficial to implement recycling projects in IPs, if the IPs master plans allow for such activities.

#### **Conference Findings**

The above outlined procedure was discussed during the conference and the potential investors tried to identify confirm the decision processes:

Swire: “Even if MONRE/DONRE agrees with the prepared EIA, can the local government still refuse an application?”

DONRE - HCMC confirmed: “The first step is to get the Investment Decision approved by HCMC DPI with a decided location. The project must be approved by all related departments in HCMC.”

VCCI: “The local PPC is in charge to support investors with the procedures.”; “There are programs and departments in place to help investors with EIA and procedures.” no details on names of specific departments were provided.

The above shows a clear understanding of DRORE regarding the top-down approval process. As outlined above, the EIA procedure is one of the later steps in the incorporation and approval process.

## **4. Location Analysis**

While the location is closely linked to the permit and certification process outlined above, this analysis provides a concrete analysis of current market options. To identify suitable locations, we worked with the Ho Chi Minh Industrial Park Management Board, CITENCO, associations and private stakeholders.

In general, waste management activities, including recycling is perceived as ‘polluting and undesirable’ by most industrial parks and wards and direct enquiries are often rejected. While regulations do not provide significant limitations, Industry Parks and local authorities often prefer to avoid local facilities as they are unpopular with residents and are perceived to put strain on existing infrastructure (roads, waste water plants, etc.). This may be due to the adverse practices of many recycling facilities, especially non-permitted operations and the transferred perception from the waste recovery ecosystem.

To choose the ideal location for a large scale rPET project, several factors have to be taken into consideration. Some of the key factors include:

- Level of support from local authorities
- Pre-approval of land for recycling activities
- Proximity to feedstock
- Proximity to customers / port
- Proximity to residential areas
- Transport infrastructure
- Reliability of electricity supply

- Absorption capacity for waste water
- Availability of workforce
- Local labour prices
- ...

Besides the location parameters, one also needs to consider the advantages and disadvantages of a greenfield vs. brownfield investment, *two types of (foreign) direct investments*. *With greenfield investing, a company will build its own, brand new facilities from the ground up. Brownfield investment happens when a company purchases or leases an existing facility.*

Brief comparison:

	Green Field	Brown Field
<b>Permit</b>	New process has to be initiated; outcome may be uncertain.	Acquired facilities may have all relevant licences, certifications and permits in place; reduced risk of uncertain outcome. Ability to transfer has to be confirmed. Can be more expensive.
<b>Time to Operation</b>	Includes full construction from ground up including building permits, hiring contractors, etc.; time to completion uncertain.	Depending on required renovation or adjustment works, varying time to completion, but typically shorter than new construction.
<b>Customization</b>	High degree of customization possible; requiring few compromises that may affect operations.	Highly dependent on the individual set-up; while some customization can be implemented in existing structures, restrictions are higher than in green field developments.
<b>Human Resources</b>	All staff need to be newly hired.	May already have an existing workforce. If not suitable, can be replaced as a whole.
<b>Supplier Base</b>	New supplier base has to be established.	Typically some usable supplier base; in case of a recycling facility, existing base may already have access to feedstock.
<b>Assets</b>	No existing assets that can be used or need to be disposed of.	May include some assets; usability has to be considered. Likely to be an unusable food grade rPET facility but typically still have to be purchased.
<b>Going Concern</b>	No existing operations, no continuation. Nothing can be confirmed and continued but also no inherited liabilities.	Potential to be less based on assumptions as an info set may exist (financial reports, environmental studies, etc.) but reliability may be questionable. Higher risk for inherited liabilities if not addressed during acquisition.

**Green Field Options:**

While a few possible locations could be identified, it is advisable to work closely with authorities to identify suitable locations for a green field investment. In general, all industrial activities are limited to dedicated industrial zones and industrial parks. Green field investments in industrial parks or zones would entail only the land lease, while some general infrastructure may already be in place, most construction will still have to be completed.

In HCMC, most industrial parks refuse to accept plastic recycling activities, and according to Ho Chi Minh Industrial Park Management Board, HCM's Industrial Parks are currently out of land (not confirmed upon written request) and it will be difficult to receive any agreement for recycling facilities, which makes the identification of a suitable site in HCMC a complex task. Concrete potential:

- Tan Phu Trung industrial park (HCMC) - will consider to accept plastic recycling factory inside the industrial park if the project can comply with requirements (limited waste water discharge, domestic waste recovery, minimum land lease size (1-1.5ha), technical details on manufacturing)

Alternatively, several industrial areas and parks exist in HCMCs periphery including Binh Duong, Long An and Đồng Nai.

Binh Duong Management Board's investment department stated that “the recycling industry is not attractive”. Although no official statement was provided in writing upon request, it was stated that no official documentation is available and “it is a general policy of the province”. To evaluate potential further, the Administration Department requires a formal enquiry including type and source of raw materials, details on production technology, required land area, and more.

The Long An Industrial Park Management Board for example has not ruled out any recycling facilities as long as they fulfil certain criteria (*recycling projects in Long An require a land area of at least 1 ha, materials should be recovered within Vietnam*). Concrete potential:

- Thuan Dao industrial park (Long An, <https://goo.gl/maps/MQX28XLTfmHdNM2k8>) - will consider to accept plastic recycling factory inside the industrial park if the project can comply with requirements (limited waste water discharge, domestic waste recovery, minimum land lease size (1-1.5ha), technical details on manufacturing)
- Đức Hoà III Silico industrial park (Long An, <https://goo.gl/maps/KP3MxCqMtD6GEy2h6>) Being a new industrial zone, it is flexible to change and expand industries to attract investors.

The Đồng Nai Industrial Park Management Board has not provided any suggestions but did not reject recycling in general regarding their industrial parks.

- Upon contacting individual industrial parks, e.g. Sài Gòn VRG (Dong Nai industrial park, Le Minh Xuan 3, Phuoc Long, Loc An - Binh Son industrial park), any recycling activities were rejected.

Please note that the above results are based on non-concrete enquiries without a formal proposal and without working with the various levels of authorities and decision makers. However, it does reflect the general sentiment on recycling as stated above.

