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Guideline for Management and Minimisation of Plastics

Note: see also *Guideline for Waste Minimisation on Atolls or Small Islands and “Rubbish is a Resource” Kit*

General Comments: Plastics



Plastics floating amongst housing on an atoll

Plastics are usually petrochemical based polymers (long chain molecules) used in most situations of modern life. Plastic packaging consumes over 200,000 barrels of oil each day in the USA alone. Plastic containers are rapidly replacing many of the Pacific’s traditional packaging materials and plastic sheet is increasingly being used to secure items with shrink-wrap and other film-based covers.

Plastic is extremely useful for islands as its waterproof, lightweight and hardy. These very features also are the reasons for many of their

negative impacts. Most plastic are technically recyclable but the logistics, economics, contamination and the price of the parent material, oil, all determine to what degree recycling occurs. In the Pacific islands, all types currently require subsidies of some level i.e. governments paying for collection or sorting costs.

Plastics also have a high calorific value i.e. they burn hot, so they are important in waste-to-energy plants or incinerators. Unfortunately, without good pollution controls, burning PVC can give rise to toxic smoke containing dioxins, a powerful carcinogen (cancer inducer).

For the purposes of this guideline, the focus will be on the most detrimental and common plastics impacting on Pacific waste management – those used in packaging.

Types

There are many types of plastic with polymers formulated to do a specific task but the most common are:

(1) PET = **P**oly**E**thylene **T**erephthalate

PET is a tough clear polymer used for water and juice bottles, carbonated drinks like Cola and beer and many food jars. It is recyclable into clothing, carpet and back into food containers and is currently the most valuable of the recycled plastics. It is also increasing in the Pacific's waste stream as its use increases by replacing PVC and glass.

(2) HDPE = **H**igh **D**ensity **P**oly**E**thylene

HDPE is often coloured and is found in ice cream containers, juice, milk, detergent and shampoo bottles, and common items like buckets and shopping bags. It can be recycled back into the same items or other products like pipes, rubbish bins and artificial timber and fencing.

(3) PVC = **P**oly**V**inyl **C**hloride

PVC is strong and cheap and has been used widely in the building industry such as pipes and electrical conduit and is found in that industry's waste stream. At home, PVC is often seen in some cosmetics and cordial bottles and also garden hoses.

PVC has been at the centre of controversy for the past decade over the use of some "plasticizers" which are added to make the final plastic more flexible and the presence of chlorine in the product. Chlorine can give rise to dioxins in both manufacture and also if it is burnt for disposal. This is particularly relevant to the Pacific where householders often burn leaves and paper mixed with plastics. PVC can be recycled back into similar products.

(4) LDPE = **L**ow **D**ensity **P**oly**E**thylene

LDPE is soft and is often used for wrapping and packaging films (sheets) and plastic bags. LDPE can be recycled but the very thinness and light weight means that there is usually very little material in each item and so requires an enormous number to make any viable quantity. The lightness also increases the litter issue as it blows out of bins and floats into drains, streams and the sea..

(5) PP = **P**oly **P**ropylene

Polypropylene is a heat resistant plastic that is used in many common products such as garden furniture, ropes, pallet wrapping, ice cream tubs, microwave dishes, car bumpers and electric kettles. It can be recycled into similar products such a clothes pegs, car battery cases and pipes.

(6) PS = **P**olystyrene

PS is clear, rigid and brittle. It snaps whereas most plastic tend to bend. It is used for CD and video cases, and cutlery like plastic knives and forks. It can be recycled into low value items like coat hangers. It can also be expanded with a foam into a very light heat insulating product which is used to make bean bag beans, shock absorbing packing balls, and take away drink cups and food containers. It can be recycled but its extreme light

Code Numbers

The numbers against each plastic are an international code to make separating easier and cheaper. Without these numbers stamped on the packaging item, guessing the type of polymer is very difficult. Unfortunately, many Pacific countries have not passed laws requiring the identification numbers to be on all plastic containers sold.

*This simple requirement common in countries like New Zealand, adds nothing to the cost, and is **the most important single action government can make to ensure plastic recycling is more viable.***

weight make it a waste managers' nightmare as it can be blown away by the lightest breeze and consumes an inordinate space in a landfill even when a compactor is used.

