**Concentrating Solar Photovoltaic Greenhouse Wind Flower**

**Salient Features**

**CENTRAL FLOWER TOWER adjacent to HIGHWAY with FLOWER PETALS Clearance 10 m over HIGHWAY as SOLAR PV CONCENTRATOR RECEPTORS with part CLEAR, part REFLECTING, SOLAR DISTILLATION AQUACULTURE GEENHOUSES with BIOGAS PLANTS and 3 DANCING BEAUTIES VERTCAL AXIX WIND MILLS. Overall ENERGY GENERATION COST of ALL SITE INFRASTRUCTURE, will be LESS THAN 10 US$ / Watt**

**DESALINATION AQUACULTURE Saline Brackish Biogas Treated MIX Water Greenhouses’ SOUTH Facing Slopes, will have SOLAR m-Silicon PANELS and NORTH Slopes Panels will be Transparent for GREENHOUSES or Reflecting for SOLAR CONCENTRATION. SOLAR PV PANEL INCLINATION will be EQUATORIAL or 24.5 degrees to Horizontal (Masdar Lat.).**

**Potential Solar PV Power Generation in NO SHADOW Zone of SOUTH EAST Site over South Slope 24.5 Degree of Greenhouse = 265 kW - Average solar irradiation in similar latitudes is 1250 W / sq.m or 1.25 kW / sq m -18 % efficiency - 5.5 Sunshine hours / day = or 1 kWH / day / Sqm Or total kWH Solar Power Generation for No Shadow South East Site alone is 1kWH x 365 x 6600 Sq M =240900 kWH**

**Potential Solar PV Power Generation with NORTH WEST Site SOLAR REFLECTING CONCENTRATING HELOSTATS over South Facing Slopes of Transparent Greenhouses in 11000 Sq m Partial Shadow Zone of NORTH WEST GREENHOUSES, with Heliostats Focussing on Outside External Surface of CENTRAL FLOWER TOWER – NORTH VERTICAL SURFACES - Higher Efficiency TANDEM PV MODULES appx 265 kW**

**Annual kWH Solar Power Generation for NORTHWEST Site 265x365=240900 kWH**

**TOTAL POWER GENERATION – 265 kW+ 265 kW = 530kW or 480000 kWH / Year**





**CENTRAL FLOWER TOWER**

**Outside External Surface of CENTRAL FLOWER TOWER – NORTH VERTICAL SURFACES - Higher Efficiency TANDEM PV MODULES with COOLING WATER TUBES as Structural Backing on NORTH VERTICAL Stamen SURFACES of FLOWER, facing SOLAR CONCENTRATING REFLECTING HELIOSTATS on the SOUTH SLOPES of NORTH WEST SITE GREENHOUSE.**

**Outside External Surface of CENTRAL FLOWER TOWER – South VERTICAL SURFACES - SOLAR PV Photovoltaic POLYCRYSTALLINE SILICONE PV Modules.**

**CENTRAL FLOWER TOWER – INSIDE V SHAPE - Inside as “V” SHAPE as SOLAR CONCENTRATOR with HIGH EFFICIENCY SOLAR PV CONCENTRATOR RECEPTORS on INSIDE BOTTOM on TOP of SCADA Computer ROOM Located Below FLOWER**

**CENTRAL FLOWER TOWER – PETALS 10 m Clearance over Highway and Sky facing SOLAR PV MODULES SILICON POLYCRYSTALLINE PANELS on PETALS CENTRAL FLOWER TOWER PETALS BOTTOM CLEARANCE 10 m above HIGHWAY Ground Level with MAIN FOUNDATION on SOUTH EAST SITE at SOUTH EAST**

**GREENHOUSES**

**POLYESTER GLASS FRP GREENHOUSES with SOLAR PV on SOUTH SLOPE in NO SHADE ZONE on SOUTH EAST SITE and**

**SOUTH EAST SITE GREENHOUSES – NO SHADING in 6600 Sq.m -EAST WEST Tent Shaped GREENHOUSES with NORTH SLOPE TRANSPARENT Glass but partially REFLECTING due to Sunlight Angle on to CENTRAL FLOWER TOWER and EQUATORIAL MOUNT 24.5 Degrees to Horizontal Sunfacing SOUTH SLOPE as SOLAR PV Photovoltaic POLYCRYSTALLINE SILICONE PV Modules.**