### **Brown Field Options:**

While not limited to industrial parks, it may be easier to identify suitable acquisition targets or strategic partners in those specified areas. The following examples are intended to show a small variety of options for brown field investment, with different angles (acquisition and cooperation).

Option 1: PLASTIC PRODUCTION FACTORY (TCN Ninh Thuan)

- Address: KSB IZ (industrial Park) - zone B, Dat Cuoc Commune, Bac Tan Uyen District, Binh Duong Province, Vietnam (<https://g.page/ksbidc?share> )
- Total area: 8,000 m2, factory area: 3000m2
- Capacity of 14,000 tons of granulate / year
- Newly constructed factory, with a large 3000kva power station, fire protection systems, wastewater treatment systems, container trucks loading and unloading area, suitable for all industries, or as a warehouse.
- Machine system from Germany: includes 2 machines: 1 machine Type: HKS 220/150/33 and 1 machine Type: HKS 250/200/32 (assumingly from Sikoplast)
- Selling price of 60-100 billion
- Fully approved

Option 2: Thanh Nam Investment and Tourism Construction Company Ltd.

- Land for rented at Thanh Nam domestic waste sorting, recycling and treatment plant
- Location: Ham Tri, Ham Thuan Bac and Binh Thuan (<https://goo.gl/maps/Cu3s4bqjVyXFNZkq6> )
- Waste treatment 70 tons / day
- Recycling plastic scrap 50,000 tons of scrap / year
- Area of 4.4ha,
- Price for rent or corporation to be negotiated (very open to corporation)
- Permit for “plastic scrap processing” without specification on specific type
- Fully approved (approval letter available)

Option 3: Vinatex - Tan Tao Investment JSC

- Investor of Nhon Trach Textile Industrial Park: Vinatex - Tan Tao Industrial Park
- Address: KCN Det May Nhon Trach, Hiep Phuoc, Nhon Trach , Dong Nai Province (<https://goo.gl/maps/G9npq6CJLcsd55Uw9> )
- The industrial zone’s investment company is willing to handle the permit process; currently plastic manufacturing is not part of the approved activities in this industrial part but the Management Board of Industrial Zones will be responsible for working with local authorities on extending the required approvals for plastic manufacturing and recycling.
- More specific information about the project would be required, such as production technology, wastewater treatment, processing volume, etc.
- Afterwards they will consult with the relevant authorities to accept business of Plastic Recycling Project.
- In case it is not approved by the local government, they will return the deposit for the land to the project owner.

Additional feedback logs on factory location research can be found in **Appendix 1**.

**Conference Findings**

All conference participants were aligned in their supportive stands towards private sector investments in the recycling sector.

### General Statements on Investor Support

DONRE - HCMC: “HCMC is very supportive of recycling in HCMC.”; “The city encourages investors in the recycling industry.”

VCCI: “There are programs and departments in place to help investors with EIA and procedures.” ; “Vietnam is very open to investors. Vietnam has created several incentive schemes including land rental and tax to help investors.” no details on specific programs were provided.

### Comments Regarding Locations and Industrial Parks

DONRE - HCMC: “The Le Minh Xuan IP allows Recycling industry, or smaller IP as well/ If choosing an IP in Binh Chanh further from the collection points, operators need to reconsider the transport cost.”

CITENCO: “There is regulation against bringing trash into Industrial Parks, which limits feedstock to pre-processed materials. For example, if a used bottle still has its label and cap attached, it’s considered waste. If the label is taken off then you can bring it into the Industrial Parks as raw material”

VCCI: “Dedicated recycling locations with specific spacing considerations according to MONRE guidelines in planning” comment on future initiatives.

CITENCO: “The city has not yet planned new spaces for the recycling industry, but investors can consider the two existing solid waste treatment complexes of the city.” recommendation for investors for possible location. Reference probably in regards to the main waste treatment and landfill sites in Cu Chi and Đa Phuoc that also include some waste processing operations (<https://mbs.hochiminhcity.gov.vn/cac-khu-lien-hop-xu-ly-chat-thai/khu-lien-hop-xu-ly-chat-thai-tay-bac/gioi-thieu> /// <https://tuoitre.vn/bai-rac-da-phuoc-se-het-hoi-khi-dong-cua-vao-nam-2024-20200103181802002.htm> )

### Possible Misalignment of Central and Local Level

In general, the relevant stakeholders present at the conference were stating that there is strong support by the Vietnamese government for private sector investments in the recycling space as mentioned above. However, the research work, particularly on the site identification and request for general investment program support did not reflect those statements, which was mentioned during the conference.

Evergreen Labs: “Our in-field research and feedback from actual inquiries on a local level does not match the presented central level intentions and stated support. Investors may be shut down on a local level and discouraged to continue.” This comment on the perceived mismatch of in-field research on a local level and conference feedback was either rejected or not further commented by participants.

### **Conclusion**

The supportive comments by DONRE HCMC were not aligned with the HCMC Industrial Parks Management Boards statements obtained during the research. Note: The Industrial Park Management Board representative was invited to the conference and stated via Phone that they could not join.

CITENCO's comment on limiting trash to be brought into Industrial Parks may be indicative why the Industrial Park Management Boards may have ruled out recycling in its IPs, as the enquiry during the research suggested raw feedstock. Most Industrial Parks that were approached directly asked for the type of waste and whether it would be washed. Concerns on contaminated wastewater were very obvious, which is very limiting for potential investors. However, it is not confirmed that raw waste cannot be treated in IPs.

A visit to a new recycling facility indicates that only certain IPs may be able to consider recycling and processing of raw waste. The visited site was located in Binh Duong, in a 'heavy industry' IP, where possibly 'polluting' operations are located. It was mentioned by the project owners that this will be the last raw waste recycling licence issued by Binh Duong. This statement would have to be confirmed by official sources but the relevant authorities could not be identified.

The contradictory and unclear statements above matter especially due to the fact that this program is intended to provide clear guidance on the investment processes and framework. However, even with the support of industry experts and government agencies, no definite answer was obtained.

Ultimately, the procedure is clear, but is very dependent on the local People's Committee decision, which requires a project proposal to obtain an official answer, which was out of the scope of this program.

## 5. Technology Overview

This chapter does not intend to provide a comprehensive overview on food grade rPET technology but rather aims to derive an estimated investment range according to targeted volume.

