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The Stella Group, Ltd.

Scott Sklar, President

## RENEWABLE ENERGY TRENDS FOR DISTRIBUTED GENERATION IN AGRICULTURE AND PROCESSING

by Scott Sklar, President of The Stella Group, Ltd.,  
Washington, DC  
before the 83rd USDA Agricultural Outlook Forum  
Friday, March 2, 2007, Arlington, VA

The Stella Group, Ltd. is a strategic marketing and policy firm advancing the utilization of clean, distributed energy applications such as advanced batteries and controls, energy efficiency, fuel cells, heat engines, microhydropower, minigeneration (natural gas), modular biomass, photovoltaics, small wind and solar thermal (air-conditioning, water and industrial process heat, and power generation); with blended financing and customer facilitation. Scott Sklar, the Group's founder and president, lives in a solar home in Arlington, Virginia, his coauthored book "The Forbidden Fuel: Power Alcohol in the Twentieth Century" is being updated and republished in late 2007, and his coauthored book, A Consumer Guide to Solar Energy, was re-released for its third printing while he appears regularly on a Q&A column on the largest renewable energy web portal: [www.renewableenergyaccess.com](http://www.renewableenergyaccess.com)

The Stella Group's Virginia office building (behind the residence) has 1 kW of UniSolar photovoltaic roofing shingles, a 3.6 kW GridPoint smart battery bank, a 0.5 kW small wind turbine by Southwest Windpower, and has the first commercial lease of a 5 kW Plug Power fuel cell (running on recycled industrial hydrogen in canisters) tied to a dedicated Xantrex inverter.

The Stella Group's Washington, DC office is located in The Grange Building one block from The White House, which has 0.5 kW of UniSolar photovoltaic roofing shingles, and 1.0 kW of various modules from Isofoton (Spain), Schott Solar (MA), Shell Solar (CA), Spire Corp (MA).with a Xantrex SW Inverter and 4 deep cycle batteries. The system was funded, in part, by a grant from the DC Energy Office.

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## MARKET GROWTH

Global investment in renewable energy reached \$30 billion in 2004, equal to 20 to 25 percent of the global investment in the power sector, according to a report released on Sunday by the Renewable Energy Policy Network for the 21st Century (REN21). According to the report, global investment in renewable energy has grown steadily since 1995, when it was at about \$7 billion. As a result, wind, solar, biomass, geothermal, and small hydropower technologies now supply 160 gigawatts of generating capacity, about 4 percent of the world total. The fastest growing technologies are grid-connected solar power, at 60 percent per year, and wind power, which grew 28 percent in 2004. The rising global investments in renewable energy have also had a positive effect on clean energy stock prices, according to New Energy Finance. The company has created a stock index of 50 clean energy companies, called the Global Energy Innovation Index (GEIX). The index finished the third quarter up 32.5 percent on the year and nearly 20 percent on the quarter. On November 13, 2006, new Rand Corp. study showing the falling costs of ethanol, wind power and other forms of renewable energy predicts such sources could furnish as much as 25% of the U.S.'s conventional energy by 2025 at little or no additional expense. A second renewable-energy report soon to be released by the National Academy of Sciences suggests wood chips may become a plentiful source of ethanol and electricity for industrial nations because their forested areas are expanding, led by the U.S. and China.

## POLICY THRUSTS

- **Federal Initiatives** (legislative and regulatory) - The recently-passed Energy Bill has an Investment Tax Credit for solar and fuel cells for both commercial and residential applications for 2006 and 2007 and a Production Tax Credit for wind and biomass at 1.8 cents per kWh. The Federal Energy Regulatory Commission (FERC) has released a rulemaking in 2005 for fast track interconnection for distributed energy applications under 2 MW.
- **State Programs** - 15 States have Clean Energy System Benefit Trust Funds which have over \$4 billion in unspent grant funds for technology applications, 29 States have mandated standard interconnection regulations, and 11 States have mandated Renewable Energy Portfolio Standards requiring a certain percentage of renewable electricity by certain timeframes.
- **Global Initiatives** - Global Environmental Facility has \$8 billion for clean energy deployment, United Nations Environment and Development programs (UNEP/UNEP) have a \$6 billion clean energy portfolio, and the Regional Development banks (ADB, IDB and EBR) as well as the International Finance Corporation (IFC) of The World Bank Group have dedicated lending for clean energy development.

## STANDARDIZATION AND MODULARITY

As the industries mature, companies now have begun to offer standardized, modular products which can be conventionally financed or leased, and serviced. Highlights are typified by a cross section of technologies and end-uses.



