



# Bicycle-Powered Washing Machine

## Introduction

D Acres is an organization that strives to achieve self-sufficiency. Although electricity is widely available, the ability to effectively utilize human power is invaluable. For efficiency purposes and availability, the bicycle is a great union of person and machine. In this document, the washing machine becomes the subject for bicycle-powered transformation.



## Design

The washing machine used is an old model dating back to at least the 1970s. The unit has a separate spinning drum for removing excess water after the clothes have gone through the wash and rinse cycles, as seen below.



The modifications made may not be possible for similar washing machines of that time. Most units used a wringing device, as seen below.



The modifications discussed will also not be possible for the modern day washing machines that rely on circuits and computer programming to operate. The model used has a drive train that is driven by a single pulley (see *Washing machine preparation and drainage*). The design is still a reflection of simplicity incorporating a direct connection to the flywheel and washing machine through the use of two v-belts.

## [Build it] Frame.

Parts needed:

- Rebar
- Welding equipment
- Bicycle

The frame that the bicycle rests on is made of rebar. The rebar was cut to appropriate lengths (dependent on the size of the bicycle) and then welded together. Connections to the bicycle were made at the front fork and chainstays. See images below for welds.





## Bicycle power.

### Parts needed:

- (2) V-belts

To provide power using the bicycle, two v-belts salvaged from old belt-driven equipment are used. The tire and tube of the bicycle were removed to give the v-belt an area to grab. The rim has to be removed in order to place the v-belt. One v-belt attaches from the rear rim to a pulley on the custom flywheel seen below. Another v-belt runs from a pulley on the flywheel to the pulley on the washing machine. See image below.



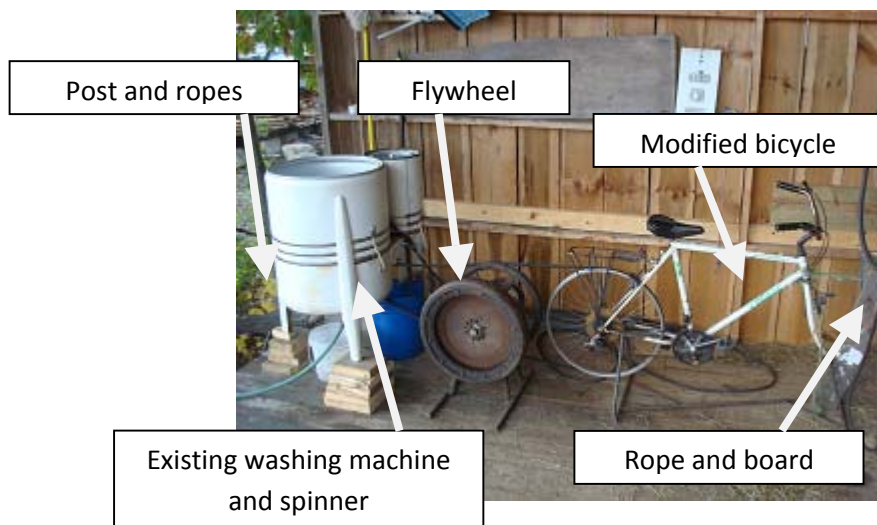
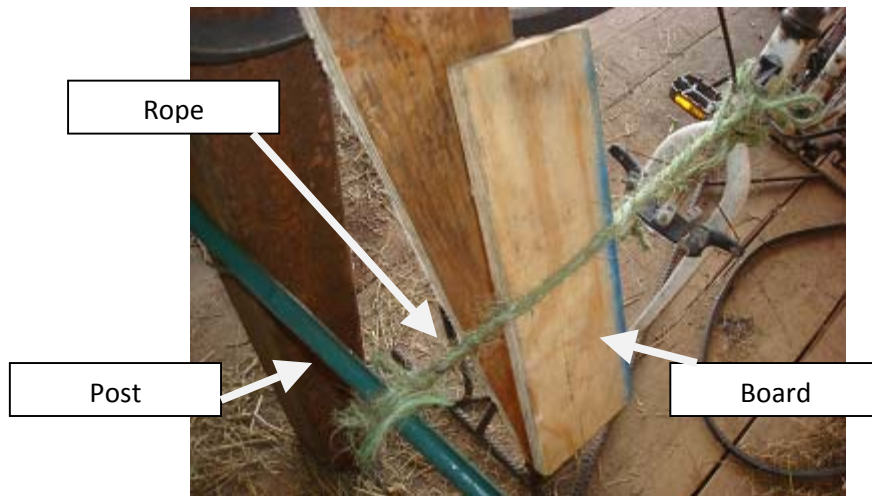
## Tension

### Parts needed:

- Rope
- Board

To keep tension in the system a rope and board were used. Without tension the v-belts tend to slip and will not provide any useful power. The rope is tied to the bicycle frame and a post. The

board is inserted between the rope strands and rotated until the rope is taut. When the v-belt stretches, the board can be rotated again to increase tension. The washing machine is secured to a post using small ropes. See images below.