While each technology company uses its own technology and processes to a certain extent, the strict regulations for food grade rPET require each machine in the process to be certified under FDA (US) and EFSA (Europe), especially for the use by the big consumer brands, which limits the available options significantly. Therefore, the machinery may be the same / similar for each operator but processes can vary.

None of the leading waste management companies have entered the Vietnamese market for food grade recycling activities, but several groups are looking at the market closely, have projects in other sectors or are establishing first projects. Some have dedicated staff in Vietnam to develop market potential while others evaluate the potential through their international offices.

Leading waste management groups in Vietnam:

Company	VN Office	Projects
Veolia	No - via France	rPET under evaluation (PRO Vietnam)
Suez	Water technology JV	Waste Water (Hau Giang)
Alba	Yes - HCMC	rPET under evaluation
FENC	Yes - Bình Dương	Polyester recycling; rPET under evaluation
Hitachi Zosen Group	Yes - HCMC & Hanoi	Waste-to-energy

Currently, no recycler produces food grade rPET quality according to FDA (US) and/ or EFSA (EU) standards in Vietnam. We could not identify any recycler to use high tech machinery from companies like Stalinger or Erema. Most recyclers use basic technology to derive rPET flakes for export and some domestic use. Some produce granulates for different industries, including the textile industry and the local food industry. While Vietnam has some preform producers, it is not confirmed if any of the locally produced rPET flakes are used and as only few of the permitted recyclers even produce granulate, it can be assumed that no local circular (bottle to bottle) rPET system is in place. Additionally, it should be mentioned that none of the international brands and bottling companies currently use rPET in their Vietnam bottles, but 100% virgin material. This was a key discussion point during the PRO Vietnam Annual Conference and addressed from several angles, including but not limited to EPR (extended producer responsibility) standpoints. More information on recyclers and producers can be found in the market analysis report.

For this report, we focus on international standards on food grade rPET production and assume state of the art facilities to be implemented for the potential project.

In general, the reprocessing of high quality PET follows similar stages as outlined below:

**1) Sorting:**

Incoming bottles are unbaled and sorted automatically via multi-level color sorting, metal detection and separation and then go through a manual quality control.

Clear and clean PET water bottles are preferable but without a deposit or integrated recovery system, it is rather complicated to avoid contaminations and only purchase clear bottles. In any way, the bottles need to be clean enough to be recognizable by the color sorting machines. The more contaminated the bottles, the more expensive the sorting and pre-treatment process.

Other PET streams such as trays or films are typically not used, due to the fact that these materials are often composite materials and not mono-PET as required and in addition, the volume of reliably collectible materials is typically low compared to PET bottles.

**2) Pre-Treatment:**

Typically via mechanical processes going through several steps, including grinding, hot wash, separation of labels and caps (e.g. via float sink tanks), drying of clean and separated flakes. The

detailed process (temperature, duration) and input parameters are determined by the technology provider according to input quality and experience.

In general, PET recycling faces a few less challenges than other polymer types. Color sorting is very limited to clear, green, blue and brown, although brown is not used much in Vietnam. Also, PET recycling does not have to deal with the same 'smell' characteristics as other packaging, for food or cosmetics that can penetrate the material and remain present for a long time.

**3) Food grade cleaning:**

Several different technologies (mechanical and chemical) are used to further clean the flakes into food grade quality input material. Steps may include chemical treatment, vacuum treatment, sieving, rinsing and neutralizing.

**4) Flake finishing:**

Process to remove or identify all remaining impurities, including remaining additives, ferrous and non-ferrous metals and colors (assuming clear flake production) via laser sorting.

**5) Thermoforming:**

Once flakes are processed and categorized into different quality levels, they can be formed into different base or finished products.

To justify the investment into the machinery and equipment required for the processing steps above, a minimum volume was mentioned by all technology companies interviewed (Alba, Veolia, Far Eastern New Century - FENC). It was mentioned that the investment cost for a 5k tons p.a. and a 15k tons p.a. factory does not vary significantly, and therefore, investors aim to operate at least at the higher end of the aforementioned volume. For the volume calculation, several factors have to be considered as follows:

It is best to use only clear PET drink bottles as the receivable price is most attractive, in comparison to coloured PET. To derive this, the actual feedstock has to be significantly higher, due to color, contamination, impurities, etc.. If the factory operator has to or chooses to purchase mixed colors, assuming a split of 70% clear and 30% color and some impurities, the general feedstock would have to be around 20k tons p.a. for a viable business case (15k tons p.a. or higher).

The pricing on a factory of this size depends especially on feedstock quality, as higher contamination rates require additional pre-processing steps. Assuming average contamination levels, under consideration of the volume of 15k tons p.a., the total investment cost can be expected to range from 15-20mn USD.

**Additional Information on rPET Technology**

Reusable Content: Technically, it is possible to use 100% recycled PET for food grade PET bottle production, but such a high ratio would bear significant challenges. In developed countries, a sustainable level can be assumed at around 50% rPET content, while in developing countries, this ration may only be 20-30%.



**Reusability Cycles:** While several studies suggest a limited recyclability of PET, limiting it to 3-7 times, due to the downgrading effects of crystallization and the shortening of polymer chains, it is technologically possible (e.g. via Solid-state polycondensation (SSP) to rebuild and lengthen those polymer chains again, leading to increased cycle count. While this technology can significantly increase the quality of the rPET, it also increases the cost of production and therefore the sales price of the product. In times of low oil prices and cheap virgin PET resin, the financial feasibility has to be considered carefully.

**Viscosity:** Linked to the downgrading effects described above, another factor to consider is the viscosity in rPET bottle production. PET bottles typically require a level of 0.8-0.82 while rPET often shows values between 0.74-0.78. The granulation process alone can reduce the viscosity by 0.02. This is one of the main reasons why virgin material is added. The viscosity can also be rebuilt but it takes time and high temperatures, which puts pressure on overall margins but is increasingly demanded by European customers.

#### **Flakes vs. Granulate vs. Preform**

The decision on level of processing driven by several factors but primarily by customer demand / market.

**Washed flakes:** High risk of competition from other suppliers. Less technology and investment required. Most facilities in Vietnam only produced flakes.