**NORTH WEST SITE - EAST WEST Tent Shaped GREENHOUSES in 11000 Sq.m with NORTH SLOPE TRANSPERANT and Equatorial Sunfacing SOUTH SLOPE as REFLECTING SOLAR CONCENTRATING REFLECTING HELIOSTATS on the SOUTH SLOPES of NORTH WEST SITE GREENHOUSE focussing on to NORTH VERTICAL SURFACES of CENTRAL FLOWER TOWER with Higher Efficiency TANDEM PV MODULES.**

**GREENHOUSES for HANGING AQUACULTURE with SEAWATER mixed with TREATED SEWAGE from BIOGAS PLANTS with SEAWATER DISTILLATION DESALINATION**



**CENTRAL FLOWER TOWER STAMEN – Central Pole – 95 m High with Co-Axial DOUBLE VERTICAL AXIX WIND MILLS of from 70 m to 95 m lvl. with multiple VERTICAL AXIS WIND MILLS of 10 M Height each one above the other with TWISTED HELICAL SAVOINIUS Type Blades on inside and multiple GORLOV Vertical Darrius Twisted Wind Mills of 10 m Heights on OUTSIDE, to enhance EFFICIENCY, to SELF START and to enhance DYNAMIC STRUCTUAL STABILITY by Cross Diaphragm Spanning.**





**Central Pole – 95 m High with Co-Axial DOUBLE VERTICAL AXIX Helical WIND MILLS of from 65 m to 95 m lvl. with multiple VERTICAL AXIS WIND MILLS of 10 M Height each one above the other with TWISTED HELICAL SAVOINIUS Type Blades on inside and multiple GORLOV Vertical Darrius Twisted Wind Mills of 10 m Heights on OUTSIDE**

**3 Numbers Co-Axial DOUBLE VERTICAL AXIX Helical WIND MILLS, each of 10 m height one above the other, ROTATE and REFLECT light from HIGHWAY and MASDAR, looking like 3 DANCING BEAUTIES**

**3 DANCING BEAUTIES, each of 10 m height one above the other, ROTATE and REFLECT light from HIGHWAY and MASDAR, consisting of 3 Numbers Co-Axial DOUBLE VERTICAL AXIX Helical WIND MILLS, each of 10 m height one above the other**

**“V” SHAPE SOLAR CONCENTRATION of Inside of SOLAR WIND FLOWER**



**GREENHOUSES for HANGING AQUACULTURE with SEAWATER mixed with TREATED SEWAGE from BIOGAS PLANTS with SEAWATER DISTILLATION DESALINATION**

**BIOGAS PLANTS may be located in GREENHOUSES, to treat SEWAGE and use TREATED SEWAGEWATER for AQUACULTURE as well as CO2 from BIOGAS PLANTS. CH4 METHANE will accumulate at TOP and collected as FUEL and CO2 at bottom for GREENHOUSE PLANTS.**





**SOLAR PV INSTALLATION and COSTING –**

**SOLAR PV PANEL INCLINATION will be EQUATORIAL MOUNT or 24.5 degrees to Horizontal inclined towards South (Masdar Latitude is appx. 24.5 North of Equator).**

**Average SOLAR PV INSTALLATION with STRUCTURE COSTS – US$ 3 / WATT**

**SOLAR PV INSTALLATION PANELS, alone COSTS 0.5 US$ / W or LESS THAN 1 US$ / WATT, on a SOLAR PV suitable Constructed STRUCTURAL SUBSTRATE with STRUCTURE like SOUTH FACING SLOPES of POLYESTER GLASS FRP with Equatorial Mount 24.5 Sunfacing Solar PV Surface over GREENHOUSES costing less than 20 US$ / Sq. m and a 15 cm thick Steel Fibre Reinforced RCC substrate will cost 7 US$ / Sq. M to 10 US$ / Sq. M.**