(7) Other or Mixed Plastics

There are many other specialist plastics used for items like computer bodies, car and appliance parts. They can be recycled as "mixed plastics" into low value products like pipes and artificial timber. Poorly sorted recycled plastics usually end up in this category and has the lowest financial value as the mix of unknown polymers make it much harder to utilize predictably.

Bio-degradable Plastics:

In response to the consumer and government reaction to plastic litter, there have been some fairly recent developments to make plastics break down more rapidly.

There are two main types –

- petrochemical polymers with a deliberate weak link that will sever under heat or UV which allows the product to break into lots of tiny (but still long lived) pieces of original plastic.
- Starch-based polymers sourced from vegetable matter and are thus both renewable and biodegradable. Recent technological advances have reduced the price of these to be more competitive with petro-chemicals.

While these can significantly reduce negative impacts, it should be remembered that a bio-degradable shopping bag can still kill marine life or breed disease carrying mosquitoes but only for months instead of many years.

The Management Challenge:

Plastics represent a huge challenge for Pacific islands. Their very light weight makes them particularly visible as they float or are blown around by the wind and their long life means they will stay visible for many, many decades, if not longer.

Their use is increasing with economic development and manufacturing changes, take tens to hundreds of years to degrade, and can have significant negative environmental impacts.

The disposal of plastics is difficult in that they consume large volumes in transport or the landfill airspace (the unused capacity of a landfill and the measure of how much life it has left before being full) and so are very costly per tonne to manage.

Incineration of plastics is possible but is very expensive to do it safely. The combination of high temperatures, high humidity and marine air are not kind to these costly systems. High temperature incinerators are notoriously temperamental and often need major repairs or replacement.

Negative Impacts

Poor disposal of plastics, particularly packaging wastes, have significant economic and environmental consequences.

- *Litter collection costs;*
- *Death of marine animals that ingest plastic bags;*
- *Capturing rain water to allow mosquitoes to breed and spread dengue and malaria;*
- *Clogging stormwater drains and increasing flooding;*
- *Litter degrading the pacific paradise image and discouraging tourists;*
- *Low density causing high collection and disposal costs;*
- *Cancer-causing pollution from incineration of PVC.*

Low temperature incineration, including backyard burning piles and setting the dumpsite on fire, is practiced on many islands and rural areas throughout the world. While such a practice can reduce the vermin and volumes of waste, it should be remembered that, if PVC is present, the smoke is toxic.

Thus plastics should never be burnt when the wind direction means there is a chance of people or animals inhaling the fumes. The residue also contains toxic products and so can contaminate soil, ground water and possibly effect an adjacent lagoon.

So why not simply ban them? Plastics are extremely useful and cheap. Often there is no sensible alternative and their very lightweight has reduced the transport and operational impacts of everything from cars to cola. In many cases, plastic packaging protects goods including food, which reduces the volumes ruined and going into the waste stream.

Seeing plastics are obviously here to stay, the issue the world faces is how best to reduce their negative impacts while retaining the good aspects. Banning all plastic is not a sensible solution though it may be appropriate for some types that cause particular problems such as disposable polystyrene foam or non-biodegradable bags.

Plastic Bags - Frequently Asked Questions

How long will bags last ?

- ❖ *Plastic bags can last over a hundred years in the environment.*
- ❖ *Most people will each leave a legacy of about 25,000 bags in our environment in their lifetime.*

Are they bad for the environment?

- ❖ *More than 100,000 sea animals, including sea turtles die each year from plastic debris including plastic bags.*
- ❖ *Water collects in them and breeds mosquitoes, spreading Dengue and Malaria.*
- ❖ *A car can drive 115 metres on the amount of petroleum and energy used to make one plastic bag.*
- ❖ *Burning PVC will release cancerous chemicals.*

Are they bad for the economy?

- ❖ *Plastic bags are very cost-effective and useful, particularly for cold or wet items.*
- ❖ *Plastic bag litter discourages tourists which costs some Pacific countries dearly.*
- ❖ *The health and cleaning costs could be better spent on something productive like education.*

What are the alternatives?