**Granulate:** Depending on the use requires high tech processing. Customers for food grade rPET would typically be Pre-Form manufacturers.

**Pre-Form:** Pre-Form manufacturers would either directly deliver to the bottling brands / plats, or the bottling brands have their own pre-form facilities, depending on the level of vertical integration. For a recycler, it only makes sense to further process granules into pre-form if framework agreements with large brands are in place.

## **6. Feedstock Recovery**

Feedstock recovery is paramount for any investment, but especially at a total capacity that covers 10% of the total available feedstock, which is assumed by FENC to be around 300k tons p.a.. With current recycling rates below 30%, it may appear deceptively easy to secure 10% out of the remaining 70% but as the collection is dominated by informal waste workers and aggregators, with untransparent processes, it requires careful consideration and an inclusive approach. In general, the ecosystem can be summarized as follows (more details highlighted in the Market Report):

*In Vietnam, collection of recyclable materials is organized through formal (contracted municipal waste collectors), independent waste collectors (IWCs) as seen in the HCMC model of CITENCO and informal channels (waste pickers and aggregators) resulting in an inefficient multi-layered and intransparent environment. Focusing on the informal sector, collection starts with the waste pickers who then feed, often relatively contaminated, recyclable materials into aggregators (collection centers and consolidation centers) who then sell*

*onto a network of traders, some of which add little to no value in the value chain. Traders then namely sell into down cyclers (i.e. those who do not properly treat recycled materials) compared to certified recyclers.*

*Volumes vary city by city and even neighbourhood by neighbourhood but the average volumes of informally collected recyclables that feed into a single recycling facility. This informal structure creates inefficiencies and as a result of certain parties receiving an uneven share of the value. The involvement of down cyclers, compared to certified recyclers, presents environmental concerns, particularly for waste water treatment and the improper disposal of recyclables that have little to no value.*

*Organized syndicates, particularly those at the aggregator level, and traders may present challenges on any initiatives that diminish their power or push them out of the value chain. Furthermore, low collection rates and lack of messaging and education result in recyclables being diverted away from traditional recycling challenges and ending up in landfills.”*

Direct purchases from waste pickers would be too fragmented and incur high administrative and logistics expenses. Even working with small or medium sized aggregators may require high numbers of direct relationships. While it may be advisable to engage in building those networks long term, initial feedstock can most easily / reliably be secured in dealing with the following stakeholders:

- a) Large aggregators / consolidation centers: These are large aggregators that typically purchase from smaller collection centers and usually have their own transport vehicles and pre-processing equipment, such as baling machines in place. The value-add of this stakeholder group lies in providing a reliable market for collection centers that do not have the storage capacity to fill entire trucks as well as in their ability to compress and transport the recyclable material.
- b) Waste traders: While there is little to no value added by this stakeholder group on a product level, traders can provide access to larger quantities of required input materials. While the inclusion of traders in the feedstock recovery can cause uneven distribution of benefits throughout the value chain, it also avoids potential conflicts with the syndicate like structures. The use of traders can either be faded out over time or depending on the volumes purchased, a buyer could imply enough pressure for traders to provide value added services such as logistics, sorting, quality control or volume guarantees.
- c) Municipal waste operators: As the regulatory framework is changing and pressure on the implementation of circular economy models is increasing in Vietnam, all of the big municipal operators, most notably Citenco and Urenco, are looking at models to divert waste to landfill and increase recovery volumes. While some municipal operators, including the HCMC based Citenco are considering their own recycling facilities, none of the operators would have sufficient funds to implement the proposed project on their own. A collaboration can make sense from different angles, including the permit process as well as recovery.

**Transfer Stations:**

The general model of transfer stations is well known throughout the region but the potential is often underutilized. Municipal transfer stations are collection points where push cart workers can drop off their waste collection and change to an empty container for a new round. These are especially used in areas, where large dump trucks cannot access smaller streets and alleyways. This reduces the requirement for time consuming door to door collection with expensive dump trucks and increases efficiencies on transport to the landfills.

In HCMC, Citenco already operates several transfer stations and sold the right of waste extraction in the transfer stations to a private entity. However, infrastructure is focused on efficient transport to landfill and recovery rates are quite low. This could be a possible intervention and collaboration approach for targeted recovery of recyclables.

In addition to improved infrastructure, Citenco is considering to also buy and sell recyclables from the informal sector to increase transparency and efficiency. This 'master aggregator' model would allow for recovery at scale, and provides access to more valuable material like PET, as a lot of the valuable material is extracted before the waste arrives at the transfer stations.

## Conference Findings

### A: Breakout Session on 'Integrated Recovery'

While this breakout session was not limited to transfer stations but material recovery points throughout the value chain, it is summarized here for a comprehensive analysis.

Intervention points identified:

1. **Source separation** - household and business level: Participants agreed that this is the preferred or best case scenario but also that it is the hardest intervention to implement. This was also made clear by CITENCO, who presented the findings of a pilot project in Tan Phu district involving 6 roads and 1 apartment building, costing CITENCO 1-2bn VND / year and only yielding 2200 kg of valuable plastic waste at a 66% participation rate. This limits the potential for replication for CITENCO. The discussion of the breakout session therefore focused on the following three potential extraction points.
2. **Municipal collection points:** Smaller than the full sized transfer stations but still used for municipal aggregation, these collection points are sometimes not more than a few bins located at a street corner or can be smaller logistics points at registered and CITENCO operated spaces. CITENCO pointed out that any intervention on this level will have to carefully consider land ownership and resident sentiment. If the land is owned by the city, it may be possible if assigned from the authorities, but most spaces are informal in nature or do not have sufficient space for any extraction interventions. Other participants pointed out that extraction at this level would be the easiest and still avoids the waste to be too contaminated from other waste. A small roof structure with a clean segregation bin setup was suggested, which would allow informal workers to operate these municipal collection points and also provide a cleaner environment and easier collection for the municipal operators. We specifically asked the informal collectors that participated in the workshop if they would be willing to work in such a collection point and if they would see value in this type of infrastructure intervention. Both IWCs stated that they would be happy to work in such a space and see the potential for easier recovery and cleaner waste.

