

# PVC is Recyclable



## Thailand PVC recycling case study

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Plastics used at present are categorized into two types based on their ability to be re-processed after use. Thermosetting plastics are irreversibly cured and could not be re-processed, Melamine and Epoxy resin for instance. Thermoplastic polymers, on the other hand, can be reformed to reuse while restoring their chemical characteristics i.e. Polyethylene (PE), Polypropylene (PP) and Polyvinyl chloride (PVC).



It is known that manufacturing patterns and consumption behavior of the consumers has led to an increase in wastes, particularly for plastic wastes. Design of the products to prolong service time, reuse and recycling are practical ways to reduce the problem. Products made of PVC present one of the most contentious issues in terms of its ability to be recycled. This is because it is quite impractical to reuse post consumer PVC products as pure resin. Besides, the prominent property of PVC whereby varieties of quantity and types of additives can be added to improve the property becomes a great barrier to recycling.

Economic demand and supply are crucial factors for material recyclability regardless whether a material is recyclable or not. This includes the fundamental mechanism of the reverse logistics to return materials for recycling. The facility of recycling a particular material is not indicative of high demand for such material and vice versa. The unclear and low reliability of the recycle material supplies also narrow the recycling capacity as well. The efficient waste management mechanism from household/customer back to the product manufacturers under price competitiveness will be possible when the market pushes demand of recycling materials.





# RECYCLING OF PVC IN THAILAND

Waste recycling is a deep-rooted behavior in Thailand, although this behavior is starting to wane in recent years. However, the reverse logistics structure is to be regarded as the highlight of Thailand and other developing countries, which included the second hand business, **“Scavenger business and Junk shop”**. These businesses are increasingly growing, hence leading to the lack of available recyclable materials. **Thailand has a good network and capability to transform used PVC products back to the market**, both domestic and export, allowing the production of new products from recycled PVC without re-export to the third countries.



Thailand has the reverse-purchasing mechanism, which adds value to PVC products as summarized in Figure 1. Flow of material starts from the District junk shops, which initially separate and collect wastes, before selling to regional junk shops. As required by purchasers, the size of PVC scraps are usually shrunk down to save on shipping costs and facilitate the recycling activity and transportation. A survey by the Pollution Control Department (PCD) in 2010 found that Thailand has roughly 10,200 junk shops nationwide.

## Recycle Loop of PVC in Thailand

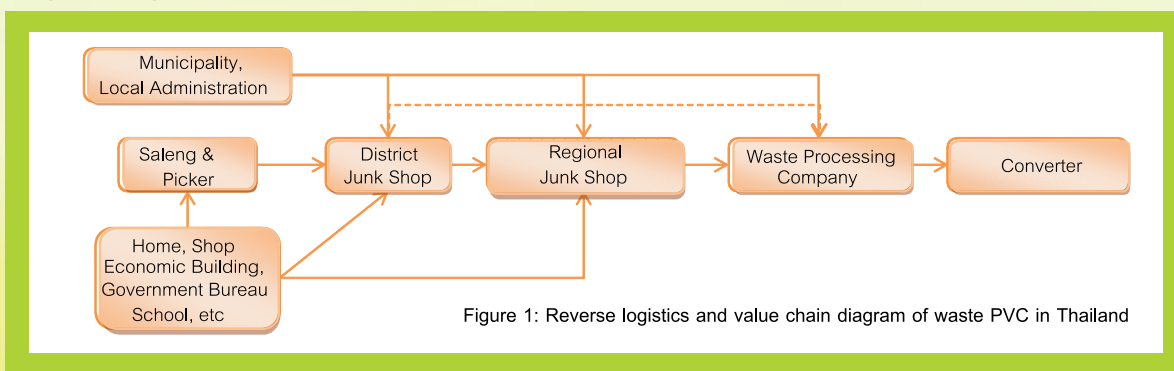


Figure 1: Reverse logistics and value chain diagram of waste PVC in Thailand

The purchase price of PVC scrap varies based on the type of the waste product, as exemplified in Table 1. Physical appearance and cleanness of material influence the selling price of the scrap. In addition, sale price of large quantities of scraps is often higher than the retail price. Purchase prices of the three main categories of scrap PVC (blue/yellow pipes, linoleum and rubber boots) between 2010-2012 indicate that the median price for a piece of PVC vary in a narrow range in comparison with other types of plastic scrap (see Figure 2). Purchase price is relatively stable suggesting that supply and demand are rather stable and constant. The lower buying price range between September - November of 2011 is a result of flooding. Higher price from January 2012 is due to large demand as a consequence of restoration activities after the flood.



