

Foye, Debra (DNRE)

From: Bodnar, Brent (DNRE)
Sent: Tuesday, July 13, 2010 3:50 PM
To: Foye, Debra (DNRE)
Cc: Benton, Timothy (DNRE); Babcock, Chris (DNRE)
Subject: Perry WWSL

Debra:

Thank you for sitting down with me last Friday to discuss the proposed project at the City of Perry and how it fits into SRF's Green Project Reserve Funding. Input from Jeff Herrold was also helpful.

The proposed project is to upgrade the current wastewater stabilization lagoon (WWSL) system by installing composite liners in cells #1 and #2, refurbishing two existing solar powered mixers, and installing one new solar powered mixer. The solar powered mixers, manufactured by Solar Bee, improve the performance of wastewater lagoons by providing additional mixing and making them more oxygenated, which increases biological treatment efficiency. The Lansing District Office has seen positive results with these units at several facilities within the district.

The 2010 Clean Water and Drinking Water State Revolving Fund 20% Green Project Reserve: Guidance for Determining Project Eligibility, has four categories of green projects which are 1) Green Infrastructure, 2) Water Efficiency, 3) Energy Efficiency and 4) Environmentally Innovative. Information submitted by Perry's consultant and the manufacturer (Solar Bee) was used in determining how this proposed project should be classified. As we discussed and as determined by the Lansing District Office, this project meets the requirements of Category 3.4, Energy Efficiency for Business Cases. The Solar Bee units are 100% self sufficient and only operate on solar power which is a great cost savings to the City of Perry when compared with what the costs would be to use electric mixers. Perry's consultant claims that approximately \$35,000 of electrical costs will be saved each year and \$690,000 will be saved over the 20 year life of the project by implementing Solar Bees. The new model Solar Bees are approximately 70 percent more efficient than the earlier models and employ a battery which allows them to operate during cloudy conditions or nighttime hours. The existing units in Perry will only operate during times of sunlight.

The information submitted by Perry's consultant suggested that this project also be classified under Category 1) Green Infrastructure and Category 4) Environmentally Innovative. Category 1) Green Infrastructure by definition includes projects dealing with stormwater which manages wet weather and maintains and restores natural hydrology. The proposed project of relining the wastewater lagoons would not fall into this category. The information submitted states that there are 22 wastewater treatment facilities in Michigan that use Solar Bees. Because Solar Bees are becoming common, especially in the Lansing District, they would not be classified as innovative under Category 4).

Please note that the green portion of this project, which was classified under Category 3.4, is only a small portion (approximately \$100,000) of the entire estimated project cost (approximately \$ 2 Million). The actual costs will be determined after bids are received.

Feel free to give me a call if you have any questions.

Brent A. Bodnar, P.E.
Department of Natural Resources and Environment
Water Bureau
Lansing District Office
517-373-3738

3/4/2011



Memo

To: Debra Foye, MDNRE Revolving Loan Manager
From: Jeff Hansen
CC: Chuck Mudge, Perry DPW
Date: 6/17/10
Re: City of Perry 2009/10 SRF Project Plan – Green Project Business Case Revision 2

The purpose of this memo is to provide information supporting that the proposed project qualifies as a green project according to EPA guidance. This memo is intended to act as a supplement to Section III, C, 11 of the Project Plan and update information contained therein to correspond with revised EPA guidance.

EPA guidance defines green projects by 4 primary qualifications. The 4 categories are 1) Green Infrastructure, 2) Water Efficiency, 3) Energy Efficiency, and 4) Environmentally Innovative. The proposed project qualifies under Items 1, 3, and 4 as discussed below.