3. **Transfer stations:** CITENCO mentioned early in the discussion that it will be difficult to integrate any recovery interventions in the larger transfer stations as there is limited space, high turnaround and possible permitting issues. On the other hand, CITENCO mentioned that it is already successfully implemented on a small scale in one of the transfer stations (visited on the next day - summary below) and that CITENCO is considering to start buying waste from IWCs, informal workers and junk shops and trading waste with recyclers in a model we call “Master Aggregator”. This model was discussed further and is summarized below in the Conclusions section.
4. **Landfill:** Lastly, we briefly discussed the potential of a material recovery facility before dumping the waste in the landfill. Participants pointed out that the waste would be very contaminated by then and that the current landfills are already almost at full capacity, so space is limited for such an intervention. But when discussing that the landfill waste pickers still recover from the dumpsite, there was a general agreement that more waste could be recovered if there was some basic infrastructure like conveyor belts that the waste pickers could utilize. It was also pointed out that it would be safer and more hygienic for the workers.

After discussing the intervention levels, we listed possible assets and equipment that would be helpful to utilize in the different levels of material recovery points as follows:

- Scale
- Segregation bins
- Personal protective equipment
- Conveyor belts
- Shredder / crusher (glass, plastic, etc)
- Baler / compactor
- Signs / manuals

#### **B: Site visit of sample Transfer Station operated by CITENCO**

Participants of the conference had a chance to visit one of CITENCO’s Transfer Stations to get a better impression on the theoretical discussion of the workshop, especially the breakout session to integrated recovery as described above.

CITENCO operates various transfer stations throughout HCMC, with varying degrees of sophistication. Out of the 27 total stations, only 6 have an integrated waste management system, while other transfer stations are simple logistics centers.

The transfer station that was visited during the site visit was a well equipped and managed facility, with a daily handling volume of 1,500 tons / day (which is significantly above the planned capacity of below 1,000 tons / day), handling waste from Binh Thanh, Thu Duc, and Go Vap district. The facility consists mainly of 4 machines, namely two large baling machines and two small ones. Waste picked up by the large municipal waste trucks (12 tons max weight capacity) come into the facility, are weighed and then unloaded onto the large baling machines that compress the load of multiple (2-3) waste trucks into specialized containers to be transported to Cu Chi Landfill. There is no extraction of usable waste on site and we were informed that there is also none or only limited extraction prior to the collection by waste truck.

On the other hand, there are the Independent Waste Collectors that come into the transfer station with small carts pulled by motorbikes which are weighed and then unloaded for compression in the small baling machines. The waste from IWCs has already been sorted and valuable items have been extracted and are typically traded with informal collection centers (junk shops) before the valueless waste is brought to the transfer station.

In the far end of the facility, there is a small space in which valuable waste is extracted by several workers. We were informed that the extraction is operated by a third party, who pays a fixed fee and in return, the waste dumped in this area comes from areas that typically still have valuable waste included but are not managed by the IWCs, such as parks, malls or schools. From what could be observed during the visit and the information provided by the transfer station management, the volume running through this extraction space is very small compared with the overall capacity.

**Conclusion: Transfer Station**

The transfer station had a high turnaround with busy traffic and most spaces were utilized, leaving little room for infrastructure or interventions. While this is a specific finding for the visited site, assumed potential of integrating recovery interventions into existing transfer stations may be challenging. However, as current transfer stations are already operating above capacity, the model still proves valid for new transfer stations, especially when considering that vast amounts of the waste handled in transfer stations are not subject to any extraction mechanisms until arriving at the landfill.

Targeted extraction interventions before and at transfer station level would not only reduce the waste transported to landfill and therefore the transportation cost, but it would also allow for central aggregation of tradable waste on municipal operator level (master aggregator function).

**Conclusion: Master Aggregator Function**

Aside from the current space restrictions of existing transfer stations, the master aggregation function of municipal operators was discussed during the breakout session and valued by the IWCs, the municipal operators and by potential buyers alike.

Independent waste collectors: Currently, the waste has to be traded with informal collection centers / junk shops which are sometimes far away from the transfer stations or other municipal drop off points. The integration into the municipal operator would save a lot of time. The IWC also hoped for better prices. The possibility for this was discussed and confirmed as the municipal operator can trade directly with recyclers and can avoid some level of non-value added middleman (comment by non-IWC).

Municipal Operator: This model would potentially allow for additional revenue generation and higher recovery rates overall. In addition, this model can have a positive influence on monitoring and reporting, as the informal recovery is hard to quantify.

Recycler: Reliable access to feedstock is essential for recycling operations. The more consolidated and the closer to source the waste is collected, the better. Framework contracts are possible, potentially even with fixed prices for certain periods, which can increase stability.

## 7. Environmental Compliance

As the recycling industry is classified as an industry with a high risk of environmental pollution according to decree 40/2019, appendix 3.1, the government is very careful on balancing the level of new investments within the defined industries. While this is expected to change as described in the chapter on the regulatory framework, it is one of the main reasons why so few facilities are permitted, why industrial parks are avoiding the pre-approval for integration into their master plan and why the majority of Vietnam's recycling industry is informal and operating in a grey zone.

This comes at significant environmental cost, as investments into non-permitted facilities will focus on the production and creation of financial gains rather than environmental protection, e.g. through adequate waste water treatment or disposal processes. This causes the adverse perception of the recycling sector to manifest itself in the communities and authorities alike.

