



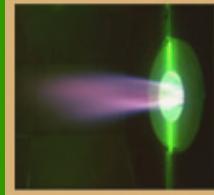
MOTIVES

INCENTIVES

METHODS

COMMUNITIES

COOL LINKS



# fossil freedom

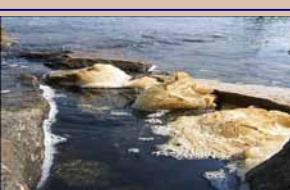
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## RECYCLED!

Evacuated  
Solar Heat  
Capture Tubes



How I (mis)Spent  
The Summer Of  
2006  
by Patrick Ward

## Electric Dryer Heat Diverter



## DIVIDE AND CONQUER

### Algal BioButanol Conquers Colorado Continental Divide!

I have been making some small amounts of BioButanol for about 2 1/2 years.

Last year's serendipitous discovery, of the "James River Mystery Foam" diatom, has greatly accelerated the steady progress towards a totally solar algal biomass BioButanol Biogasoline.

Methods development and solar processing methodology, has begun to advance more rapidly now.

I am delighted to report a breakthrough demonstration of algal BioButanol Biogasoline's potential to replace petroleum gasoline.

Early work was slow, and somewhat tedious, as only small quantities of biogasoline were made from scarce algae biomass (the "Holy Grail" of mass produced Alt/Fuels without detrimentally impacting farmland use patterns or competing with human food-stocks for biofuel feed-stocks).

I have now started ramping up production slowly as the more abundant diatom algal feedstock availability permits.

I have made only about 25 gallons of biobutanol so far, of which about 15 gallons were from the diatom's starch and sugars.

Much of that has already been consumed in generator and small test engine, power tests, and in the AlgaeMobile stock-car engine tests

It is assaying as primarily N-BioButanol and Iso-BioButanol with some Sec-BioButanol co-produced.

The worst of the odors come in the early wet algae concentration step and the solar sterilization oven, algal biomass pre-treatment steps.

It is a little like seaweed, decaying on the beach, in the sunlight.

Some butyric acid is produced, as the anaerobic reaction occurs, but the smell it is really not bad, since the fermentation consumes the butyric acid rapidly, at the same rate it is produced, (provided that, I successfully keep removing, the BioButanol [poop], as fast as it is produced) so that there is not that much butyric around at any instant



The anaerobic fermentation vessel is also sealed to keep oxygen out, which also suppresses odors quite well.

The BioButanol itself, just smells a little like a slightly minty paint thinner.

I am currently trying to produce 50-60 gallons, of mixed isomer BioButanols (but no Tert-Butanol) made entirely with solar energy, from algae or diatoms, to use in some record-breaking transcontinental trips, to effectively silence, the endless parade of ill-informed, or misleading (petroleum industry shills?) critics who repeatedly assert and falsely claim, that "all biogasolines have a negative energy in v. energy out problem."

I have just returned from a trip to NM where I did some serious high altitude astronomy on the continental divide in NM.

I took along a couple of gallons of Solalgal Fuel (Algal BioButanol made using only solar energy.)

On 27 June 2007 I put the algal BioButanol to a very severe driving test!

I drove the AlgaeMobile eastward through, Colorado I-70 on petroleum gasoline, until I had intentionally let the tank run out of gas (which occurred about  $\frac{1}{4}$  mile west of Eagle, CO).

Then, I added 1 US quart of (solar energy only) algal sourced biomass BioButanol Biogasoline, (just to purge any residual petrol gasoline out of the tank, and engine) and drove, until the tank was again empty, (at just about 0.2 miles east of Wolcott, CO). Then, I added another 1 US quart of (solar energy only) algal sourced BioButanol Biogasoline, (to purge any tiny amount of remaining residual petrol gasoline out of the tank and engine) and drove until the tank was again empty (about 1 mi west of Dowd's Junction, CO).

