

## Recycling Made Easier

Written by Tzu Chi Foundation  
Thursday, 25 January 2007 00:00

---

Recycling is often touted as an easy way to conserve natural resources and protect the environment. And recycling materials is easy--from the consumers' point of view. But preparing raw recyclables for resale is more time-consuming and arduous than many realize.

Once volunteers enter a Tzu Chi recycling station, they are constantly on the move. Each piece of recycled material delivered to the station must pass through their hands. There are dozens of steps that must be performed to process raw recyclables, and each must be performed thousands of times each day.



The repetitive motions, the long hours, and occasional heavy lifting take their toll. Swollen fingers, aching muscles, sore wrists and lower back pain are some of the typical ailments that plague volunteers in the recycling stations.

Fortunately, the price the volunteers are paying is not going unnoticed. Tzu Chi volunteers usually provide assistance to the needy everywhere else in the world, but this time two volunteers have set out to answer the unspoken call to provide relief to their own comrades.

"Want to be a good citizen and perform some community service?" Zeng Ju-wen (曾居文), a Tzu Chi recycling volunteer, asked Wang Chun-xiong (王春雄) one day in 1999. At Zeng's invitation, Wang began volunteering at a Tzu Chi recycling station in southern Taiwan. He's been helping out ever since.

At the time, Wang worked in a local factory. After a long day at work, he would rush to the recycling station to join the other volunteers already busy at work. But Wang, approaching 60 years old, soon found out that volunteering was more demanding than he had anticipated.



Most raw recyclables are collected from ditches, streets, market stalls, or small shops. The recyclables arrive unsorted at the recycling station on small trucks. Volunteers manually unload each truck, piling the recyclables into a large heap on the ground. That's the easy part.

Next, volunteers huddle around the heaps to sort the items. This may seem simple enough, but in fact it requires a good deal of physical labor. There are no shortcuts and no substitutes for the manual work, especially at the smaller recycling stations, where large-scale automation is out of the question. Volunteers do most of the sorting while squatting or sitting on low stools, but the repetitive motions required--frequent reaching, bending up and down, standing up, and sitting down--tax even the healthiest of volunteers. There is no question about it: This is physically demanding work.

## Recycling Made Easier

Written by Tzu Chi Foundation  
Thursday, 25 January 2007 00:00

---

Volunteers usually work for one, two, or even three hours on end. Over time, working at the recycling station takes its toll on the workers, some of whom are well over 80 years of age. "Repeatedly bending, sitting down and standing up over an extended period of time was hard on the body," remembers Wang.

Wang started thinking about what might make the job easier for the volunteers. He hit upon the idea of a conveyor belt. Although simple, it seemed like a perfect solution. Such an innovation would make processing the raw recyclables faster and might even put an end to the aches and pains that constantly plagued the volunteers. It might even make the job enjoyable.

Unfortunately, Wang knew next to nothing about manufacturing or engineering; he was just a humble factory worker with an idea. How could he make a conveyor that would meet the exact needs of the volunteers in the recycling station? He recalls, "I wondered how I could possibly pull it off. I was actually quite apprehensive."

Although Wang had only a vague idea of how such a contraption could be fashioned, he decided to take the first step and give it a try. He reasoned that the benefits of succeeding outweighed the cost of failure. After all, if he succeeded in building a working conveyor, the design could be replicated to bring relief to countless volunteers at the other recycling stations throughout Taiwan. The worst that could happen was that he would end up with a pile of non-functioning metal equipment that could itself be recycled.

When he shared his idea with the other volunteers, they encouraged him to proceed. It seemed that everyone was looking forward to a reprieve from the current situation.

Using overtime pay from his factory job to purchase needed supplies, he went to work. He used every available spare moment to make his dream a reality. He rode his motorcycle to scout out suitable materials; he examined and studied similar machinery for ideas; he chatted with mechanically inclined friends and acquaintances to gather their input; he even delved into mechanical engineering and ergonomics.

Wang began designing the conveyor with a few basic considerations in mind. For example, it had to be high enough to be comfortable for the majority of the workers, and just wide enough that volunteers could readily reach from one side of the belt to the other. The speed of the belt had to be easily controllable by a switch. Little by little, the original specifications were modified and improved. Slowly, the conveyor began to take shape.