## FUEL CELL PRODUCTS (25 kW) FOR PREMIUM POWER GENERATION Systems



### **Uninterruptible. Plug Power.**

GenCore fuel cell systems are high-performance solutions for the critical backup power needs of the Telecommunications, Cable Broadband, and Uninterruptible Power Supply markets. Our platform-based design provides a high degree of flexibility to meet your unique needs.





# Shell Solar

## QUICK DEPLOY

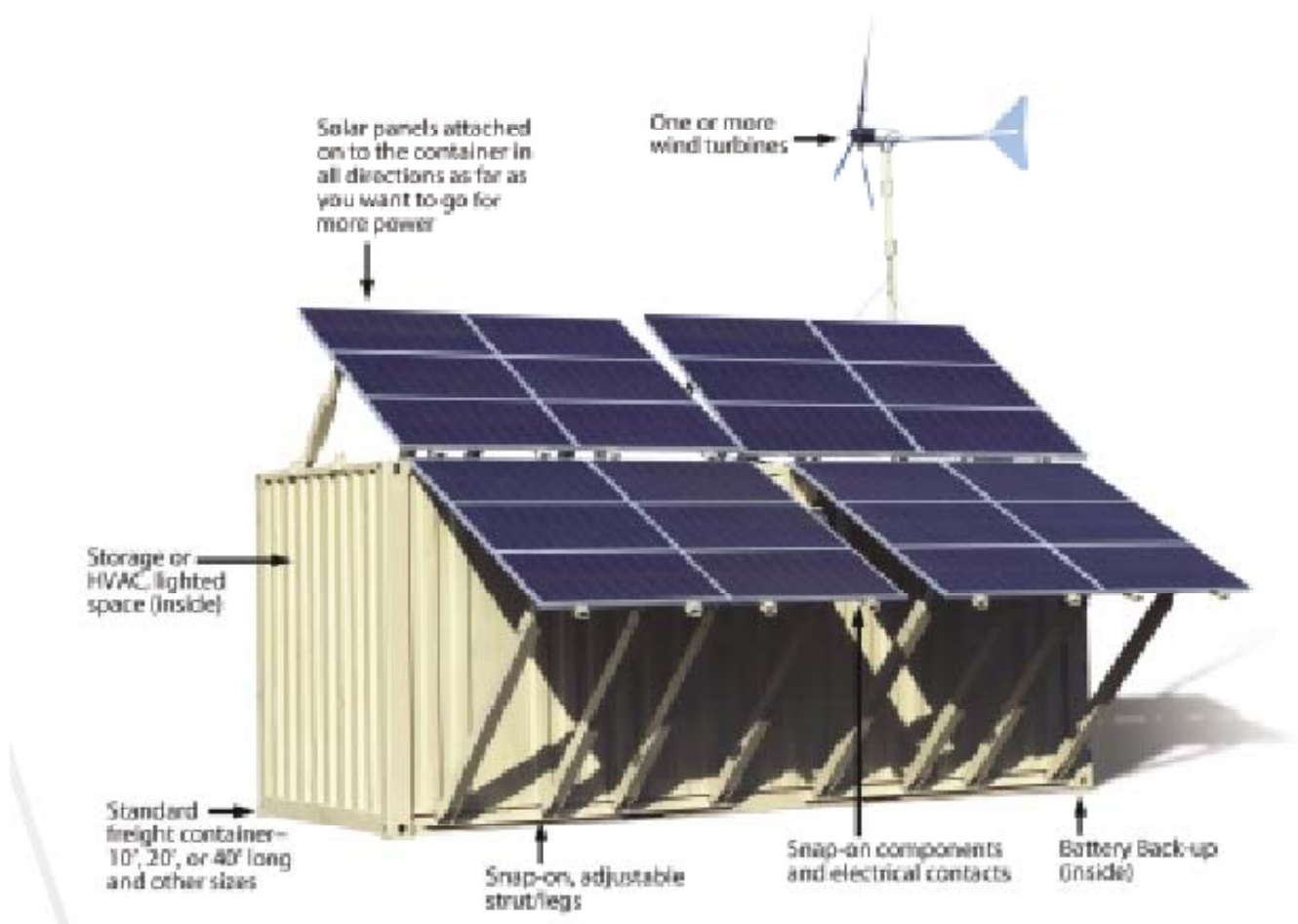
**Solar Electric Systems:  
Modular Grid Interactive  
Primary Power Systems**