Then I added a measured US gallon of the precious "SolAlgal" BioButanol

Biogasoline and drove 49.6 miles, (including up a long 7% steep grade, way up to, and through the Eisenhower Tunnel, under the US Continental Divide at the Loveland Pass, CO, at over two miles altitude!) until finally running out of the "SolAlgal" BioButanol Biogasoline, at Silverdale Colorado, on the long downward slopes of the descending Interstate 70, well down the eastern side of the Continental Divide.

This was a preliminary trial; a power/altitude test, just to test the power, and performance, of BioButanol Biogasoline under extremely sever conditions, as well as to test the ability of the AlgaeMobile's (stock car) computer, to get the stoichiometry right, for the fuel-air mixture, even at extremely high altitudes.

That's no simple feat.

The Eisenhower Tunnel is one of the longest tunnels in the world It is 8,941 feet (1.69mi) long, with a height of 48 feet, and a width of 40 feet.

The Eisenhower Tunnel, at Loveland Pass in CO, is the highest part of any Interstate Highway, in the US.

It's probably, is also the highest, vehicular tunnel in the world!

The official elevations are 11,013 at the east portal, 11,112 at the midway point, and 11,158 at the west portal, which is likely the HIGHEST altitude tunnel on planet Earth!

The ascent approaches, from both West (7% grade) and East (6% grade) are very steep.

Vapor lock, and overheating (partially due to the reduced radiator heat transfer, into the rarified air at altitude which can not cool the radiator very well that high up!), are common events, in cars and trucks, on the approaches. In the week before July 4, one year, 42 vehicles stalled and two caught fire **in the tunnel!**

So this was the perfect place, to test SolAlgal BioButanol biomass Biogasoline, under the most severe conditions imaginable, with regards to high altitude performance, under very severe Interstate driving conditions.

The results were very encouraging!

Not only was the mileage, a couple of MPG BETTER than petroleum gasoline, but the high altitude power performance, on the steep 7% grade leading up to the mountain pass was outstanding.

Normally, when using petroleum gasoline on a long 7% grade I will need to downshift the 5 speed manual transmission from 4<sup>th</sup> to 3<sup>rd</sup> gear, since the engine cant quite keep the RPM's up without "lugging" the engine.

So on a long, steep 5 mile, 7% grade, I would generally spend about 30% of the time in 4<sup>th</sup> gear and 70% in 3<sup>rd</sup> gear with petrol gasoline.

With the BioButanol Biogasoline I was able to maintain the engine RPM's in 4<sup>th</sup> gear, without "lugging" much longer, and spent about 50% of the ascent in 4<sup>th</sup> gear and 50% in 3<sup>rd</sup> gear!

This testing, has given me the needed confidence, that the AlgaeMobile, will make the BioButanol fueled trip from New York City, to San Diego California, without choking in the mountain passes.

Now, the main remaining hurdle, is to finish making the remaining 50-55 gallons of "SolAlgal" Biomass BioButanol Biogasoline fuel, that I will need to complete the transcontinental BioButanol demonstration drive.

Unlike Dr. David Remey's 1995 Butanol fueled, transcontinental drive, which merely used purchased petroleum industry sourced, (non bio) fossil-fuel Butanol, refined using fossil fuel power sources, my planned demonstration drive (if successful) will use only home-made, home-refined, solar energy sourced only, algal biomass bioButanol fuel.

I think, that this is a very important distinction.

Dr. Remey simply purchased his fossil sourced Butanol, from Ashland Oil Company.

I want absolutely no oil company involvement at all...not even as a sponsor!