Wang chose to construct the conveyor frame out of light aluminum, but he mounted it on heavy-duty rollers to make the device mobile. For the belt itself, Wang chose a high-density canvas. The canvas was pliable and water-repellant, but actual use quickly proved the canvas unsuitable. The leftover liquids present in many of the containers to be recycled spilled onto the canvas and eroded it within just a few weeks. Without a more adequate and durable belt, the conveyor was useless.

Undaunted, Wang hopped on his motorbike and set out to find a replacement belt. While browsing in a hardware store, he noticed a transparent cover designed to protect the top of a

## Recycling Made Easier

Written by Tzu Chi Foundation  
Thursday, 25 January 2007 00:00

---

desk. Made of polyethylene, the transparent cover was pliable, impervious to water, and resistant to most solutions. Ecstatic, Wang immediately purchased a ready supply and rushed back to the station. The desk cover was a perfect fit! With that, the conveyor was officially launched and put back to work.

This conveyor has completely changed the way work is done at the Renwu Tzu Chi Recycling Station.

Now volunteers unload the recyclables from trucks onto the conveyor belt. The 6-meter-long conveyor slowly moves the recyclables along while other volunteers stand on both sides of the belt, each one picking out their assigned type of material. Beside each worker are two large bamboo baskets to collect the sorted items. Another group of volunteers remove the filled bamboo baskets for further processing and make sure empty baskets are always ready. The conveyor belt never stops.

At every stage, the volunteers work comfortably. Gone are the days of constantly stooping down to pick up recyclables. Although everyone is just as busy as before, the aches and pains associated with the work have decreased. Workers can now work longer shifts without tiring. The arrival of this worker-friendly conveyor has made their work more enjoyable, and they have Wang Chun-xiong to thank for it.

Wang hopes to install his invention in Tzu Chi recycling stations throughout Taiwan. Giving volunteers some mechanized assistance to make their work easier gives him great pleasure. He is glad to provide design diagrams and assembly assistance to any recycling station contemplating adopting his device. In fact, ten Tzu Chi recycling stations in southern Taiwan have already started using the new conveyor system, with success equal to that of the Renwu station. **Chen Sheng-ren**

Renwu Tzu Chi Recycling Station

Ever since the invention of the recycling conveyor, our recycling station has gained a reputation for being automated and worker-friendly. As our fame grows, more and more environmental preservation organizations and communities come to observe our operation. Most of the visitors just want to see Wang's recycling conveyor. We call it the treasure of this station.

There is another benefit, too: Because raw recyclables are placed directly on the conveyor instead of the ground, we have been able to keep our station clean and tidy!

**Chen, Xiu-fang**

Renwu Tzu Chi Recycling Station

We are taking a different approach to processing recyclables here at the station. In the old days,

## Recycling Made Easier

Written by Tzu Chi Foundation  
Thursday, 25 January 2007 00:00

---

we dumped everything on the ground. To be efficient, many workers were needed to squat down and sort things into piles. With the conveyor, we no longer need to do that. Moreover, we can adjust the speed of the belt to suit the number of workers. When there are fewer of us, we decrease the speed of the conveyor. When there are more, we can speed it up.

### Liu Su-qing



Bagualiao Tzu Chi Recycling Station

The stripper was designed with the users in mind. It is very easy to operate. You just put a wire in, crank the handle, and the wire comes out the other end with its insulated coating sliced open. All that is left to do is to peel the coating off to separate it from the metal wire within.

There isn't much to learn before you can use it. All you need is to observe another person do it a couple of times, and you are on your way.

The crank handle adjusts to the size of the wire being split. Designed for the safety of the operator, the cutting edge is not razor sharp. Even if you touch the cutting edge by accident, you won't get hurt.

Before the stripper came along, I separated the metal core from the insulation by hand. It was very time-consuming. I often couldn't finish my work before closing time. I frequently had to take the unfinished work home.

Now, we sort the wires by size first. One of us cranks the stripper and another manually peels the outer insulation off the metal core. More than 10 kilograms [22 pounds] of wire can easily be finished in two hours.