1.0 GREEN INFRASTRUCTURE

The Perry waste water treatment lagoons are essentially man made surface waters that are now part of the natural hydrologic cycle of the Perry Drain. The Perry WWTL system receives and contains rainfall, releases water through evaporation, provides treatment of water prior to discharge to surface waters of the state, and contributes directly to the recharge of the Perry Drain. Any improvement made to the treatment process directly benefits Perry Drain and associated floodplains and wetlands via improved discharge water quality. Lining the lagoons will prevent sewage from leaking to ground waters and will allow proper treatment of water prior to discharge to Perry Drain. The aerators / mixers that are part of the project provide improved water quality by enhancing natural treatment within the lagoons. Finally, rip rap for erosion control installed along the banks will prevent sediment from mixing into the water and being discharged to the Perry Drain.

Specific business case characteristics of the project under the EPA CWSRF Technical Guidance document, Section 1.4 Decision Criteria for Business Case, are as follows:

1.4-1 The entire premise behind the functionality and effectiveness of waste water treatment lagoons is based on mimicking a natural impoundment. Flow of the waste stream into a WWTL system, detention time within the lagoons allowing for treatment, and ultimate outfall to waters of the state is the same process as a drainage ditch flowing into a pond or lake with an outfall to a stream at the opposite end.

1.4-2 WWTL systems capture, treat and evapotranspire both waste water and rainfall that falls on the site. All flow entering the lagoons whether by direct flow from sewers or precipitation is detained until the lagoons are discharged and is subject to treatment while contained in the lagoons by settling, natural



microbial action and natural treatment processes enhanced by the SolarBee units. Additionally, all flow entering the lagoons is subject to evaporation while contained.

1.4-3 WWTL systems provide natural treatment in lieu of mechanical / structural waste water treatment plants.

1.4-4 Installation of an impervious liner, aerator/mixer improvements and additions, and installation of rip rap erosion control are improvements that will protect the water quality of the Perry Drain and associated floodplains, wetlands and downstream waters of the state by providing improvements in water treatment and minimizing the introduction of sediment. The proposed liner prevents leakage thus increasing detention time of all inflow which in turn improves treatment. The SolarBee units improve the performance of WWTL's by promoting algae growth near the surface, distributing oxygen, and increasing pH. The rip rap protection on the WWTL banks prevents erosion and entry of sediment and therefore the release of sediment during discharge. Combined, the proposed improvements provide upgrades to the existing WWTL system which will allow for the most success in treating inflow, the most success in minimizing entry of sediment pollution, and the most success in protecting water quality in the Perry Drain.

3.0 ENERGY EFFICIENCY

The SolarBee aerators to be installed are energy efficient in that they operate entirely on solar power and no electricity needs to be purchased. In utilizing a renewable energy source, the SolarBees qualify as categorically green under 3.2-1. The battery packs are charged by the solar panels during sunny periods so that the units can run overnight and through cloudy periods. The solar capability of each aerator / mixing unit is equivalent to a 30 hp electric unit.

The cost to operate a 30 hp electric aerator 24 hours/day for 200 days/year at the rate Perry pays for electricity is as follows:

$$30 \text{ hp} \times (200 \text{ days} \times 24 \text{ hrs}) \times (0.746 \text{ Kwh} / \text{Hp hr}) \times \$0.107/\text{Kwh} = \$11,494.$$

The SolarBee aerators are entirely solar powered so there is no electricity cost. Therefore, each aerator saves the City 107,424 Kwh or \$11,494 per year. The project involves 3 aerators so a total of 322,272 Kwh or \$34,482 will be saved each year in electric charges. Over the life of the project, 6,445,440 Kwh or \$689,640 will be saved through the utilization of solar power.