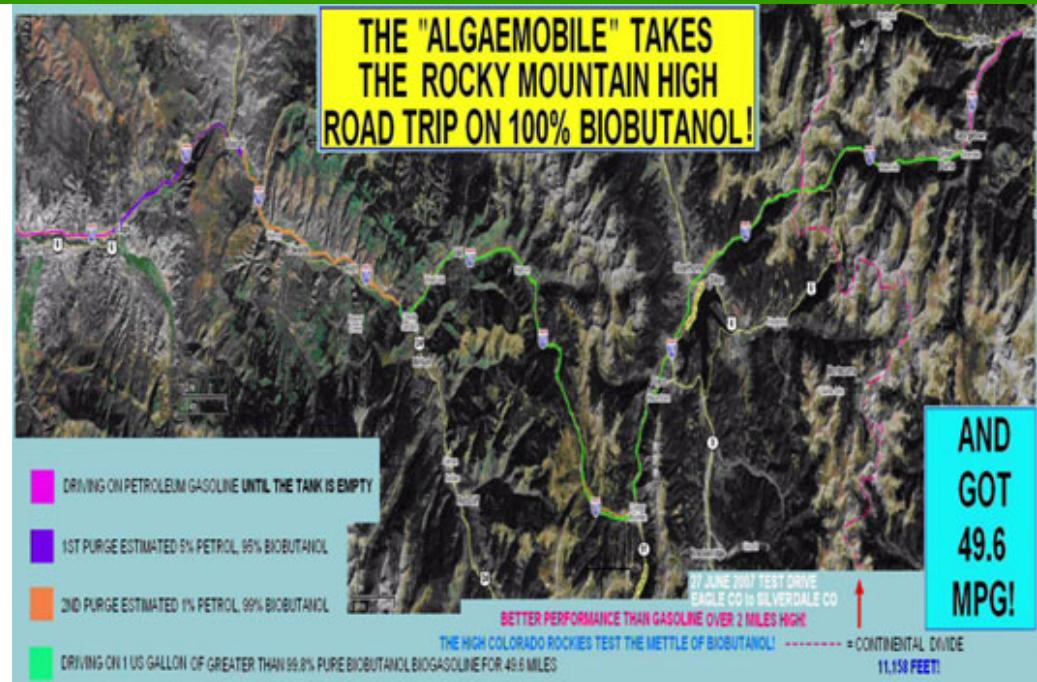
I will use a non-petroleum, fully synthetic oil, rather than petroleum oil, as the engine lubricant as well!

I want all the energy for the SolAlgal BioButanol demonstration drive, to come from solar photosynthesis, solar photovoltaic, or solar thermal energy sources used to create, and refine, and distill, and process, every drop of fuel that I will use to make the transcontinental demonstration drive.

With Best Regards,

Patrick Ward





### The Vail, CO Pass Segment Of The Test Was Run On 100% SolAlgal BioButanaol Biogasoline!

Actually, I was still carrying about 400LBS of solar thermal tubes, that were bound for Denver, CO in the back of the AlgaeMobile, (when I left Richmond, VA there were twice that many on-board) so it could have easily done 50 MPG + had I not been carrying a lot of extra weight onboard.

Also, I could have simply coasted downhill, gaining, perhaps another 10 or 15 MPG, (which would have been completely fair, since the uphill leg was on BioButanol power!) but the steep downhill grade, made me stop when the 1 gallon of SolAlgal BioButanol fuel ran out.

Without the engine power, the vacuum brake assist would not work properly on the steep decline grades, east of the Continental divide. I, therefore, decided, not to try to coast any farther, with no engine power, for safety reasons, and to keep from overheating the brakes!

The "AlgaeMobile is an unmodified, "stock car" 1.0 Liter 3 cylinder throttle-body fuel-

injected 1992 Geo Metro, with a 5 speed manual transmission and a curb weight of 1,368 LBS.

At Pie Town NM (10,000 FT) I am installing a couple of community food cooking versions, of the same basic Stationary Solar Energy Concentrating Solar Oven that is used in BioButanol refinery for the sterilization (pasteurization) of the wet algal biomass concentrate.

The sterilization (pasteurization) kills all the living cells including the algal cells and any other bacteria or zooplankton so that might be hitchhiking a ride into the refinery anaerobic fermentation Bioreactor. That prevents growing any undesired invader species so that the only organism that can grow is the desired inoculate from the BioCulture Bacteria Inoculate Nursery Tank

Pie Town will serve as the high altitude solar UV exposure materials lab, as well as the AstroLab.

The Stationary Solar Energy Concentrating Solar Ovens located there, will be used for community events to bake 12 pies at a time from sunshine. There will be another for cooking barbeques and the like.