Table 1: Waste PVC price @ 25/07/2012

PVC Products	PRICE (THB/kg)	PVC Products	PRICE (THB/kg)
Bottle	0.40	Small Cable Sheet (Black)	8.50
Linoleum	3.90	Cable Sheet (Mix)	8.00
Pipe (Blue/Yellow)	10.50	Shoe	8.50
Pipe (Gray)	2.00	Booth	14.50
Window Frame, Door	2.50	Flexible Hose	8.00
Large Cable Sheet (Black)	9.50	Rigid Hose	5.50

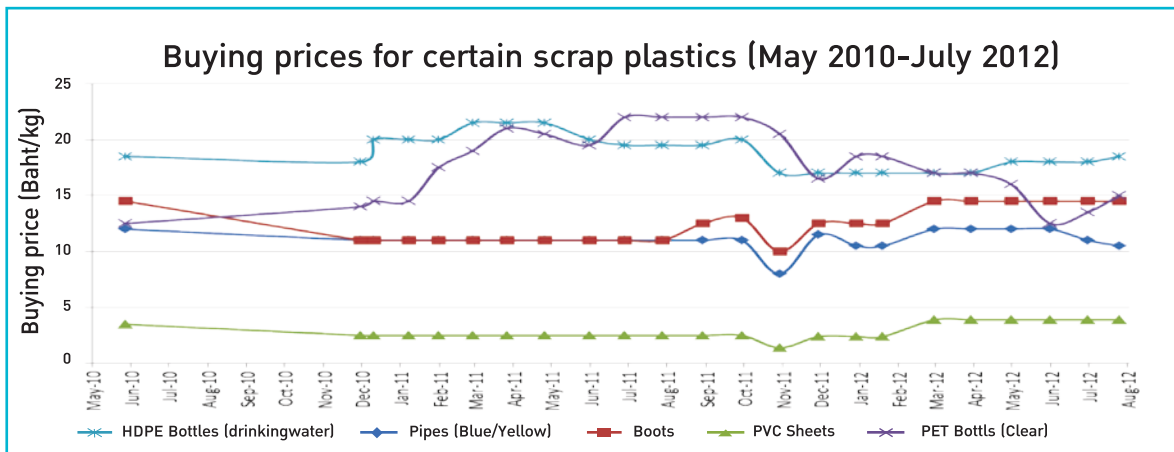


Figure 2: Median purchase price of plastic wastes (2010-2012)

Source: Goods purchase invoice from Wongpanich Company Limited

Regional junk shop serves as a warehouse for scrap in scrap processing plant, which depends upon the demanded quantity at specific period of time. These outlets are often limited to a specific material for which they have the expertise. Most entrepreneurs have been doing business in this industry for more than 10 years and have reliable business networks. The business group fixes the purchasing price and let the distributors buy the high demand scrap from retail shops. This system controls the consistency of the supply of PVC material at a certain level.

PVC waste processing business is not well-known publicly. Nonetheless, large processing plants tend to be known among the regional junk shops. These facilities use mechanical recycling processes (cutting, cleaning, grinding and mixing various PVC wastes together) to meet PVC converter plants' requirements. Recycled PVC can be in the form of a small piece of material, or coarse powder or fine powder, depending on the end products to be made. Unlike typical plastic recycling, PVC recyclates do not need to be melted and palletized. Likewise, no extra chemicals have to be added that can increase production cost than necessary. Dry blend of PVC recyclates is directly used and the recipe is formulated by virtue of experience and knowledge by grades and combination of additives, which is a trade secret of each converter.