- ❖ *The best option to reduce plastic bags is to take your own bag when you go shopping.*
- ❖ *Bio- degradable bags are the next most appropriate alternative, however, they still use valuable resources and contribute to unsightly litter until they degrade.*
- ❖ *Paper bags compost easily but do use energy in manufacture.*
- ❖ *Many Pacific countries have traditional containers and carrying devices that use renewable materials.*

Reduce:

Reducing plastic packing requires a multi-pronged strategy. A combination of bans or taxes (economic instruments), and public education will be necessary.

Bans and taxes:

Both bans and taxes can be used to reduce the problem plastic packaging. It should be remembered that taxes can be used just as effectively as outright bans to shift usage from one product to another. Taxes are often preferable as they provide some income to government and can facilitate a phased withdrawal of a problem product. In the case of plastic packaging, the impacts are volume-related and so significant reductions in volume will often be adequate to minimize the impacts. For example, in Ireland (Eire), a A\$0.25c tax on every bag sold reduced bags by over 90% and raised funds for environmental activities.

Given the availability of adequate substitutes made of cardboard or even biodegradable plastics, Governments should examine the costs and benefits of banning expanded polystyrene takeaway

“clamshells” and containers or taxing them to the point that the alternatives become more attractive. Their use is increasing and given the lack of litter bins in most of the Pacific, they are increasing their representation in litter and in the environment.

The other obvious candidate for bans or taxes are lightweight plastic shopping bags. The very cheapness of these has encouraged a retailing culture of dispensing, “for free”, an excessive number of bags at the point of sale. These bags are perhaps the worst of all plastic packaging. Reducing their usage should be a priority as there is no economic recycling option for Pacific islands.

The biggest culprit is the very thin bags – those under 30 microns. These are too thin to be re-used. By encouraging bags in the thicker > 30 micron class, the bags are strong enough to carry more goods and allow shoppers to re-use them. They also become expensive enough that retailers restrict the numbers that they “give” away.

Selection, Design and Implementation of Economic Instruments in the Solid Waste Management Sector in Kenya The Case of Plastic Bags

Lessons learned from other countries

- *A package of instruments, including command and control, voluntary and economic instruments rather than a single economic instrument is required. For instance, introduction of a tax on plastic bags may not work well without a comprehensive education and awareness campaign.*
- *A ban on single-use thin plastic bags seems to be a logical element of the policy package.*
- *As plastic shopping bags are banned or taxed, another key element of the policy package becomes the provision of an alternative bag.*
- *A tax or levy, especially when directly targeted at the shoppers and set at an appropriate level, has a huge impact on the use of plastic shopping bags. Directing the tax at the producers and importers has considerable impact too.*
- *Even developed countries lack the elaborate data required to calculate the optimal level of tax, levy or surcharge. In most cases, regulators and the industry negotiate the level.*
- *For acceptability and therefore effectiveness of the levy, the revenue collected from it should be earmarked for environmental protection projects.*

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Taking the lessons from the UNEP study, these thin bags should either be significantly taxed or banned outright. Taxes will provide some funds to government which will reduce as the bag consumption reduces while banning solves the issue once and for all but with impacts on the packaging and retail industry. Any such ban will need to be well consulted and then a transition period mandated to allow business to eliminate old stock and change their practices. The UNEP study also recommended a tax on the thicker bags. The aim of this tax is to reduce usage and fund waste management.

The level of the tax is best set by consultation as it needs to take into account the peoples' ability to pay and a decision on what level of tax will discourage excessive use. It also needs to be decided whether your country wishes to exempt biodegradable bags. That decision hinges on whether you see the major aim – to significantly reduce plastic bags or whether you are trying to shift from non-biodegradable to biodegradable bags.

Samoa simply banned all non-biodegradable shopping bags and the industry has swapped over to biodegradable bags. The biodegradable bags must be 50% starch and rot away within 12 months in a compost heap. It is unsure how long they would last in the sea or bush. This will reduce the long-term impacts but not those over the first year.

PNG attempted a ban on local bag manufacturing with insufficient consultation and were stopped by the courts because it discriminated against local business. Other countries have had similar problems when they attempt a hasty ban without talking to stakeholders. This shows that good consultation with industry and the community is essential to be successful.