Pie Town, NM is world famous for its, (perfect high desert plateau climate) sun dried apple pies.

The solar ovens will be used at the annual Pie festival as well as for the Pie In The Sky star Festival and some alternative energy workshops planed there.

I just threw a couple of gallons of BioButanol on board in Richmond, VA before leaving for the US southwest.

Originally, I had planed to just test burn some of the BioButanol on the return trip the last hundred miles or so, in the VA/ West VA mountains as I returned to Richmond.

I did take some photos, (some not yet developed) and had been pre-acclimated to the high altitude, for a week already, at the Pie Town, NM AstroLab (also on the US continental divide) where I spent a full week at altitude, installing, and upgrading solar PV systems, to run several new telescopes and a future 24 inch Robotic Schmidt Camera system.

Then at the last minute someone in UT suddenly Internet purchased some extra solar equipment which I had onboard, and, so, I delivered that to Kanab, UT.

That last minute change in routing took me through the I-70 corridor through (the absolutely magnificent Colorado River) Glenwood Canyon, and then, right into the most rugged part, of the high Colorado Rockies.

So, because I happened to already have the SolAlgal BioButanol on-board, and, because my body was already fully conditioned, and fully acclimated to high altitude, and because the chance was simply just to good to pass up; at the last minute, I decided, "what the heck, I may have to walk home, but I was hell bent on taking on the 11,000 Ft Loveland, Co Rocky Mountain High Pass on BioButanol!"

So I took a bold/foolish gamble, and planned to let the gas tank run out, and then planned to burn 1 measured gallon of the BioButanol over the most challenging, grueling, and rigorously steep stretch of high altitude US Interstate Highway.

After I ran out of BioButanol in Silverdale, CO., I just used a 5 gallon can of petroleum gasoline to refill the tank to get to Denver, CO.

I would have stopped at the NREL (National Renewable Energy Labs) in Golden CO on the way into Denver, but I had not planned for that or made any appointments there, and, I was trying to outrun some fast approaching storms, that had already flash-flooded parts of Texas and Oklahoma

The AlgaeMobile performed flawlessly the whole trip even after the Rocky BioButanol Mountain Road Test Adventure.

The only mechanical problem encountered on the entire trip, was the mechanical failure of the driver's side windshield wiper regulator arm retaining clip, during the Texas Oklahoma, and Kansas flash-flooding events that had me "high water dancing" all the way back to the Mississippi River.

So, as it turned out, I did not have to walk back to Richmond, but I did have to do the high water shuffle with high water spilling over roads...made it back just in the nick of time ahead of the biggest high plains flash-flooding since 1928!

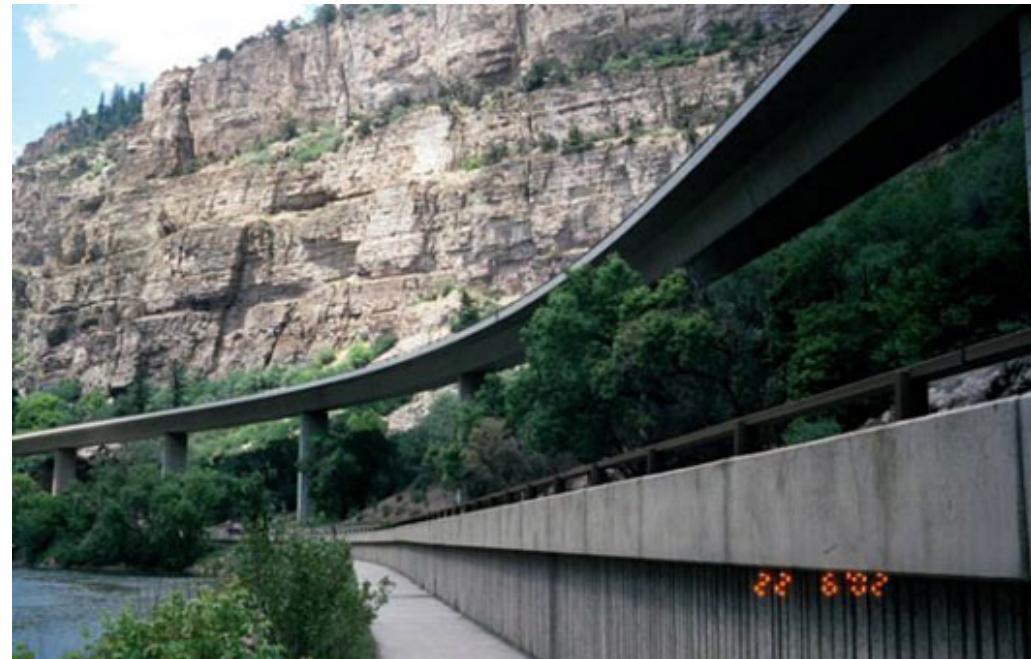
That brings really new meaning to the term "high plains drifter!"

