Global Solar EPC O&M services and technologies

TECHNICAL ASSISTANCE REQUEST: For the project entitled:

ECO-FRIENDLY COST-EFFECTIVE Dirt/Vegetation Control, Dirt/Concrete/Asphalt Pavements replacement, and Bi-Facial Solar Panels Albedo Reflection Surface for Solar Ground Mount projects.

Abstract: Losses in PV systems due to soiling have been the subject of considerable past research spanning decades, as described in several recent and thorough literature reviews. These losses range from 5% to 50% in reduced output from the system. Regular cleaning of solar panels with fresh water by workers is one current solution to this problem that is labor-intensive, not eco-friendly and cost-effective. Weed or vegetation management is important for ground-mounted solar systems. Tall weeds growing around the installation create shading, which negatively impact system production. They also cause hot spot heating — if a part of the solar cell is shaded, the cell can heat up to such extreme temperatures that a module can burn out, causing permanent damage. Mowing, spraying herbicide, and relying on herbivorous animals or covers are some of the current solutions to this problem. Unfortunately, these solutions are labor intensive, not eco-friendly or cost-effective.

Bi-facial panels are capable of capturing solar irradiation from the front and back. This means they have the capacity to generate power from the sun by capturing the sunlight reflected from the ground, as well as direct sunlight, therefore increasing total energy generation. Currently there is no eco-friendly or cost-effective product, method for albedo from ground surfaces. Since the solar industry has no single ideal, eco-friendly or cost-effective solution for albedo for bi-facial panels, the developers, investors, and EPC companies are having a difficult challenge creating accurate revenue models, bi-facial performance models, parametric sensitivities, project economics, and optimized system designs for bi-facial solar projects.

Currently, non-eco-friendly very costly very hazardous petroleum-based asphalt, concrete and dirt roads allow maintenance and emergency vehicles to access all areas of the not so green, eco-friendly solar farms, highways, cities and villages roads. Many workers are exposed to cancer causing fumes from asphalt, asphalt emulsion products (AEP), Bitumen MC30 petroleum hydrocarbon-based products used extensively in road paving, and concrete work. When hot asphalt is applied in a molten state, it generates toxic fumes. Workers exposed to asphalt fumes, AEP and MC30 are at risk of developing headaches, rashes, cough, and possibly cancer. Hydrocarbon-based products contain chemicals non eco-friendly toxic to the soil, water and which impact storm water runoff.

Terra Pave products are solutions which are eco-friendly (non-toxic, non-hazardous, non-corrosive, non-petroleum based) and cost-effective for all these challenges in the solar and pavement industries worldwide. Moreover, our eco-friendly cost-effective products allow solar farm owners to reap the benefits of reduced operation & maintenance costs (O&M) by decreasing dust pollution, vegetation growth and by providing a great reflection albedo 24/7/365 surface, easy financial modeling, accurate engineering design, accurate production prediction for bi-facial panels.

TERRA PAVE PRODUCTS for the SOLAR & TRANSPORTATION PAVEMENT INDUSTRIES will SOLVED ALL ISSUES for THE IMPLEMENTATION of BI-FACIAL PV SOLAR FARMS, will LOWER COSTS of O&M for EXISTING SOLAR FARMS, and will have a DIRECT POSITIVE ENVIRONMENTAL IMPACT for THE HEALTH of OUR PLANET, and for EVERY HUMAN and LIVING SPECIES on EARTH by replacing toxic asphalt and climate wrecking concrete/cement for roads, highways and many other pavements.

(1) Environmental Testing: The team has received data by San Antonio Testing Labs for the products for environmental testing to compare with current AEP (Asphalt Emulsion Product) : For Example in Table 1 for the *original TSW*. Additional environmental testing with our *Improved Albedo TSW Albedo, TSW, TSB, TPP, TF, TR* by SANDIA National Laboratory. For Example:

Table 1: Comparison of Asphalt Emulsion Product (AEP) to TerraSeal (TS)
Constituents of Concern 2018 Laboratory Data

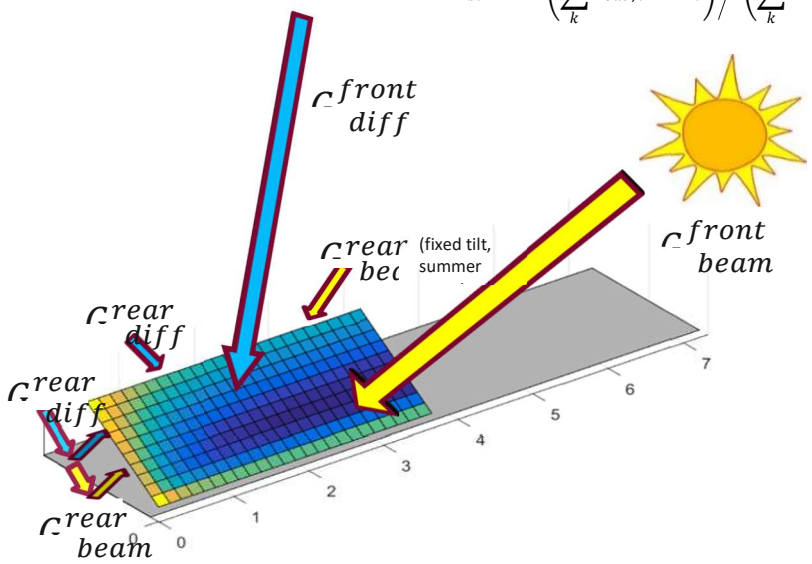
Chemical	Concentration (mg/kg) ***AEP***	***TS (Original TS)***
Nickel	1.58	<1.00
Benzene	7.3	<0.025
Toluene	89	<0.025
Ethylbenzene	71.3	<0.025
Xylenes	370	<0.075
Fluorene	6.1	<19.8
Napthalene	38	<19.8
Phenanthrene	15.4	<19.8
Pyrene	7.3	<19.8
Total Petroleum Hydrocarbons		
C6-C12	13400	<50
C12-C28	123000	<50
C28-C35	<500	<50
C6-C35	137000	<150

NOTE: (a) only those constituents detected in one or both samples are shown on the table AEP sample 3/19/18 and Terra Seal White (TSW) sample 5/8/18. Emulsion Product (AEP) is a mixture of asphalt oil and water and is used as a dust suppressant and base treatment prior to asphalt application. As a hydrocarbon based product, it contains chemicals not necessarily friendly to the soil and stormwater runoff. Chemicals such as benzene, pyrene, naphthalene, and C6-C35 hydrocarbons are present in the high percentage levels and some are known and possible carcinogens. (b) Samples were analyzed by San Antonio Testing Labs, a NELAP certified lab, following EPA approved test methods.

(2) **Bi-Facial Solar Panels Reflection Testing**: for the ***Improved Albedo TSW Albedo***: Testing by NREL will tremendously help the product TSW for commercialization in the solar industry.

From a bi-facial point of view…

$$PR_{bi} = \left(\sum_k P_{out,k} \times \tau_k\right) \Big/ \left(\sum_k \frac{P_0 \times \left(G_{i,k} + \varphi_{Pmax} \times G_{i,k}^{rear}\right) \times \tau_k}{G_{i,ref}}\right)$$



(3) **Ground Depth and Steel Material Reduction of ground mounting system pile driving/screw:** Testing by a national lab, private facility, and/or member of the American-Made Network could tremendously help the product TSW for commercialization in the solar industry. Using TSW can reduces the depth of ground depth penetration for ground mount system thus reducing the steel materials. (If money still available)