For an overview of Vietnam's Environmental regulation relevant for plastic recycling, please refer to the following:

<b>Laws, Decrees, Circulars, Directives and Decisions on environmental protection relevant to the plastic recycling industry</b>
Vietnam's Law on Environmental Protection No. 55/2014 / QH13 passed by the 13 National Assembly of Socialist Republic of Vietnam on June 23, 2014, effective from 01/01/2015;
Decree No. 179/2013 / ND-CP dated November 14, 2013 of the Government on sanctioning of administrative violations in the field of environmental protection
Decree No. 38/2015 / ND-CP dated April 24, 2015 on Waste and scrap management;
Decree No. 59/2015 / ND-CP dated June 18, 2015 on Management of Construction Investment Projects; (Nghị định số 59/2015/NĐ-CP ngày 18/06/2015 về Quản lý dự án đầu tư xây dựng)
Decision No. 2149 / QĐ-TTg dated December 17, 2009 of the Prime Minister Approving the national strategy on integrated management of solid waste till 2025, vision to 2050;
Decision No. 166 / QĐ-TTg dated January 21, 2014 of the Prime Minister Promulgating the plan to implement the national environmental protection strategy up to 2020, with a vision to 2030;
Directive No. 25 / CT-TTg dated August 31, 2016 of the Prime Minister on a number of urgent tasks and solutions on environmental protection;
Decree No. 40/2015 / ND-CP of May 13, 2019 of the Government detailing the implementation of the Law on Environmental Protection;
Circular No 25/2019/TT-BTNMT Detailing a number of articles of the Government's Decree No. 40/2019 / ND-CP of May 13, 2019 amending and supplementing a number of articles of decree detailing and guiding the implementation of Environmental protection law and regulation governing environmental monitoring service activities;
Decree No. 38/2015 / ND-CP dated April 24, 2015 of the Government on waste and scrap management;

Circular No. 36/2015 / TT-BTNMT dated June 30, 2015 of the Ministry of Natural Resources and Environment regulating hazardous waste management

### Environmental standards related to water, soil, air, waste

QCVN 03-MT: 2015 / BTNMT - National technical regulation on permissible limits of some heavy metals in the soil

QCVN 05: 2013 / BTNMT - National technical regulation on ambient air quality

QCVN 06: 2009 / BTNMT - National technical regulation on some hazardous substances in the surrounding air

QCVN 07: 2009 / BTNMT - National technical regulation on hazardous waste threshold

QCVN 08-MT: 2015 / BTNMT - National technical regulation on surface water quality

QCVN 09-MT: 2015 / BTNMT - National technical regulation on underground water quality

QCVN 14: 2008 / BTNMT - National technical regulation on domestic wastewater

QCVN 26: 2010 / BTNMT - National technical regulation on noise

QCVN 27: 2010 / BTNMT - National technical regulation on vibration

QCVN 40:2011/BTNMT National Technical Regulation on Industrial Wastewater

QCVN 02: 2019 / BYT - National technical regulation on dust - limited exposure value at workplace

QCVN 03: 2019 / BYT QD of the Ministry of Health's allowable exposure limit of 50 chemical factors in the workplace

QCVN 50: 2013 / BTNMT National technical regulation on the danger threshold for sludge from water treatment process.

## Environmental Impact Assessment (EIA)

An important regulation for the proposed rPET factory project are the [regulations on preparing environmental records for plastic recycling facilities](#) as defined in Decree 40/2019 / ND-CP amending decrees and guiding the implementation of environmental protection laws, as outlined in **Section 40, Appendix II. List of projects subject to the EIA report or project of production and business plan that must prepare an environmental protection plan**. All investment projects to build recycling and solid waste and hazardous waste treatment facilities are required to have an environmental impact assessment (EIA).

## **Overview on the preparation of an EIA**

### **A) Preparation of EIA dossier:**

For the preparation of environmental impact assessment reports for projects, a dossier comprises the following documents and data, which shall be created by the project owner under the professional guidance of an external expert:

- Business registration certificate / investment certificate;
- Policy on project implementation / location agreement;
- Certificate of land use right or land lease contract;
- Feasibility study report or Investment report with technical-economic explanation of the project;
- Supporting documents related to the project such as: Blueprints of selected land; drawing of surface water and wastewater drainage; design documents of environmental protection items; electrical systems, water supply systems, fire protection, etc.

### **B) Process of appraisal and approval of EIA reports:**

Once the general dossier is prepared including all of the supporting documents, the following process of appraisal and approval is followed:

#### **Appraisal:**

- Document of project owner requesting appraisal and approval of environmental impact assessment report (according to a set form)
- Project's environmental impact assessment report (standard form)
- Feasibility study report or investment project or equivalent document
- Profile of consultant's capacity supporting the process
- Relevant legal papers enclosed with the project's environmental impact evaluation report

#### **Approval**

- The approval requires an evaluation council meeting after which the proposed project EIA is approved or amendments may be requested.
- The process of reviewing the content of the environmental impact assessment reports includes the following steps:
  - The Project Owner's written explanation of amendments and supplements to the EIA report contents: 01 original.
  - The report on the evaluation of environmental effect of the project, which has been amended and supplemented according to the opinions of the evaluation council members: 01 original.
  - Relevant legal papers (if any): 01 copy of each type enclosed with the project's environmental impact evaluation report.
- *The approval process after the environmental impact assessment report has been fully revised according to the opinions of the appraisal council members includes:*
  - Project owner's written request for approval



- The report on the evaluation of environmental effect of the project, which has been amended and supplemented, according to the opinions of the evaluation council members
- Relevant legal papers (if any): 01 copy of each type enclosed with the project's environmental impact evaluation report.
- Digital files via CD Rom containing one (01) electronic document file in the format ".doc" with the content of the report and one (01) electronic document file in the format ".pdf" containing the scanned content (scanned) of the entire report (including appendix).

### **C) Handling time**

#### Time limit for evaluation of environmental impact assessment reports:

- A maximum of 30 (thirty) working days from the date of receipt of a complete and valid dossier for the evaluation of environmental impact assessment reports of projects in Appendix IIa Section I Appendix issued together with Decree No. 40/2019 / ND-CP.
- Maximum of 25 (twenty-five) working days from the date of receipt of complete and valid dossiers in case of appraisal of environmental impact assessment reports of projects in Appendix III but not in Appendix Annex IIa, Section I, Appendix to Decree No. 40/2019 / ND-CP.
- Maximum of 20 (twenty) working days from the date of receiving a complete and valid dossier for the evaluation form through consultation with relevant agencies and organizations on the impact assessment reports. environmental impact of the projects specified in Clause 4, Article 14 of Decree No. 18/2015 / ND-CP amended and supplemented by Decree 40/2019 / ND-CP including projects that are subject to repeat the environmental impact assessment report.

Time limit for approval of environmental impact assessment reports: A maximum of 20 (twenty) working days.