Best Regards,

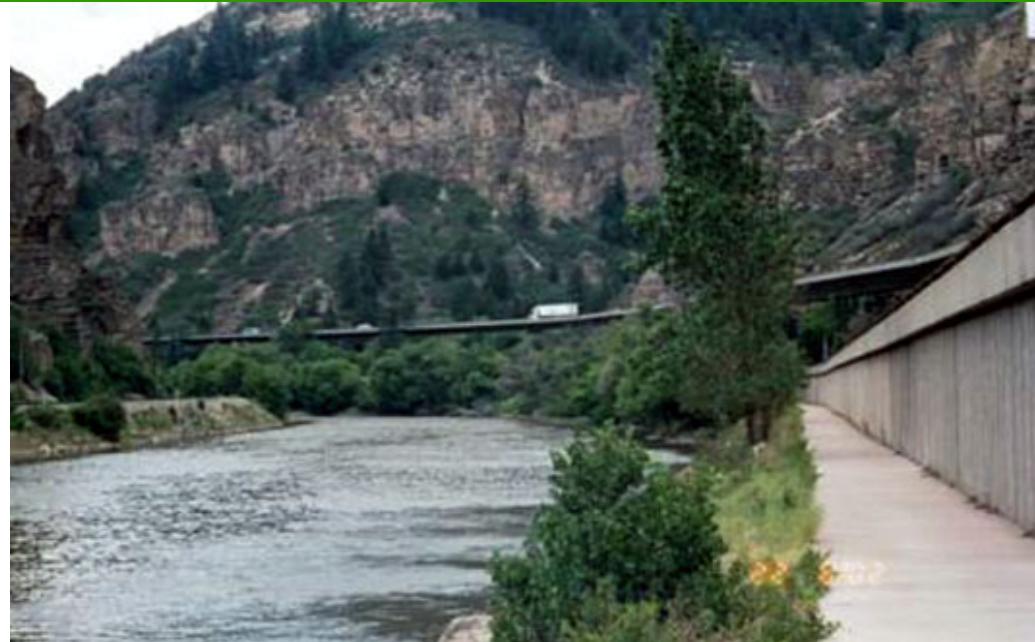
Patrick Ward

FossilFreedom

4 July 2007



I -70 In Glenwood Canyon, CO hugs the Colorado River East of the Grand Canyon



**Tubular... Man!**



**Mixed**

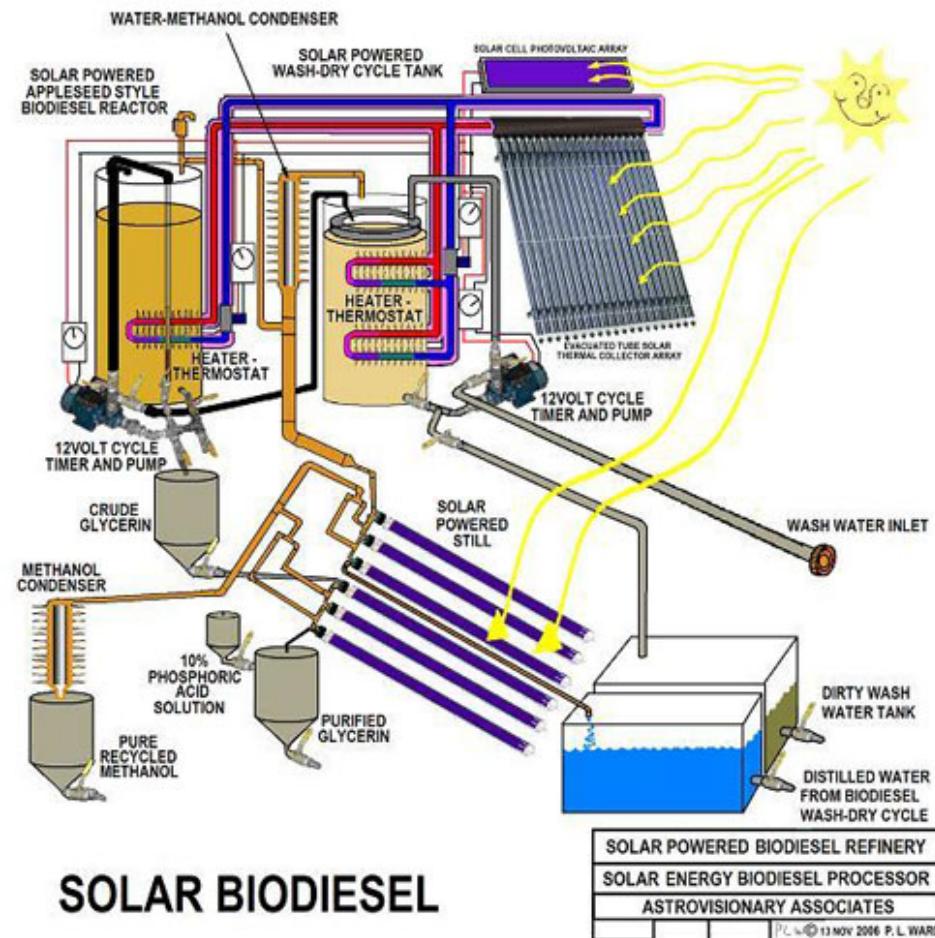
## **Transportation Use River Basin**

**Rapid-Transit Opportunities Really Are Quite Abundant, Along the Colorado River, and US Interstate Highway I-70, in Glenwood Canyon, CO!**