The SolarBees also qualify as categorically green under 3.2-2. The new SolarBee unit to be purchased provides 100% energy savings compared to an electric aerator/mixer. All SolarBee units are powered entirely by solar power, so the total energy savings is truly 100% since no electricity charges are incurred. However, even if electricity cost savings are ignored and refurbishment of the 2 older SolarBee units is treated as a retrofit, the work still qualifies under 3.2-2. According to the SolarBee manufacturer, upgrade of the old SolarBee units to the new refurbished motors provides a reduction in energy usage from 120 watts to 36 watts, or a 70% reduction for each unit. The energy reduction with the new motor innovation is the key component that allows the unit to be operated by battery power during periods of limited or no sunlight. In addition to the power draw reduction with the refurbished units, there is also a real world operational efficiency realized with the addition of the battery pack. With the battery pack, the net result is that the refurbished SolarBees can operate 2-3 times longer than the older units with the exact same sunlight exposure or energy source. Information provided by the manufacturer is attached for your reference.



4.0 ENVIRONMENTALLY INNOVATIVE

The SolarBee aerator / mixing units are environmentally innovative in that the mixers are solar powered and are designed to optimize natural processes to produce improved water quality. Standard aerators add oxygen directly and utilize mixing action to disperse the oxygen into the water. The SolarBee mixers utilize natural algae to produce oxygen by bringing nutrients from the lower regions of the pond to the surface and to a usable location for the algae. The additional oxygen results in higher BOD reduction and decreased odor. The mixing action also increases pH which results in better treatment of ammonia and phosphorous and a reduction in sludge. The original SolarBee design has been dramatically improved recently to allow for operation during low light periods. Design improvements include power storage in a battery pack and substantial reductions in energy consumption via innovative efficiency modifications.

Specifically, it is likely the SolarBee units would qualify as green under 4.4-1b. According to the manufacturer, SolarBee units are now in operation at 22 different facilities in Michigan. It is unknown how many waste water treatment facilities there are in Michigan, but the number must be in the thousands meaning that a small percentage of facilities have utilized this relatively new technology.

Hansen, Jeffrey R.

From: Corey Simnioniw [corey@solarbee.com]
Sent: Wednesday, June 16, 2010 3:45 PM
To: Hansen, Jeffrey R.
Cc: Michael Christensen; Eric Schiebold
Subject: Re: LAN contact info
Attachments: 14-In-BrushlessMotorSpec_20100108.pdf; ATT00001.txt; Detailed_LGv18-ElecSchem_20100616.pdf; Detailed Electrical_20100616.pdf; ATT00002.txt; Example_4_OperationLog.pdf; ATT00003.txt

Hi Jeff,

We appreciate your interest in knowing more about our latest technology.

Prior to introducing our battery backup models (v12 and v18) that run day and night, clear or cloudy, we invested in developing a high efficiency motor and higher efficiency machine design. We were tasked at using close to the same power input to operate the circulator 3X as much, which meant shaving off approximately 3X the power requirement for operation. To achieve high efficiency, we had to go to the drawing board and design the motor to operate without gear reduction, basically no gearbox. We found that this required us to use a large motor diameter (14-inches) which offers the torque we need without wasted energy to obtain that torque that the smaller off the shelf motors require. The brushless motor used on our current production (v18 models) operates at approximately 36 Watts or less under full load, full rpm. On the Solar Only Models (older), we were operating at a motor load of approximately 120 Watts under full load, full rpm. The first attachment is a motor specification for our current production motor.

The new SolarBee models now have 80 Watt solar panels where the older units had 55 Watt which adds a little more power input and safety factor for continuous operation. Another feature with our current production is that we use precise jigs and manufacturing equipment to achieve consistent alignment in the frame and impeller assembly. Through component redesign and procedure changes, we've eliminated all but one welding step in the impeller assembly to minimize warping during construction. These steps have shaved off an estimated 15-20 Watts of power consumption in addition to the high efficiency motor design.

I've attached two electrical diagrams, one of each model configuration which lists the motor power requirement and solar power input differences. In addition, you'll find a real operation monitoring log that we pulled off one of our machines that had satellite monitoring and reported back machine information to the factory from the field. This log is the same as what you would see on our current production models and the far right column of data shows power consumption in watts. The older solar only models didn't have automatic monitoring or logging capabilities.

Please feel free to call me if you have questions after reviewing this information.