### **D) EIA for recycling plastic**

General assessment: The recycled plastic manufacturing industry is an industry classified as “potentially polluting” due to the fact that it typically generates large amounts of wastewater and due to the risk of generating emissions during the production process. Plants need large land areas to collect and store raw materials for production activities. The following is a summary of points of environmental concern for the production process, especially the pre-treatment of raw materials. The main sources of pollution during operation when the project is operating are summarized as follows:

Affected Area	Waste generation activities	Impact Agent	Impacted Environment	Impact Assessment
<b>The main source of impacts related to waste</b>				
Air	Stage of heat-forming (extrusion, granulating, spinning, laminating, etc). During the plastic melting process some pre-degraded molecular segments, monomers, volatile organic compounds (VOC) are generated.	Heat, VOC vapor	Air environment	Medium, long term, local, controllable
	Pre-processing and processing	Noise, Dust		
	Transportation of raw material and final product	Dust, NO <sub>x</sub> , SO <sub>2</sub> , CO		
Waste water	Domestic wastewater	Organic matter BOD, COD, SS, total N, total P, pathogenic micro-organisms.	Water Environment	Medium, long term, local, controllable
	Wastewater from the washing process: Raw material washing water is a special concern for the recycling industry because the amount of water generated is relatively large, the concentration of pollutants can be significant. Raw materials include dust, decomposed organic matter, food, residual liquids including washing detergents and chemicals. The wastewater must be treated to meet QCVN 40: 2011 / BTNMT: National technical regulation on quality of industrial wastewater before being discharged into regional wastewater receiving systems.	SS, COD, BOD, total N, total P, cleaning chemicals micro-Plastic, etc.		
Solid waste	Domestic waste	Degradable and non-degradable material	Soil environment	Medium, long term, local, controllable
	Waste from production processes	Sorting and production rejects, waste from maintenance and supplies		Medium, long term, local, controllable
	Sludge from wastewater treatment system	Hazardous or non-hazardous sludge		Low to High, long term, local, controllable
	Other hazardous waste	Lubricant, oiled rags, light bulbs, batteries, toner, ...		High, long term, local, controllable

## E) Relevant environmental mitigation measures

### Minimizing air pollution

- Installing dust collection and treatment systems to collect dust and related exhaust gas
- Emissions from the manufacturing process must meet relevant environmental standards when discharged into the environment)

### Minimizing water pollution:

- Dividing the drainage system into different streams.
- Rainwater runoff will be channelled and drained to the area's general drainage system.
- Domestic wastewater will be treated by septic tanks and then put into the centralized wastewater treatment system.
- Factory wastewater is collected and treated at a centralized wastewater treatment system before being reused or discharged outside the centralized wastewater collection system of the industrial park.
- Wastewater from production process must meet relevant environmental standards when being discharged into the environment

### Minimize solid waste pollution

- Control input materials, control material flow
- The treatment of sludge from the wastewater treatment system will be carried out periodically to ensure the normal operation of the system.
- Sludge treatment must comply with the standard QCVN 50: 2013 / BTNMT (National technical regulation on the danger threshold for sludge from water treatment process)
- Hazardous waste must be collected in suitable containers and collected and treated by suitable service provider or municipality

## 8. General Implementation Plan

During the analysis of the PET market in Vietnam, it became clear that the envisioned state of the art food grade rPET facility would be first of its kind, although several investors and operators are looking at the market closely and some have started with non-food grade recycling facilities or established country offices to further evaluate the potential.

In general, this feasibility study finds that the envisioned project is suitable and the timing is good for a market entry. However, as outlined throughout the report, there are several steps that need to be completed before a hard investment into the facility can be justified. We therefore suggest investors to consider a staged approach as follows:

- 1) Feasibility study (3 months)

While this analysis and the linked Market Report can be seen as part of this stage, there are additional elements depending on the individual operator's requirements and may include but are not limited to the following:

- Analyse general bottle quality and consistency: The general quality of different bottles can vary significantly and the general quality shall be analysed during the investment readiness stage.
- Evaluation of food grade rPET requirements in Vietnam, legally and operationally.
- Collaboration potential with lead buyers for domestic use or with exporters / logistics companies for overseas.
- Import procedure and duties: As most machines would be imported, the requirements and costs need to be evaluated in detail.

## 2) Investment readiness phase (6-12 months)

After the above mentioned required parameters are fully confirmed, an investor may enter into an investment readiness stage, which would mainly focus on obtaining all relevant permits and securing a location as well as initiating the process of securing sufficient feedstock.

- Permit Procedure and Location: Initiate the permit process and evaluate all options, from acquisition of existing recycling companies to use the permit (potentially extend it) to green field investments in generally approved areas.
- Feedstock: As mentioned above, one of the major hurdles for a large scale rPET factory is securing the feedstock. While several different approaches may be able to secure sufficient volume, VCCI highlighted that such processes need to be socially inclusive and may take time.
- Evaluation of a stages approach, with the end goal of food grade rPET but potentially starting with fiber or less demanding rPET production, e.g. PET in automotive.

## 3) Implementation (6-12 months)

Once all permits are obtained and feedstock can be assumed to be secured, the procurements and implementation phase would follow, at which stage, regular FDI mechanisms will apply.

