PVI Solar Next Generation Technology

1. Integrated Solar/Grid-assist (ISG) (patent pending)

Integrated Solar / Grid-assist (ISG) technology combines PVI SOLAR's existing solar controller, energy management software and electronics technologies, marketed by PVI under its PowerLine™ Power Management System with supplemental electric power provided by connection to the local utility grid. ISG technology is designed to use solar energy as its primary source of power. Energy from the grid is only added to the ISG system during periods of low solar energy. All solar energy collected is stored by the ISG system using batteries and none is sent to the utility gird (no net metering).

Benefits:

1. Cost Savings
   Grid-assist capability greatly reduces battery and PV panel size/expense for signs and outdoor lighting.
2. Design Flexibility
   Solar products can now be placed in shaded locations that do not adequately provide all the energy necessary to light signage or outdoor lights. Also, solar panels can be esthetically sized and placed on signs and outdoor lighting to publically display its renewable/green qualities without having to use excessive amounts or having to compromise the effective lighting of the product.
3. Light Output at Municipal and Industry Illumination Standards
   Today's solar lighting systems cannot match the light output levels of grid-powered lighting systems unless one is willing to pay extra for installing large amounts of solar panels and storage batteries. Currently available LED sign and outdoor lighting luminaires have been designed for gird-connect applications with its "unlimited" supply of electric energy. ISG products can provide lighting solutions that match current illumination standards, offset some/most energy costs using solar and provide off-grid benefits as further explained below when utility grids fail.
4. Evening Peak-Power Load Shedding
   Solar energy is touted to be most effective at producing energy when utility grids are experiencing maximum stress during hot summer days. While true, these peak-power periods extend into early evening hours when people returning from work turn on their residential air conditioners, lighting, appliances, etc. ISG products will power signs and outdoor lighting using solar energy stored during the day and eliminate or delay the need to pull additional power from the utility grid until late in the evening, after peak-power periods have ended.
5. Utility Grid "Cold Load Pickup" Reduction
   When utility grids fail and have to be restarted, especially at night, the power required to simultaneously turn on all sign and outdoor lighting at once adds to the large surges of power that utility companies have to supply to reestablish grid power. During this period of power surging,

   called 'cold load pickup", sensitive commercial electrical equipment can be damage. ISG products will continue to use stored solar energy during cold load pickup periods to power outdoor lighting and only draw grid power after the grid has been fully reestablished.
6. Emergency Lighting
   By its inherent design, all ISG products will automatically continue to operate outdoor lighting and signage during utility grid power outages. The lighting levels of operation and the time of

operation during power outages are fully programmable based upon the site's specific lighting requirements. Retrofitting existing outdoor lighting and signage with these new backup features will improve public safety. Area lighting and illuminated informational signage can be maintained for evacuation, site stabilization and to provide public assurance. Lower maintenance level lighting can also be provided for an extended period of time until grid power is restored.

7. Improve Solar Lighting Reliability
   Grid connecting solar lighting systems will provide power when solar energy is very low, thereby improving its reliability. This will enable solar lighting systems to be installed in applications requiring higher degrees of reliability (such as for hospital emergency signage, evacuation route egress, emergency roadway information, etc), than can be afforded using currently available solar lighting technologies.

8. Improve Solar Lighting Retrofit Costs
   Grid connecting solar lighting systems will reduce solar battery costs by reducing total system energy storage requirements. More importantly, combining PVI's PowerLine™ controls, software and electronics with grid-assist power backup will reduce the physical size of solar panels mounted on existing signs, buildings and lighting poles. For existing sign cabinet retrofits, fewer batteries need to be placed within the sign. For existing street and parking lot lighting retrofits, poles and support foundations were never sized to handle large PV panel wind load forces. ISG enables PVI to install smaller size PV panels for pole mounted lights, reducing panel wind loads and enable most existing light poles/foundations to be reused for LED/solar retrofit.