Recycling is a very useful way of developing the private sector involvement in waste management. The private sector is often better placed to chase good prices and to keep the system efficient. However, as with any private sector long term contracting, governments need to be very sure of the details of the system and the costs of the private sector. For this reason, a number of countries have found it easier to begin recycling and then tender it out when the operation is fully understood. Also, the private sector will be far better informed in

Re-Usable Bags

A number of countries in the Pacific have now adopted strong re-usable synthetic bags. In French Polynesia there is a "Bag for Life" which is replaced by the shops when it gets worn. In Samoa, the bags were produced by SPREP, the ANZ and various private sector partners. The bag promoted the Year of the Sea Turtle as a way of focusing attention on the impact of plastic bags.

The bags were accompanied by a high profile media campaign and provided shoppers with a cheap alternative to one-use plastic bags. The private sector got very good advertising as the bags look good and will display their logos for a few years. The bags were sold at normal prices with a small donation going to a save the turtle fund. The project was extremely successful with 4000 bags being sold in 3 months.



its tendering and what policy settings (i.e. laws, education programs, site availability, etc) and practical measures government can take to reduce the costs.

In the absence of a viable material, it is essential to develop an extremely cost-effective system. Thus any mechanisms to reduce collection, separation, sorting or export costs are vital. PET is the most valuable plastic at time of writing and is often the obvious type of plastic to begin the system with, leaving the other less viable plastics to subsequent phases.

The other advantage of beginning with PET is that there are usually some easily recognized containers that make up the bulk of the material. That means that recycling can begin while you are still implementing a plastic identification number system to make sorting of all types of plastic cheaper. It also means that you can begin recycling with a targeted collection that uses specific drop-off bins or cages. Even better is a deposit and refund system which removes almost all collection costs (~ ¾'s of the total costs!!) and delivers clean well sorted recyclates.

Contamination by other materials or even other plastics will further reduce the meager value of your plastics and must be eliminated whenever possible. It's possible that you will receive an invoice for shipping and handling after export rather than a cheque for sale of recyclables if the receiver detects any contamination beyond the tiniest levels.



The image shows the cover of the 'SPREP-IWP Waste Resource Kit'. The title 'SPREP-IWP Waste Resource Kit' is at the top. Below it is a photograph of a woman in a tropical setting, with a circular graphic on the right that says 'RUBBISH IS A RESOURCE!'. At the bottom, there are three columns of text: 'WASTE STRATEGIES' (CDL, Toxics, Waste plans), 'WASTE MANAGEMENT' (Recycling, Organics, Landfill), and 'LIBRARY' (Photos, Symbols, KIT GUIDEBOOK, Print a copy, ADOBE READER, Download here). The bottom of the cover has the text 'THIS IS MY PARADISE' on the left and 'IS THIS MY FUTURE?' on the right.

SPREP's "Rubbish is a Resource" Kit has useful information about different systems and equipment for recycling plastics and other materials. Obtain free copies from SPREP.

The final critical issue is minimizing shipping costs. Because plastic is so light, consolidating the material before packing into the containers is essential. Various presses and bailers are available and some extensive research must be done before you commit to purchase of any particular one.

The denser the resulting bale the better but, as with everything, there are diminishing returns so a good cost-benefit analysis needs to assess the reduced shipping costs over the life of the expected life of the machine.

Some plastics are so expensive to recycle that it is unadvisable to spend precious funds on keeping them out of the landfill. Plastic films (e.g. shopping bags) and expanded polystyrene are two plastics that are disproportionately expensive due to their minimal value and very light weight.

Plastic recycling requires another important pre-condition and that is a predictable source of funds to subsidise the process. As plastics are not yet viable in their own right, there needs to be some subsidy, whether that is "free" collection paid by government, a deposit and refund scheme, or a simple bounty paid to a private contractor on a weight basis for plastic exported. All these (and others) have different consequences but all require an ongoing provision of money on a regular basis. It is vital to assess what this figure is likely to be before recycling begins so that your government can make an informed decision. SPREP is happy to assist governments analyse their situation and choose what approach to take. However, in the absence of country-specific barriers, the deposit – refund system offers the best way.

With a simple import or manufacturing levy to provide the deposit, the funds are generated for the refund. By paying a refund of sufficient incentive to deliver the PET bottles, you have avoided most of the collection costs and avoided sorting costs. Also, by retaining around 20% of the levy (i.e. the deposit is bigger than the refund), it means that government has the funds to subsidise the system at no impact on the central budget. The refund money also plays an important role in providing the collectors (often children, and unemployed) with a source of money to enable them to participate in the emerging economy.

