The Best Solution For the Next Generation,
Photovoltaic Energy!

Floating Photovoltaic System
Floating PV system is a great efficient system which innovates the limitation of conventional PV site. It enables the best use of land, tidal control, building eco-friendly environment and the increase of generation. (10% more)

In comparison with conventional mounting based-PV system, Floating PV system is so cost-effective that it makes the best use of high generation supported by cooling effect.

### Population Density of the World

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**Key Benefits of Floating PV System**

- **Conservation of Forest & Farmland**
  - No Deforestation Damage
  - By Green System

- **Use of Water Surface**
  - The Efficient Use of Land
  - By Eco-Friendly System

- **High Efficiency**
  - 10% Generation Increase
  - By Natural Cooling Effect

- **Preventing Green Tide**
  - Green Tide can be Controlled
  - By Blocking Sunlight

- **Saving the Water Resources**
  - Reducing Water Evaporation
  - By Blocking sunlight

- **Eco-friendly System**
  - Natural Fish Farms
  - Under the Floating Platform

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### Application of LSIS Floating PV System

<table>
<thead>
<tr>
<th>Contents</th>
<th>Structure Type</th>
<th>All-in-one Buoyancy Type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Concept Image</strong></td>
<td><img src="image1.png" alt="Concept Image" /></td>
<td><img src="image2.png" alt="All-in-one Buoyancy Type" /></td>
</tr>
<tr>
<td><strong>Features</strong></td>
<td>Easy to design for optimal PV module tilt</td>
<td>No need a platform design</td>
</tr>
<tr>
<td></td>
<td>Metallic Structure: Stable &amp; Excellent Strength</td>
<td>Easy to transport and fast to install</td>
</tr>
<tr>
<td></td>
<td>Buoyant Tank: Stable floating platform against a wind and a tide. Styrofoam inside that can maintain its buoyancy when it is broken</td>
<td>Cost effective</td>
</tr>
<tr>
<td><strong>Applicable Site</strong></td>
<td>A place that is around 40-50m water deep lake and has much water level fluctuation.</td>
<td>A place that is around 10-20m water deep such as a reservoir or a pond and had a little water level fluctuation</td>
</tr>
<tr>
<td><strong>Material</strong></td>
<td>Aluminum, Zinc, Magnesium alloy</td>
<td>HDPE (High Density Polyethylene)</td>
</tr>
<tr>
<td><strong>Period &amp; Workforce for Construction (1MW)</strong></td>
<td>Approximately 60 days (3 team, 10 people per team)</td>
<td>Approximately 50 days (3 team, 10 people per team)</td>
</tr>
<tr>
<td><strong>Site Image</strong></td>
<td><img src="image3.png" alt="Site Image 1" /></td>
<td><img src="image4.png" alt="Site Image 2" /></td>
</tr>
</tbody>
</table>

※ Period & Workforce for construction can be changed by field environment.
Floating PV System Design

System Benefits (Especially for All-in-one Buoyancy)

- **Optimization**
  - Optimal design reflecting wind speed and wave height

- **Durability**
  - Using HDPE, more durable than LDPE & LLDPE, powered by high ‘Molecular Mass’ and ‘Yield Strength’
  
  *HDPE: High Density Polyethylene
  *LDPE: Low Density Polyethylene
  *LLDPE: Linear Low Density Polyethylene

- **Eco-friendly**
  - Qualified floating equipment (received ‘Test Report’ by Korea Testing & Research Institute)
  - *Completion of Material & Hygiene Safety Verification Test* (Dec. 2013)
  - Compatible with Eco-environment ‘Water-floating PV Module’ (No leaching lead & aldehyde)

- **Safety**
  - Applying mooring gear & reliable structure suitable for site
  - Featured flooding prevention (inserting Expanded Polystyrene inside)

- **Easy for Installation-Carrying**
  - Available for carrying humanly
  - (PVF 300M: 18.5kg/PVF 300SL: 8.5kg/PVF 300SS: 3.3kg)
  - Easy to install by commercialized tools

- **Reliability (Supported by Patents and Guarantee)**
  - Increase reliability powered by Eco-environment ‘Water-floating PV Module’ (under free guarantee within 5 years)
  - Patent Application Completed (Domestic/Overseas)
  - *Republic of Korea (Dec 10, 2013)*
  - *Europe (Jan 9, 2014)*
  - *USA (Dec 31, 2013)*
  - *China (Jan 10, 2014)*
  - *Japan (Jan 10, 2014)*
  - *Singapore (Jan 6, 2014)*

Installation Condition (Especially for All-in-one Buoyancy)