---

### The conveyor's special creative features

The conveyor is a sizeable piece of equipment that needs a powerful motor. Wang chose a cost-effective three-phase motor that generates high horsepower but low noise.



Wang had to look far and wide for a suitable frequency inverter which would allow the conveyor to run at variable speeds on demand. The equipment that he eventually found is adaptable to

## Recycling Made Easier

Written by Tzu Chi Foundation  
Thursday, 25 January 2007 00:00

---

both industrial and home-use voltages. Home-use power is more economical.

Made of polyethylene, the belt is pliable, waterproof, resistant to most solutions, impervious to punctures, and tough enough to handle the heavy weight of some recycled items. The polyethylene belt is also very easy to clean up after use. The liquids that leak out of containers stay on the belt without leaking through to the underside of the conveyor or to the ground. At the end of the conveyor is a built-in canister to catch the liquid collected on the belt. This keeps volunteers dry and the working environment much more pleasant. Moreover, a canopy has been erected over the conveyor to protect volunteers from the sun and rain.

### If I Get Tired, So Will Others

From the inventor

Wang Chun-xiong



Sorting through recyclables sounds simple. In reality, it can be quite complicated and there are no shortcuts. The neat appearance of the recycling station is deceiving, in that it masks the physical and mental exertions required of the volunteers.

The work has a way of taking its toll on you over time. I figured that if I got tired, others were getting tired too. Especially disconcerting was to see elderly volunteers bending down over and over again, or working in uncomfortable postures that made them tired and achy. I felt I had to do something to bring them some relief!

When I started building this conveyor, I didn't even know how to weld. But I didn't let that stop me. I consulted with others who could give me advice, and I slowly taught myself. Constructing the machine made a lot of noise, but I chose to work on weekends when fewer of my neighbors were home.

I am grateful that I was able to complete the project in just two months. The conveyor has proved to be a great help for the volunteers at many recycling stations. Volunteers can now work in more comfortable, less tiring postures. As an added benefit, their productivity has also improved.

I have worked full-time as a volunteer since I retired from my job at the factory. I mainly work on recycling electronics in the dismantling/disassembling area. I have volunteered here for eight years. I feel that I am very blessed to be able to do recycling here.

---

### The Stripper

A Wire-Stripping Machine Renders

## Recycling Made Easier

Written by Tzu Chi Foundation  
Thursday, 25 January 2007 00:00

---

### Used Wires More Valuable

All modern households are filled with electric appliances and gadgets of all types. Each appliance or electronic device comes with its own cords and power cables. When the appliances and gadgets are thrown away, so are their accompanying wires and cables. Remnant wire from industry is also very common and takes up precious space in already overcrowded landfills. For the benefit of our environment, it is essential that electric wire is recycled along with paper, bottles, and plastic containers.



The first step in recycling wire is to separate the outer insulation coating from the inner metal core. There are two main ways that this can be accomplished.

Some unscrupulous establishments purchase unprocessed wire and burn it to melt away the coating from the valuable metal underneath. This method is very harmful to the environment: The burning insulation releases toxic fumes into the atmosphere, harming the earth and its inhabitants.

Tzu Chi recycling stations process wire differently. Instead of burning it, a volunteer first untangles and straightens it out. Next, a lengthwise cut is made in the outer insulation with a paper cutter or a knife. Once that is done, the plastic coating can be peeled away from the metal core. The method is environmentally friendly, but very time-consuming. It can also be dangerous: Small injuries and skin cuts are common as volunteers work to strip the insulation away from the wire underneath.

Cai Zong-yuan (蔡宗元), a volunteer working at the Bagualiao Tzu Chi Recycling Station in southern Taiwan, has heard his share of complaints from other volunteers suffering from minor cuts. Since Cai specializes in manufacturing machinery, he thought that his expertise might help devise a solution.



Although ready-made wire strippers are commercially available, they tend to be large, sophisticated, and expensive. They are also all driven by electric motors. Although powerful and productive, electric models would tend to run faster, and Cai felt that a manual wire stripper would be safer. An electrical wire stripper would require a good deal of training, but Cai figured that many volunteers would be using the new device without much training. A manual device would be easier for an untrained volunteer to operate.