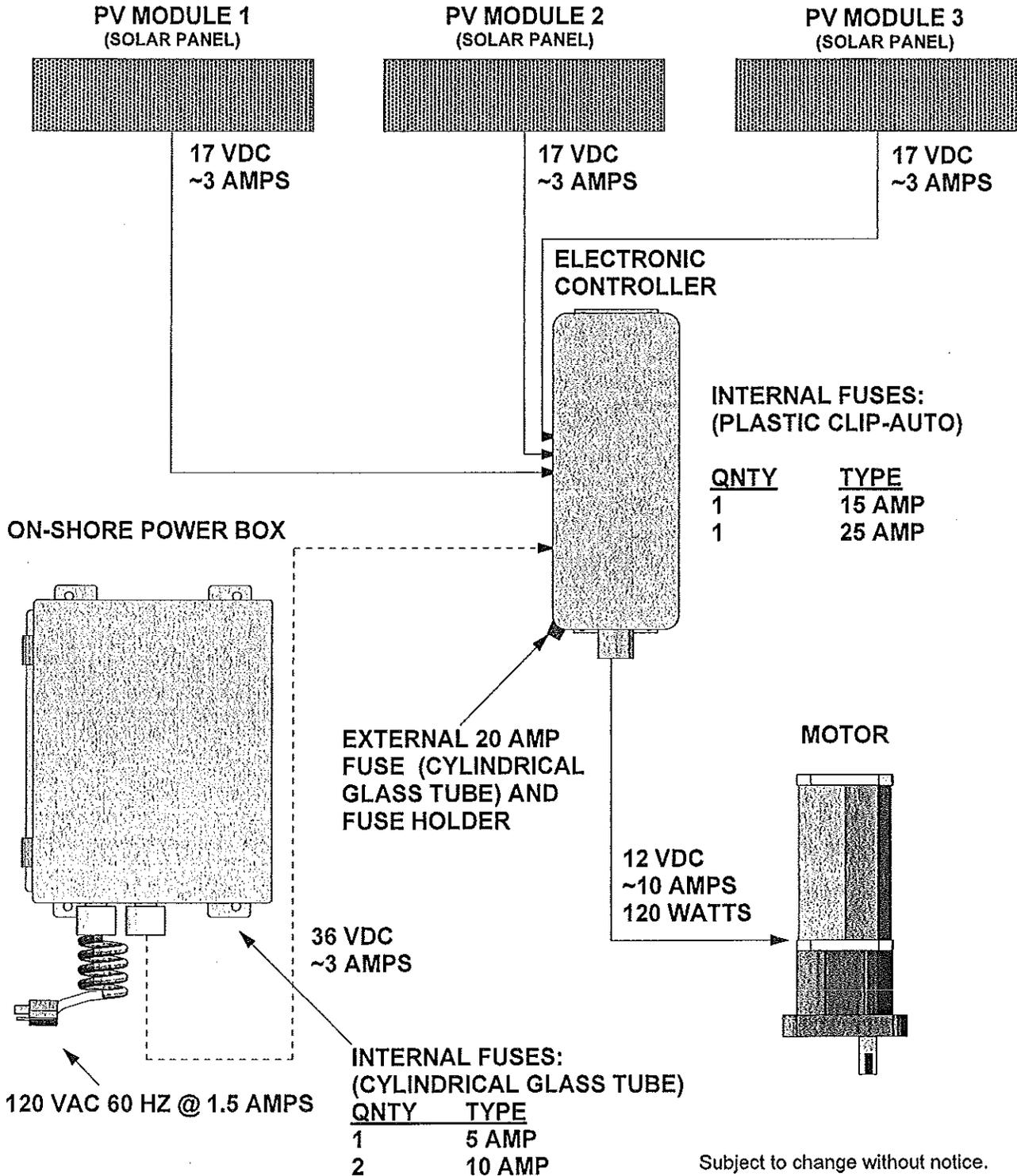
Regards,

Corey Simnioniw, Engineering Dept
SolarBee, Inc
3225 Hwy 22
Dickinson, ND 58601
Local ph 701-225-4495
Toll Free ph 866-437-8076