## The Mobile Power Station™ (MPS)

THE BEST SOLUTION FOR DISTRIBUTED GENERATION



5 kW – 150 kW – open architecture with quick ‘plug in’ ports to add other MPS units, diesel gen sets, and other distributed energy devices – out put in 220 volts, 120 volts (AC) and 12 volts and 24 volts and 48 volts (DC)

## **STM Power**

35 kW stirling gen sets using biogas, methane from waste water treatment plants and coal bed methane, landfill gas, and biogas – plus hot water for cogen uses







## **Verdant Power**

35 kW freeflow microhydropower units on pontoon or 'set' buttresses  
Needs no dam or diversion – fish friendly – shipping and recreation friendly –  
both urban and rural applications



O. P. T.  
OCEAN POWER TECHNOLOGIES, INC



## **Autonomous PowerBuoy™**

Ocean Power Technologies Autonomous Power Buoy™ (APB) converts ocean wave energy into useable electrical power for remote at-sea power applications. The APB has been proven effective and reliable in sea trials and can be tailored to meet the weight, volume and power generation requirements for a wide variety of commercial and military applications. The APB is protected under multiple U.S. and International patents.

## COMMUNITY POWER CORPORATION (CO)

The BioMax<sup>®</sup> (see figure 1) is the world's first modular, fully automatic, mass-producible system for the global distributed generation market. The BioMax converts renewable biomass residues to a gas this is a substitute for non-renewable gaseous fossil fuels such as natural gas or propane. DOE reports that the US alone consumes over \$35 billion per year in natural gas, and \$4 billion in propane. Whereas high natural gas prices are a barrier to conventional gas-based combined heat and power (CHP) distributed generation systems, they are an advantage to the BioMax. In addition, gas-based conventional CHP is not seen as “green” whereas the BioMax is a renewable alternative.



Figure 1 - BioMax Modular Biopower System (25 kWe) manufactured by Community Power (CO)

QuickTime™ and a  
TIFF (Uncompressed) decompressor  
are needed to see this picture.

## **World Water and Power**

Uses photovoltaics to drive heavy duty pumps, compressors and motors for  
Municipal water systems, irrigation, refrigeration, industrial motors with this unit  
shipped to Waveland, MS after hurricane Katrina

## Elevated Security

blend small wind and photovoltaics (and in some cases fuel cells) to power mobile cellular towers, city WIFI systems, and perimeter security systems for airports, military bases, and nuclear facilities





## Intelligent Renewable Energy Management

Renewable energy users face a confusing array of technologies that provide an inadequate level of reliability, safety and support. Additionally, installers must choose from these disparate options to build a customized system for each installation, resulting in wasted time, increased complexity and unnecessary costs.

Now there is a smarter choice. GridPoint Connect™ easily integrates renewable energy in a revolutionary way. Unlike traditional renewable systems, GridPoint Connect is encased in a single cabinet for "plug-and-play" installation and insures you're never without power day or night.

GridPoint Connect is the first intelligent renewable energy management appliance. No other product offers advanced performance and safety monitoring for automatic and worry-free ownership.

GridPoint Connect actively communicates with the company's performance monitoring center, GridPoint Operations<sup>SM</sup>, to ensure maximum efficiency and early detection of maintenance needs, prompting a preemptive service call from a GridPoint representative. Installers appreciate the fact that GridPoint handles all service and support after installation.

GridPoint Connect's advanced power electronics and high capacity batteries maximize the efficiency of converting renewable energy into useable electricity. It also empowers users to automatically sell excess electricity to the utility company.

Featuring a sleek, stainless steel, safety-rated enclosure and backed by a comprehensive warranty, GridPoint Connect is a quiet and attractive intelligent renewable energy management appliance.

Reliable. Economic. Automatic.



# Solar Integrated Technologies (SIT)

Uni-Solar flexible thin-film integrated with single-ply membrane



1

## Lowest Cost per watt & per sq.ft.

Synergy with dual function and synchronized warranty



9

## **AirBird by Southwest Windpower**

provides hybrid wind (1 kW, 3 kW) and Photovoltaics (100 – 350 watts) to power communications, back up highway intersection signal lights and park and public space power




# UNISOLAR

UNI-SOLAR®

## Field Applied Roofing PV Laminate For Steel Roofs

Models: PVL-31, PVL-62, PVL-68, PVL-93, PVL-124, PVL-136

Data Sheet

- **Lightweight, Flexible, Durable**
- **Easy to Install "peel and apply"** application
- **20 Year warranty on power output**
- **Roll Shippable**
- **Top Termination quick connect or Junction Box**
- **Bypass Diodes for Shadow Tolerance**
- **UL Listed** 



### Product Description and Application

Each PVL (photovoltaic laminate) utilizes the proprietary Triple Junction solar cells manufactured by *UNI-SOLAR*. These cells are made in a roll-to-roll deposition process on a continuous roll of stainless steel. The result is a unique, flexible, lightweight solar cell.