Furthermore, a good portion of the volunteers are senior citizens, who tend to be less agile. Cai reasoned that older volunteers might not have the manual dexterity necessary to safely operate

## Recycling Made Easier

Written by Tzu Chi Foundation  
Thursday, 25 January 2007 00:00

---

an electric model. A manual device might provide them with more control.

Cai set out to design from scratch a wire stripper that would fit the needs of Tzu Chi volunteers. He succeeded in creating one in 2003. The device has worked so well that he has made more copies for other Tzu Chi recycling stations throughout Taiwan. In fact, he has given away 150 strippers so far, and demand for more is high.



It costs Cai about NT\$5,000 (US\$150) to buy the materials for one wire stripper. He has pledged to donate 200 of them to Tzu Chi recycling stations, making his total donation one million NT dollars (US\$30,300), a threshold that will earn him a seat on Tzu Chi's Honorary Board of Directors (patrons who have donated a million dollars or more).

Cai's stripper neatly slices a fissure in the insulation coating of the wire. It is safe, easy, fast, and even fun to use. Once the insulation is cut, it can easily be peeled off to yield two items--the insulation and the metal--both ready for recycling. Many workers have used his device and can vouch for its handiness and safety. As more recycling stations adopt Cai's wire stripper, the productivity and satisfaction among Tzu Chi recycling volunteers grows.

Here is a sample of what Cai's fellow volunteers at the Bagualiao Recycling Station say about the stripper:

Guo Ying-mei (郭映梅): We used to have to squat when we separated the coating from the metal. Squatting down for an extended period of time made our joints stiff. It was hard to stand back up, and we got light-headed after standing up too fast. These problems have all been resolved since we started using the wire stripper.



Shen Zheng-yi (沈正宜): Although the stripper is well designed and built, it still takes time and practice to operate proficiently. You need to maintain just the right amount of tension between the cutting edge and the surface of the wire: not too tight and not too loose. If you set the tension too tight, the handle is too hard to crank and the cutting edge wears down too quickly. If you set the tension too low, you can't slice open a fissure deep enough to separate the coating from the metal core.

Liu Su-qin (劉素琴): It is important to keep the cutting edge of the stripper in good condition. In order to prolong the life of the cutting edge and prevent it from becoming dull, I always use the machine with the utmost care. For example, I set the tension at the lowest possible setting that is still sufficient to create a deep enough cut in the insulation. I also immediately reposition the cutting edge if it is off center and oil the gears regularly. I really treasure this piece of equipment.

## Recycling Made Easier

Written by Tzu Chi Foundation  
Thursday, 25 January 2007 00:00

---

It has helped transform otherwise useless wires and cables into a gold mine. I call it a "gold-giving machine."

---

### Precious Volunteers' Hands

From the inventor

Cai Zong-yuan

You might think, "What's the big deal in slicing a fissure in the outer coating of a wire?" This seemingly trivial task can prove to be quite thorny. First, you need to untangle and straighten the wires. Then you need to hold the wire in place while you use a box cutter or utility knife to slice along the length of the wire. This is quite difficult, as the wire is very thin and the knife easily slips off.

All these steps require the small muscles in the hands. Over time, volunteers' hands tend to get swollen and sore. Small cuts are also inevitable. Furthermore, it's hard to completely remove the insulation from the wire when sliced by hand. Even small pieces of insulation stuck to the wire render it unrecyclable. Thus, it is necessary to completely separate the wire coating from the metal, both of which can then be recycled and reused.

Some unscrupulous companies want the profits from selling reclaimed metal from the wires, but they don't want to painstakingly separate the coating from the metal. So they simply burn the unseparated wires to get rid of the coating and get at the prized metal inside. This is a very poor practice. The fumes produced contaminate the atmosphere and pollute the earth.

I designed and built this stripper to serve our recycling volunteers, to give them a safer, more convenient and pleasing work environment. Hopefully, using such a device can attract them to do recycling and keep them at it longer.

Currently, there are about 150 wire strippers in use in our recycling stations throughout Taiwan. I am really happy my machines can make the recycling work easier for our volunteers. All my wire strippers come with a lifetime guarantee. If anyone has any problem using it, just give me a call and I will cheerfully help you solve the problem.

By Guo Shu-hong

Translated by Tang Yau-yang

Photographs by Lin Yan-huang