SolarBee®

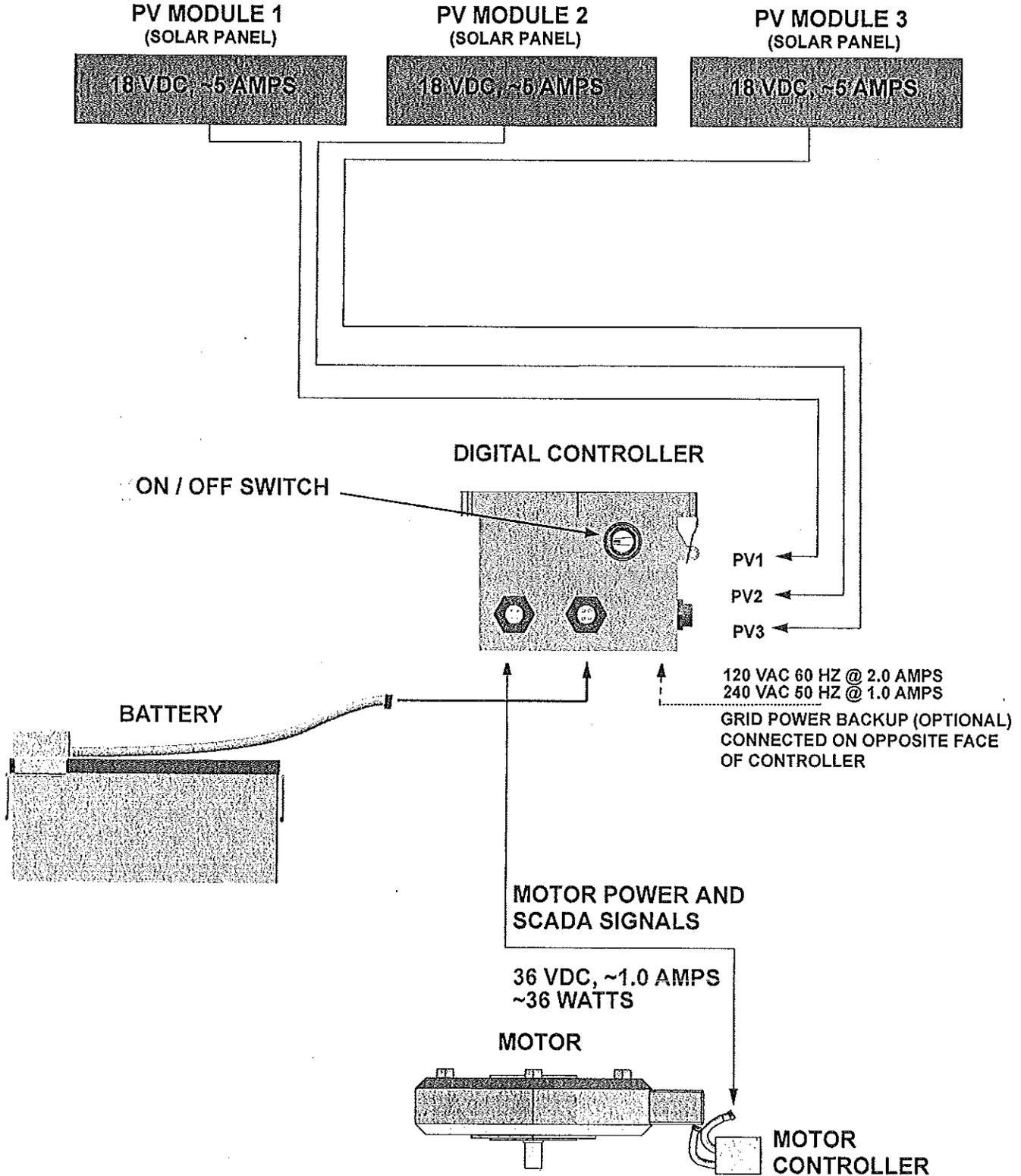
Circulating the World's Water

GENERAL ELECTRICAL SCHEMATIC FOR SOLARBEE SOLAR ONLY CONFIGURATION



Subject to change without notice.