The *UNI-SOLAR* PV Laminates are encapsulated in UV stabilized polymers making them exceptionally durable.

Bypass diodes are connected across each cell, allowing the modules to produce power even when partially shaded.

These special roofing laminates are designed to be bonded on 16-inch wide (minimum), flat steel pans. They come with the bonding adhesive factory-installed on the back of the laminate. Included is a rugged, weatherproof junction box and/or Quick Connect Terminals.

### Application Criterion

- PVDF Coated (Galvalume® or Zinalume®) steel metal pan
- Steel pans with flat surface (without pencil beads or decorative stippling)
- 16" minimum steel pan width
- Installation temperature between 10°C - 40°C (50°F -100°F)
- Maximum roof temperature 85°C (185°F)
- Certified Installer
- Cleaned as per manufacturer's instructions
- New or qualified new roof installations

For further information contact:

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202-347-2214 (DC) 703-522-1195 (VA)  
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## Conclusion: Technology Trends

The Skystream 3.7, a wind generator from Southwest Windpower in Flagstaff, Ariz., stands 35 to 100 feet tall — depending on the location — and costs about half that of conventional turbines currently available. Southwest Windpower is mass producing the Skystream and selling it for between \$10,000 to \$12,000 installed, about half the cost of similar size turbines, which are typically assembled by hand on a much smaller scale.

According to the developers, the system could save the average homeowner \$500 to \$800 per year on electricity. "I think Skystream has a chance to break the 10 cent per kilowatt hour at the best sites," said Jim Green, senior project manager at the National Renewable Energy Laboratory's National Wind Technology Center in Golden, Colo.

Biomass Combustion Systems (MA), offers industries one stop shopping for wood energy feasibility studies and project development. BCS consultants have designed and installed more than 300 wood fired systems through out the United States, ranging from 100 hp to 1200 hp, and for a variety of industry sectors. Let BCS find a solution to your energy needs, or fuel markets for your wood residue. In general any industry which uses thermal or process energy continuously six to seven days a week is an ideal candidate for wood fuel. There are many potential energy applications from wood fuel: BCS sells wood fired boilers which produce steam. This steam can be used for process applications, heat, or to produce mechanical energy through a turbine. Other companies sell direct fired wood systems which are ideal for high temperature drying applications where fly ash is not a problem (brick kilns etc.) (<http://www.biomasscombustion.com/>).

Scientists are on a 'full court press' to harness nature's processes to tap into energy and other products and processes. Trees do not generate electricity though, but they do use sunlight to convert sugars into energy to grow. The April 2005 U.S. Department of Energy and U.S. Department of Agriculture report, "A Billion-Ton Feedstock Supply for a Bioenergy and Bioproducts Industry", helps to dismiss those who question the ability of biomass to supply enough energy to meaningfully displace petroleum. This study found that biomass production potential in the U.S. exceeds 1.3 billion dry tons per year, which is enough to meet over one-third of the current demand for transportation fuels. University and national laboratory scientists have a plethora of research from tapping into algae to produce hydrogen and ethanol, tweaking photosynthesis to accelerate biomass growth and resistance to drought and pests, and configuring genes of algae, plants and woody biomass so their cellulose, sugar or molecular setup is more conducive to existing conversion processes and growing regimens. The recently passed Energy bill creates an ethanol mandate requiring fuel manufacturers to use 7.5 billion gallons of ethanol in gasoline by 2012 – a move that will reduce oil consumption by 80,000 barrels of oil a day by 2012, according to Energy Information Administration. Even the United Nation's Conference on Trade Development (UNCTAD) has launched the Biofuels Initiative which will coordinate different activities jointly with other UN agencies, private sector, non-governmental organizations and applied research centers. The meeting stressed that biofuels (bioethanol, biodiesel and biogas), derived from agricultural crops such as sugar beet and sunflower, are an ecological alternative to conventional fossil fuels, that are expected to last no more than 50 years for petroleum, 60 years for natural gas and 200 years for coal. And I continually point out the versatility of biomass for thermal energy, electricity, and transportation fuels makes it one of the most flexible renewable energy options. Conversion of biomass needs to incorporate the use of other renewables (geothermal, hydropower, solar electric and thermal, and wind) as well as utilize more of the biomass coproduct and waste heat to enhance its positive energy balance further. I expect this decade and next to culminate in substantive advances in research, new applied applications, and solid growth in marketshare for all the biomass energy sectors.