Public Consultation and Education:

Public consultation and education (which includes the business community) is an essential part of any strategy to manage plastics packaging. Education and consultation can identify any unforeseen problems with your options. It can also build a strong political consensus that makes government support much easier to obtain. For example, experience overseas has shown that public support for a levy on plastic bags depends largely on the use the money is put to. Again, experience has shown that funding environmental issues is the most popular but those issues will vary and consultation will assist you in identifying the most popular.

You will find that consultation is more successful if you have already educated the public to the issues and consequences of our increasing plastic usage. It is important to realise that education is not a school issue. In this case, you need to educate the whole community. The re-usable shopping bags in Samoa were used as both a simple alternative for the public but also as a focus of public education. Every time someone sees the blue bags, they will remember the information about impacts on marine life.

A program of consultation will alert you to industry's concerns and will give clear information on any required transition periods or policies that can minimise the negative impacts on those that import, make, sell or recycle plastics. A recycling program can be a business development opportunity and economic development departments may be able to help you with setting up a sensible recycling system with private enterprise. By taking into account industry's concerns and minimising their costs, you will reduce the chances of being rejected by Cabinet.

Once your strategy has been adopted by the Government, you will need to educate the public about their role in the new system such as where they can get a refund on their PET bottles or why burning PVC is dangerous.

Disposal:

Currently, the most likely disposal method for plastics in the Pacific is landfilling or open dumping. Plastics in a landfill consume excessive amounts of airspace and also present a wind blown litter potential. Other than that, the small issues of phthalates or other poisonous leachates are tiny when compared to the negative impacts if they are not landfilled or dumped. For that reason, public education can be very effective in getting plastics off the streets and out of the backyard burning pile and into the bin.

It is likely that there will be further development in reliable incineration over the next decade with a focus on capturing the energy for electricity generation, an imperative in the Pacific. The calorific value of plastics make them very attractive for this process but they also can give rise to cancer-causing dioxins if PVC is present. While it is important that we keep up to date on this technology, it is highly unlikely that it will be sufficiently refined to be suitable for the very harsh situation of the Pacific in the near future. For this reason, it would be wrong to delay plastics management in the hope that waste-to-energy plants will solve our problems.

Draft Strategy for Plastics Management

Waste Reduction

Waste reduction is a necessity for any island with limited land for disposal. Reduction of the waste will reduce the volumes to landfill and prolong the life of the current disposal facility. As such, reduction represents a cost-effective element of the strategy that is environmentally responsible and sensible for a country with high shipping costs and little land space.

Priority issues: 1 Plastic bags, 2 expanded polystyrene

1 Plastic bags: target is to reduce plastic bag consumption and litter by 10% each year for three years.

Rationale:

Plastic bags, while very useful, have become a significant source of litter, mosquito breeding, marine mortality, discouragement to civic pride and tourist satisfaction. This is wasting government and public money in cleaning up, health care, and tourism income. A wholesale or retail tax on plastics bags will discourage excessive use, doesn't discriminate between producers or importers and also provides some funds to Government to partly pay for the negative impacts already mentioned. Experience overseas has shown this approach to be very effective and efficient. The high visibility of plastic bags offers an opportunity to engage the public on waste management in an area likely to show rapid improvement. The tax will both reduce this problematic waste stream but also be revenue positive to government after the first six months.

Actions – plastic bags

1. Research overseas experience in taxing plastic bags
2. Consult with public, suppliers and retailers about options for tax
3. Institute a litter prevention tax on plastic bags to reduce the number dispensed free by retailers
4. Commence a public and school education campaign on the issues of plastic bag litter, the reasons for the tax, and alternatives that can be used
5. Increase litter collection in public places
6. Monitor imports and litter to gauge effectiveness

2 Expanded Polystyrene packaging: target is to eliminate this packaging in the litter stream.

Rationale:

Expanded polystyrene is used mainly in takeaway containers. Cardboard substitutes exist for all products. The expanded polystyrene form a disproportionate amount of the litter stream as they are often used away from rubbish facilities, are light and blow away, or float downstream. If landfilled, they consume too much transport and landfill space. The expanded polystyrene are best banned as the substitutes are bio-degradable.