GENERAL ELECTRICAL SCHEMATIC FOR SOLARBEE (v18)



SolarBee 14-inch Brushless Motor

Motor Features

Brushless, No Brush Replacement Required

Specifically Designed For v18 SolarBee

No Lubrication, No Maintenance

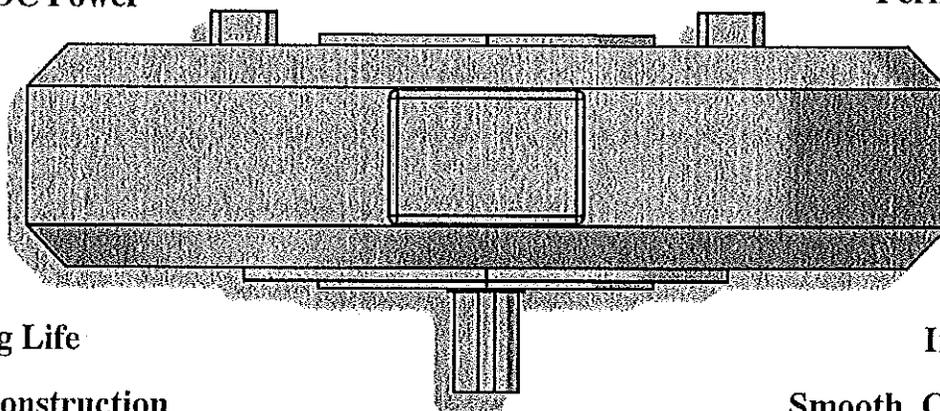
Effective Use of Solar Energy

Direct Drive, No Gearbox

Hall Effect Commutation

Low Voltage DC Power

Permanent Magnet



High Torque

Axial Air Gap

Durable, Long Life

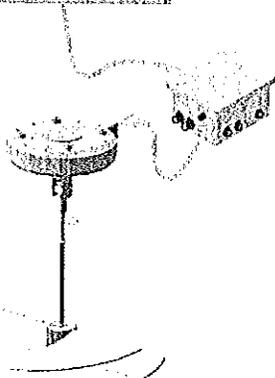
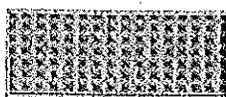
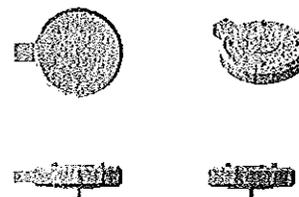
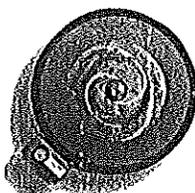
Iron Free Stator

Immersible Construction

Smooth, Quiet Operation

Advanced, Innovative Motor Design

No Cogging At Low Speed Operation



Specifications		
Size	14-inch (36cm) diameter X 6-inch (15cm) height	
Weight	75 lb (34 kg)	
Housing	1/2-inch (13mm) Thick Cast Aluminum	
Thrust Bearing	Stainless Steel, 25+ year life, Grease life: 100,000 hrs.	
Motor Control	Hall Effect Commutation	
	Normal SolarBee Operation	Maximum Motor Ratings
Current	Less Than 1.0 Amp	7.0 Amps
Voltage	36 VDC	36 VDC
Torque	3ft-lb (0.4 N-m)	30 ft-lb (40 N-m)
Power	1/20 HP (36 W)	1/3 HP (250 W)

Continuous Day/Night Operation powered by solar energy is made achievable through the use of this high efficiency motor design.