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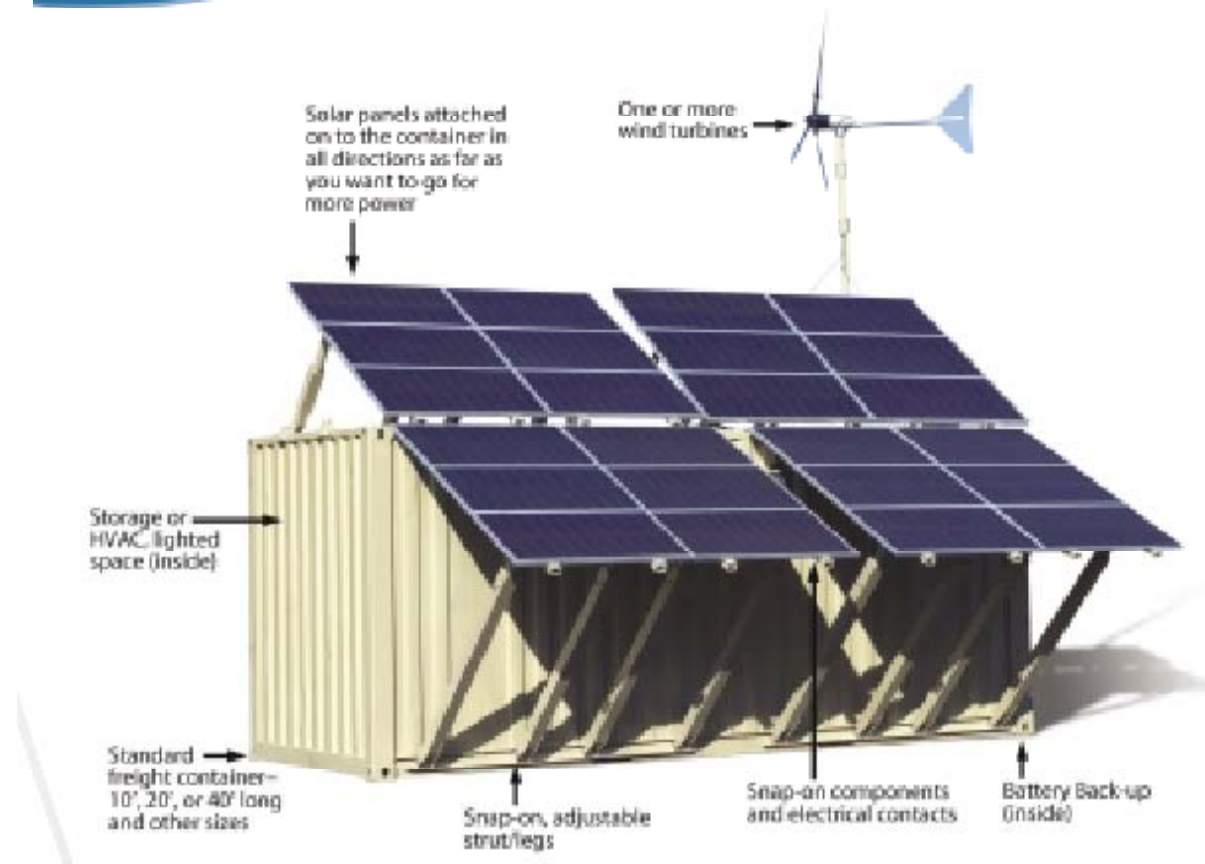
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Dec

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Dec

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## Conclusion (continued): **Technology Trends**

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On February 26, 2007 in a Mead, Nebraska plant, a herd of cows part of an experimental scheme dubbed "Genesis", churn out a steady supply of energy-rich excrement each day. But these 27,000 cattle stand on slatted floors to deposit an estimated 1.6 million pounds (726,000 kg) of dung daily into deep pits, which are located adjacent to a new ethanol plant. The waste is then processed into methane gas, which powers the ethanol plant. Other byproducts of the manure include fertilizer for the surrounding corn fields. Corn is then fed back to the cattle or distilled into ethanol. The operations all are contained in one 2,000-acre complex which produces about 24 million gallons of ethanol a year.

The United States currently counts 117 operational ethanol plants with the capacity to produce 5.3 billion gallons annually. More than 70 are under construction. Traditional ethanol facilities use natural gas or coal to fuel the boilers that create steam and distil ethanol from corn or other plant-based sources.



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