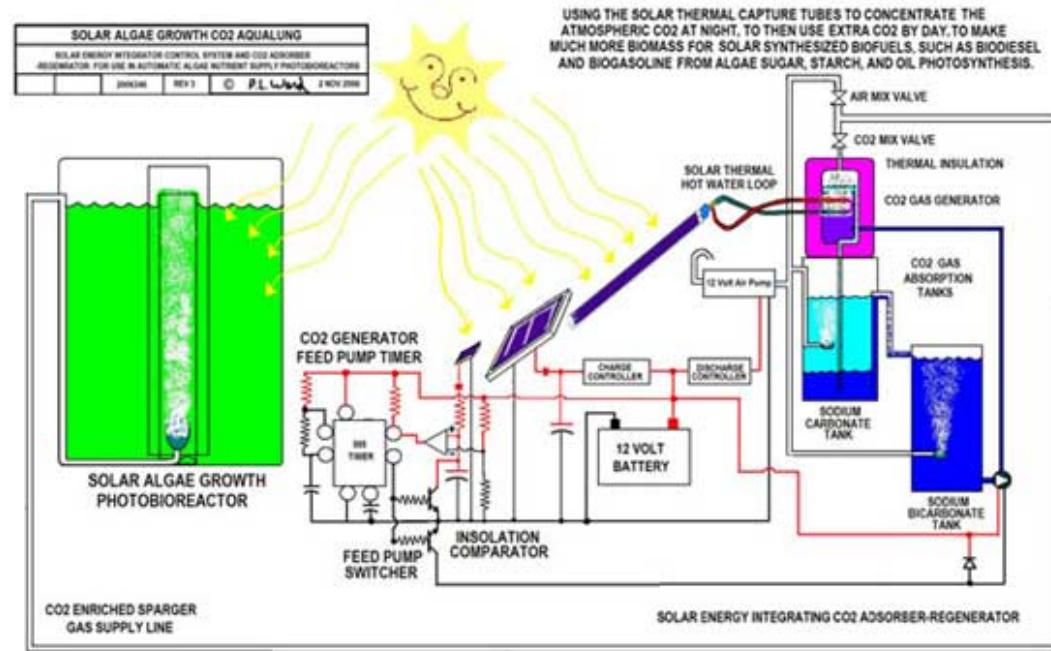


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## Solar Powered Bio-Diesel Refinery



## Solar Algae growth CO2 Aqualung



## Solar Thermal Energy Capture Tubes (for hot water/heating)

**RECYCLED!**



**Gently used by Uncle Sam!**

**RECYCLED!**

These are evacuated thermal solar collector tubes....the most efficient solar collectors available. They are 46 inches long, by 2 inches in diameter. Water flows in the central tube and collector space, surrounded by two outer tubes with a vacuum between them. The water gets so hot that it will boil, so water must be kept moving by a circulation pump.

Maximum temperature is about 250 degrees F..... Hot enough to heat your home with a hydronic radiator system, or heat your domestic hot water.

Each tube captures approximately 80-150 watts or 300-450 BTU/HR.  
*Works even in the coldest climates!*

They mount on 4-inch centers and are 2 inches OD. They are often combined with multiple tubes in an array, however, just the solar capture tubes are being offered. Combined with manifolds, this is an inexpensive way to capture a lot of solar energy to make domestic hot water or heat for the home.

Each evacuated tube consists of two glass tubes made from extremely strong borosilicate glass. The

outer tube is transparent allowing light rays to pass through with minimal reflection. The inner tube is coated with a special selective coating, which features excellent solar radiation absorption when compared to conventional flat plate collector systems. The top of the two tubes are fused together and the air contained in the space between the two layers of glass is pumped out while exposing the tube to high temperatures. This "evacuation" of the gasses forms a vacuum, which is an important factor in the performance of the evacuated tubes.

A heat pipe is inserted into the length of the tube. The heat pipes contain a special fluid that allows solar radiation to be absorbed and transferred to the stored hot water very efficiently. Solar heat energy gets trapped inside, and cannot escape except via the fluid.... air if you prefer. The solar heating fluid is separate from the water to be heated and is connected to the solar cylinder via a heat exchanger.