**SOUTH EAST SITE –**

**NO SHADOW ZONE SOUTHEAST of CENTRAL FLOWER = 6600 Sq M in Trapezium shape with Equatorial Mount 24.5 Sunfacing Solar PV Surface over GREENHOUSES**

**Approximate Peak Solar Power Generation with Multi Crystalline Silicon Solar Cells at this Latitude = 2 Hectares or 5 Acres / MW to 3 Hectares or 7.5 Acres / MW or = 20 Sq. m / kW to 30 Sq. M / kW or total Peak Solar PV Electricity generation in 6600 Sq. M. = 330 kW to 200 kW**

**So Peak Power Generation on Southeast Part of the Site can assumed to be around 265 kW**

**Carbon Di Oxide Mitigations due to Solar PV at South East Site – 8120 Tonnes or equivalent of Planting 13000 Teak Trees over lifetime**

**Potential Solar PV Power Generation in NO SHADOW Zone of SOUTH EAST Site over South Slope 24.5 Degree of Greenhouse = 265 kW - Average solar irradiation in similar latitudes is 1250 W / sq.m or 1.25 kW / sq m -18 % efficiency - 5.5 Sunshine hours / day = or 1 kWH / day / Sqm Or total kWH Solar Power Generation for No Shadow South East Site alone is 1kWH x 365 x 6600 Sq M =240900 kWH**

**Potential Solar PV Power Generation with NORTH WEST Site SOLAR REFLECTING CONCENTRATING HELOSTATS over South Facing Slopes of Transparent Greenhouses in 11000 Sq m Partial Shadow Zone of NORTH WEST GREENHOUSES, with Heliostats Focussing on Outside External Surface of CENTRAL FLOWER TOWER – NORTH VERTICAL SURFACES - Higher Efficiency TANDEM PV MODULES also 265 kW or total kWH Solar Power Generation for NORTH WEST Site is 1kWH x 365 x 6600 Sq M =240900 kWH –**

**TOTAL POWER GENERATION – 530kW and 480000 kWH / year**

**Commercial Panels are appx. 2 m Wide ( 78 “ ) x 1.0 m Inclined High ( 39” ) or 384 W / Panel**

**In 2018 a 65”x39” or 163 – 165 cm x 98 -100 cm SOLAR PV PANEL with Typical 18.7% Efficiency produces 320 W / PANEL**

**Or**

**During Equinoxes the Shadow Angle of 24.55 Degrees Equatorial Mount PV Panel - Shadow will be 0.45 m horizontal / 1 m Vertical Height of Panel**

**Calculations for 2 Rows of Panels For 2 nos x 1 m High Panels Panels the appx Vertical Height will be 2 m / 2.2 m or appx. 0.8 m**

**Or appx. 1 m including thicknesses and supports**

**The WINTER SOLASTICE SHADOW will be appx. 1.11 x 2 = 2.2 m and the Horizontal Footprint of Panel for 24.5 Degree EQUATORIAL MOUNT will be appx. = 1.8 m**

**Total SHADOW + HORIZONTAL FOOTPRINT of PANEL= appx. 4 m for 2 Rows of Panels and 6 m for 3 Rows of Panels = One Row of GREENHOUSE including SOUTH SLOPE and NORTH SLOPE**

**So Optimal Centre to Centre Spacing for 2 Vertical Rows of Panels One above the Other = 4 m**

**And for 3 Vertical Panels above South Slope of Greenhouse = 6.0 M**

**GREENHOUSES ROWS c/c SPACINGS – 6 m Optimal Centre to Centre Spacing for 3 Vertical Rows of Panels One above the Other = 6 m which may be a better Choice for the South East Part of the Site as 6 m c/c for Greenhouse Structure may be more Economically Structurally Viable**

**TOTAL POWER GENERATION – 530kW and 480000 kWH / year**