## Appendix 1: Additional feedback logs on the factory location research

NO	Items	PIC	Phone	Email	Feedback
1	Long An Industrial Zone Authority	Mr Tinh	09848444648	<a href="mailto:tinh.vietnam@gmail.com">tinh.vietnam@gmail.com</a>	Feedback through email; Received inquiry letter and forwarded to 1 industrial park and otherwise mentioned that recycling permit is difficult to obtain in Long An
2	Tp HCM Industrial Zone Authority	Trung	0989002456	<a href="mailto:nvtrung.hepza@tphcm.gov.vn">nvtrung.hepza@tphcm.gov.vn</a>	There is 1 industrial park that considers recycling activities but they are concern about waste water of pre-processing line (feedback via phone call)
3	Industrial Zone Authority Tây Bắc Củ Chi (manage 40 industrial park in Cu Chi)	Mr Son	908344377	<a href="mailto:soncidico@gmail.com">soncidico@gmail.com</a>	"We have researched the dispatch sent by your company and it is very sorry that your project could not be accepted due to environmental criteria" (feedback via email)
4	Long An Industrial Zone Authority Tân Phú Trung	Ms Lan	09349100919	<a href="mailto:lantanphutrong.iz@gmail.com">lantanphutrong.iz@gmail.com</a>	They can consider recycling but are concerned about waste water (feedback via phone call)
5	KCN Thuan Dao Ben Luc Long An	Mr Thai	0907381023	<a href="mailto:thai@dongtam.com.vn">thai@dongtam.com.vn</a>	"Generally open but concerned about waste water. Without the plastic washing line they will accept a recycling factory." With investments into own wastewater treatment potentially acceptable. (feedback via email)
6	Sài Gòn VRG ( KCN Le Minh Xuan; Dong Nam; Phuoc Dong; Loc An Binh Son) - HCM industrial park	Ngoc Huynh	(+84-28) 3847 9273	<a href="mailto:nhungoc@saigonvrg.com.vn">nhungoc@saigonvrg.com.vn</a>	Rejected recycling factory enquiry. (Feedback by email)
7	HCM Investment Promotion Board	Mr Phong	0989002456	<a href="mailto:phonglt@itpc.gov.vn">phonglt@itpc.gov.vn</a>	Written enquiry sent by mail; no feedback received.
8	Management Board of Binh Duong Industrial Zone	Investment Officer	3848224	<a href="mailto:bqikcn@binhduong.gov.vn">bqikcn@binhduong.gov.vn</a>	Recycling activities very restricted to be accepted in Binh Duong (feedback via phone call)
9	KCN Hiệp Phước KCN Hiệp Phước "	Investment Officer	Tel: (+84) 964 11 88 33	<a href="mailto:sales@hiepphuoc.vn">sales@hiepphuoc.vn</a>	Rejected recycling factory enquiry. (Feedback via phone call)
10	Industrial area Tân Thuận - 300ha	Investment Officer			Rejected recycling factory enquiry. (Feedback via phone call)
11	INDUSTRIAL AREA Mỹ Phước 1 and Mỹ Phước 2, 3 - Binh Duong	Investment Officer	(84) 650 3822655 (84) 650 3811777	<a href="mailto:vninvest@becamex.vn">vninvest@becamex.vn</a>	Rejected recycling factory enquiry. (Feedback via phone call)

12	Industrial park Đất Cuốc	Mr Nghĩa	093884391 4	<a href="mailto:nghia@ksip.com">nghia@ksip.com</a>	Rejected recycling factory enquiry. (Feedback via phone call)
13	Đức Hoà III Silico industrial park		(+84) 24626.0001 6		Being a new industrial zone, it is flexible to change and expand industries to attract investors (Feedback via phone call)
14	Industrial park Vinatex-Tân Tạo	Mr Han	091529229 4	<a href="mailto:hangoc0906@gmail.com">hangoc0906@gmail.com</a>	Offer to facilitate approval and issue investment certificates but need to take a closer look at the project's production process and recycling technologies. (Phone and email)

## Appendix 2: Three day conference

A 3-day conference was hosted by ASSIST with organization and technical moderation support by Evergreen Labs including focus group discussions and orientation sessions.

### Conference - Day 1: Focus Group Discussion 1<sup>ST</sup> October 2020, HCMC.

#### Participants

VCCI  
VPA - Vietnam Plastic Association  
CITENCO  
JOHN SWIRE Representative in Vietnam  
DONRE HCMC (Solid Waste Management)  
DONRE Binh Duong  
DONRE Long An  
DONRE Dong Nai  
Head of Commercial Office (Embassy of Denmark)  
Rieckermann Vietnam

#### Agenda

Time	Activity	Note
8:30-9:00	Check-in	
9:00-9:10	Opening remarks	VCCI
9:10-9:20	Welcome, PCR project intro & recap	ASSIST
9:20 – 9:30	Plastic waste issue in Vietnam	CITENCO
9:30-10:00	Technical report presentations: Key findings	EGL
10:00-10:30	Tea Break	
10:30-12:00	Facilitated report discussion: Q&A, feedback, etc	ASSIST, EGL
12:00-13:00	Lunch Break	
13:00-14:00	Drive to site visits	
14:00-15:00	Visit suitable industrial park	Assist, EGL
15:00-16:00	Drive back to HCMC	

## Conference - Day 2-3: Orientation Sessions 2 – 3<sup>rd</sup> October 2020, HCMC

### Participants

VCCI  
 CITENCO  
 John Swire representative in Vietnam  
 ENDA  
 Independent Waste Collector  
 Lagom  
 mGreen  
 Ocean Works  
 Kim Delta  
 IDH  
 GreenHub  
 IDE  
 Nhựa Hiệp Phát  
 Ms. Hanh Family Business  
 Highlands Coffee  
 Revival Waste  
 Siam City Cement

### Agenda

Time	Activity	Facilitator
<b>Day 2 – Orientation Day</b>		
8:30-9:00	Check-in	N/A
9:00-9:15	Welcome, PCR project intro & recap	ASSIST
9:15 – 9:30	Opening remark	CITENCO
9:30-10:00	Technical report presentation: Excerpts of PET recovery / feedstock	EGL Team
10:00-10:30	Citenco about integrated waste collection (focus on transfer stations)	Citenco
10:30-10:45	Tea break	
10:45-11:00	Best practice session 1: Corporate collection	Lagom
11:00-11:15	Best practice session 2: Digital Solution	OceanWorks
11:15-11:30	Best practice session 3: IWC and IWP overview	ENDA
11:30-14:00	Lunch break	
14:00-15:00	Breakout session #1: Integrating collection schemes Designing new transfer station model	Facilitated by EGL



14:00-15:00	Breakout session #2: Market access for recyclers Platform approach or direct access	Facilitated by ASSIST
15:00-15:30	Tea Break	
15:30-16:00	Conclusions and wrap-up	ASSIST
Day 3: Site visits - Location off site		
08:30 - 08:45	Check-in at meeting point	
08:45 - 09:15	Drive to site visit 1	
09:15 - 10:00	Visit CITENCO transfer station Gò Vấp	CITENCO
10:00 - 11:00	Drive to site visit 2	
11:00 - 12:00	Visit PET recycling center (Củ Chi)	
12:00 - 13:30	Lunch	