## Washing machine preparation and drainage

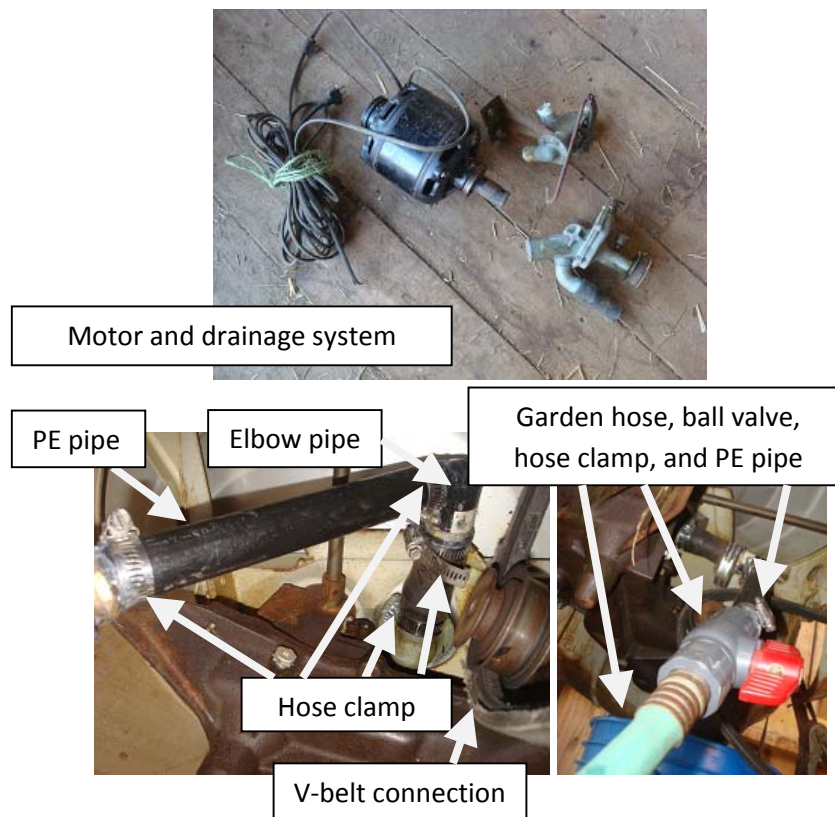
Parts needed:

- Elbow pipe
- PVC ball valve
- Polyethylene (PE) piping
- Garden hose
- (4) Hose clamps

See images below. In order to attach the v-belt to the washing machine, all other components under the machine had to be removed. This includes the motor, and in the particular case below, the existing drainage system. A section of the front machine housing was removed using a

hacksaw and the machine was elevated so that the v-belt did not rub against the machine housing. If the location is suitable, the washing machine can simply be raised to avoid cutting the housing.

The pulley that connects to the v-belt was originally driven directly by the motor. The drainage system was replaced using an elbow pipe, a PVC ball valve, a section of PE pipe, a garden hose and four hose clamps. A short section of PE pipe is connected to the original drainage pipe and elbow pipe. The connections are sealed with hose clamps. Another section of PE pipe connects the elbow pipe and ball valve and the connections are sealed with hose clamps. The garden hose is connected to the opposite end of the ball valve and runs to an area where the water can be discharged. To empty the washing machine of water, simply open the ball valve.



## Alternate Designs

Other designs that were considered include the power take-off and an exercise bike. A separate document located on [www.dacres.org](http://www.dacres.org) goes into detail on the power take-off design. The exercise bicycle design incorporates a forward facing bicycle. The bicycle is driven by a single gear and the v-belt is attached in the same manner as the bicycle discussed previously in this document. This design is less desirable due to the effort required to operate the machine. The gear ratio produces little agitation and becomes uncomfortable for most users. The forward facing orientation of the bicycle is a good trait for users who would like to watch the items being washed or spun dry.



## **Application**

Depending on the condition of the materials being washed, a five to ten minute agitation cycle followed by one or two rinse cycles (each for five minutes) is suggested. A full load requires 8-10 gallons of water plus the additional rinse cycles.