The maximum temperature reaches 250F-300 F+ in bright sunlight and each tube can boil more than a pound of water per hour, but you would not want to let steam actually form, so about 180 F maximum water delivery temperature (determined by flow rate).

The tubes must be angled at a specific degree above horizontal so that the process of vaporizing and condensing functions. There are two types of collector connection to the solar circulation system. Either the heat exchanger extends directly into the manifold ("wet connection") or it is connected to the manifold by a heat-conducting material ("dry connection"). A "dry connection" allows to exchange individual tubes without emptying the entire system of its fluid.

Evacuated tubes offer the advantage that they work efficiently with high absorber temperatures and with low radiation. Higher temperatures also may be obtained for applications such as hot water heating, steam production, and air conditioning. Evacuated tubes can still work efficiently even on cloudy days, because it is able to absorb the energy from infrared rays passed through clouds.

You could also use the heat to desorb ammonia from calcium chloride salt to make your own "Crosley Icy Ball" solar powered refrigerator for off-grid living!

These solar capture tubes were made by Owings-Illinois Glass Company, for Sunpac.

They are made of extremely strong borosilicate glass.

They cost Uncle Sam \$250.00 per tube new.

These solar capture tubes were working well, when removed from a large hot water system in order to add on to an existing building. Each tube is re-tested before sale.

Manifolds are not included, but we will provide plans for do-it yourself manifolds, using standard plumbing fittings that can be found at any good home improvement store, or we can provide tube-ready manifolds *at a very reasonable cost*.

**Now available at the [Fossil Freedom Store](#)**



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