Scrap PVC processing plants have strong skills in PVC business and have close relationship with PVC product manufacturers in the country. PVC recycling is produced by processing scrap PVC and formulated to meet the needs of each customer. Quality control is applied to guarantee the consistency of the recyclates. If problem occur, the product will be returned for re-blending until it meets the needs of customers.

The exact number of PVC waste processing companies in Thailand is still uncertain. Based on interviews of PVC waste processing plants in the country, large manufacturing facilities have been in operation for at least 10 consecutive years and there are roughly 3-5 players in Bangkok and Eastern provinces. PVC product processing plants in Thailand have their own development technologies and continuously improve the production technology to guarantee product quality as well as reduce the cost of production. Based on available information, these large facilities have a total capacity of at least 50,000 tons per year, although production quantity fluctuates according to the market behavior of products made from virgin PVC resin and the availability of PVC materials in the market.

Main facilities accept post consumer PVC wastes such as linoleum, booth, pipe, fittings and profile production plants. Price of the processed PVC scrap is roughly 2-3 times greater than the median purchasing price based on the quality of recyclates and current market price of virgin PVC resin.

The current usage of recycled PVC in Thailand is about 75,000-90,000 tons per year based on information from converters (see Table 2). This is about 19-23% of the quantity of virgin PVC resin produced in 2010. In other words, the use of recycled PVC is about 20% compared with new material.

Today, Thailand imports PVC scrap from developed countries with slightly exports to neighboring countries. However, the statistics in the past five years indicate insignificant import/export amount of PVC recyclates.

Table 2: Usage estimation of recycled PVC in Thailand

Main Products	Average use (MT/Y)	Source
Pipe, Fittings, Profiles	10,000-15,000	Recycle PVC converters (2 players)
Linoleum	60,000-70,000	Recycle PVC converters (2 players)
Booth	5,000	Estimation based on 25% of PVC products made from virgin PVC resin in 2010
Total	75,000-90,000	
Remarks: Quantity of recycled PVC is calculated from post consumer PVC products.		





## CHALLENGE AND STEP FORWARD TO INCREASE RECYCLE RATE OF PVC WASTE

Although Thailand has the complete chain to recycle PVC scrap and has a relatively high proportion of recycled PVC, the reverse logistics is still limited to produce only 2-3 types of products. This is due to the current market that limits the use of producing other PVC products from recycled materials i.e. backing layer of carpet tiles (capacity 10,000-20,000 T/y), agricultural pipe, fittings, drainage pipe and profile products (capacity several tons per year).



For soft PVC products i.e. base plate for carpet tiles, rubber; the main limitation to the use of recycled PVC is demand. The image of recycled PVC is in the level that could not stimulate the demand of recycled material to be more environmentally friendly among producers and consumers.

The survey of landfills in 14 locations throughout all regions of the country found insignificant amount of PVC waste. Based on the existing mechanism, the remaining PVC scrap is not circulated back for recycling. Demand for recycling PVC in soft products at an excess supply under current conditions may be able to stimulate the market for the purchase of other soft PVC materials i.e. toys, office equipment and PVC film. This will result in the circulation of short-life PVC products back to the system.

The main limitation of rigid PVC products is the waste supply because rigid PVC has several decades of service life. The availability of rigid PVC waste in reverse logistics system is still low; thus, making it difficult to stimulate the demand of these particular articles. Increasing the use of recycled PVC under limited supply conditions can be achieved by developing technology to process waste PVC as an ingredient for the production of soft PVC. However, the current condition of PVC recycles demand is not at a significant level that can encourage the waste processing plants to increase the investment. It is worth noting that the suitable condition to stimulate the cooperation between parties and long term investment between the producers and waste processing plants has to be renewed.



## Conclusion

PVC is intrinsically recyclable and practically not too difficult to be recycled based on the current condition in Thailand. In addition, the variety of PVC products is not a limitation to recycle PVC. On the other hand, this presents the option to adjust the formulation to suit a wide range of products. Recyclability of PVC as well as the development guidelines for the more sustainable production and consumption is a complex roadmap and cannot be considered only from the specific features or combination of additives in materials.

“ PVC is the most Sustainable, Environment-Friendly and  
**Safe-to-Use** Commodity Plastic in the ASEAN Community.”



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