Actions – expanded polystyrene
1. Consult with suppliers and retailers about alternative packaging options, transition times to use old stock and any other concerns
2. Brief cabinet on proposed ban and results of consultation.
3. Commence a public and school education campaign on the issues of expanded polystyrene litter, and alternatives that can be used
4. Institute a ban on polystyrene packaging by law
5. Increase litter collection in public places
6. Monitor imports and litter to gauge effectiveness

Plastic Recycling

Recycling is an opportunity to both reduce the pressure on the landfill and to recover resources for economic development. Recycling is usually very labour-intensive and has significant social benefits in addition to the environmental ones. Recycling is not economically viable so it needs some financial assistance to be sustainable. Most of the costs in recycling come from the on-going costs of collection and sorting. By using the proven deposit refund system, collection and sorting costs are minimal, un-employed people can enter the cash economy by collecting the littered resources, and a source of revenue is generated to provide the on-going subsidy.

While all plastics are recyclable, it is sensible to begin with the high value polymers first. PET is the fastest growing and the most valuable so is the obvious first plastic to begin with. When the systems are established, consider expanding the recycling to include other plastics. To do this, you will need identification numbers stamped on all plastic packaging sold.

When the government is considering the situation of PET recycling, it is sensible to consider including other materials such as aluminium and steel cans to make the resulting business more sustainable. The first year should be run as a trial period to determine the economics and should be awarded on an “open book” basis so that government can create a sensible tender for the following 5 years.

NB It is strongly recommended that you draft the deposit refund laws to have a general head of power and then various resources (eg aluminium and steel cans, car bodies, glass bottles, car batteries etc) can be added as they become sensible. This avoids having to pass a multitude of laws and also allows you to expand recycling at a sensible and orderly rate.

Priority issues: 1 PET containers; 2 Polymer identification on packaging

Rationale: PET is the most valuable of the common plastics and the obvious material to begin recycling with. Using PET, systems can be established and subsequent decisions made on whether to expand into other plastic types. PET is increasing in its use as it progressively replaces glass for much packaging so the system has an increasing resource.

Identifying and separating plastics is the long term key to reducing recycling costs and maximizing the value of the recovered materials. Placing the appropriate number on the mold requires an inconsequential cost yet makes the recycling system able to handle the many different types of plastics while minimizing cross-contamination. All countries with recycling systems require polymer identification numbers.

Actions: Recycling PET plastic containers

- 1. Determine the easy-to-identify PET containers by product type and the likely volumes of recovered containers**
- 2. draft a general law allowing government to levy a container deposit and for it to be lodged in a account called the Recycling Fund. The Fund will be used to pay for refunds and also to pay the subsidies necessary to fund the PET recycling.**
- 3. Consult with industry and the community about the law, proposed system and**

the size of the incentive needed to encourage people to return most PET back to drop off centres. Add approximately 20% more onto the refund to determine the deposit level eg a 20c refund will need a 25c deposit.
4. Identify interested private sector companies who might operate the plastics recycling system. Look for those with existing experience eg scrap metal recyclers or importers and exporters.
5. Brief Cabinet and get decision on deposit refund legislation
6. Call expressions of interest in operating plastic recycling
7. Choose operator for trial period and decide on what infrastructure is needed eg drop-off depots, press and baler.
8. Determine refund payment system (this must be very efficient or operator will not be able to pay collectors and system will collapse)
9. Design and institute public education campaign to explain new system and how the public can access refunds for collected recyclates.
10. Run trial for one year and analyse results for needed improvements and inclusion into a 5 year tender
11. Tender system to private sector.

Actions: Mandatory Identification of plastic packaging
1. Consult with industry about the need for polymer identification, proposed system and any transition issues that industry identify
2. Consult with other departments about the methods and costs of enforcement and decide whether it will be at import and manufacturing (the most efficient) or at retail point of sale (expensive and time consuming).
3. Draft law requiring all plastic packaging to have the international code of polymer identification on it.
4. Brief Cabinet and get decision on legislation
5. Design and institute public education campaign to explain new system and how the public can access refunds for collected recyclates.

For further and more detailed information or assistance to implement the strategy, the waste team at SPREP can always assist.

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