- Water Depth: 1~20m (at least: 1m)
- Wind Speed (Average per year): ~5m/s (at most: ~30m/s)
- Wave Height (At most): 0.54m
- Temperature Range: -20~55℃
- Snow Load: 50kgf/m² (Dry Snow: 50cm, Wet Snow: 17cm)
- Space Requirement (1MW): 13,617 m²

*Note: Cable installation is subject to change under circumstances.*
Main Components of All-in-One Buoyancy System

1) All-in-one Buoyancy System Components

<table>
<thead>
<tr>
<th>Image</th>
<th>&lt;PVF 300M&gt;</th>
<th>&lt;PVF 300SS&gt;</th>
<th>&lt;PVF 300SL&gt;</th>
<th>&lt;PE bolt/nut&gt;</th>
<th>&lt;Clamp&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model Name</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material Weight/Boayancy</td>
<td>HDPE/18kg/210kgf</td>
<td>HDPE/3.3kg/30kgf</td>
<td>HDPE/8.5kg/80kgf</td>
<td>HDPE</td>
<td>Al</td>
</tr>
<tr>
<td>Size</td>
<td>1,508x1,132x470mm</td>
<td>646x586x225mm</td>
<td>646x1,520x225mm</td>
<td>M30</td>
<td>53.86x40x43.4mm</td>
</tr>
<tr>
<td>Function</td>
<td>For PV module installation</td>
<td>For maintenance</td>
<td>For maintenance</td>
<td>For unit combination</td>
<td>Fixing PV module</td>
</tr>
<tr>
<td>Characteristic</td>
<td>- Reliable floating units (Minimize flooding by inserting stuff material inside)</td>
<td>- Enhancing strength by applying HDPE / Gray-color (UV resistant) / Light and easy to install</td>
<td>- Optimized design considering ventilation &amp; prevention of declining PV generation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2) Water Floating PV Module

- Water Floating PV Module VS Normal PV Module

<table>
<thead>
<tr>
<th>Contents</th>
<th>Water Floating PV Module</th>
<th>Normal PV Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encapsulant Material</td>
<td>Specialized material</td>
<td>EVA</td>
</tr>
<tr>
<td>BUSBAR Material</td>
<td>Pb Free</td>
<td>Pb (including lead)</td>
</tr>
<tr>
<td>IP Class</td>
<td>IP67</td>
<td>IP64</td>
</tr>
<tr>
<td>Insulation Class</td>
<td>&gt;50MΩ</td>
<td>&gt;40MΩ</td>
</tr>
<tr>
<td>Presence of water-polluted material</td>
<td>None (passed by drinkability)</td>
<td>Aldehyde can be detected in EVA &amp; Busbar</td>
</tr>
<tr>
<td>Resistance for high temperature and humidity</td>
<td>High resistance</td>
<td>Low resistance</td>
</tr>
<tr>
<td>Damp Heat Test Result (5,000hr, 85% humidity, 85℃)</td>
<td>2~3% output decline</td>
<td>90% output decline</td>
</tr>
</tbody>
</table>

- Test Reports and Certificates of floating PV system (KTR, KTL, LSIS)

3) Inverter

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Capacity</th>
<th>EA</th>
</tr>
</thead>
<tbody>
<tr>
<td>500kW Photovoltaic Inverter</td>
<td>LSP-T500L</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DC Input</th>
<th>AC Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max.Power (kW)</td>
<td>550kW</td>
</tr>
<tr>
<td>MPPT Range</td>
<td>450~850V</td>
</tr>
<tr>
<td>Starting Voltage</td>
<td>450V</td>
</tr>
<tr>
<td>Max. Voltage</td>
<td>1,000V</td>
</tr>
<tr>
<td>Max. Current</td>
<td>1,222A</td>
</tr>
<tr>
<td>Size</td>
<td>W : 2,350mm / H : 2,074mm / D : 822mm</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-5~+40℃</td>
</tr>
<tr>
<td>Protection Degree</td>
<td>IP21</td>
</tr>
<tr>
<td>Communication Method</td>
<td>RS485</td>
</tr>
</tbody>
</table>

4) Mooring System

- Anchor: Supporting Floating PV system
- Mooring Bar: Dispersing heavy weight concentrating floating units
- Nylon rope: Supporting system by connection floating units and anchor
- Chain: Prevention for damage of mooring line
- Shackle: Connection component of mooring bar and line
- Swivel: Prevention for twisting of mooring line
2) System Overview

- Capacity: 1,004.4kW
- Main Equipment
  - Photovoltaic Module: Water-Floating system PV Module(310W)
  - PV Inverter: LSP-T500L
  - Monitoring Unit: LS Local Server, CCTV
  - Structural Equipment: All-in-one Buoyancy
- Requirement for grid-connection
  - Within 200m of intervals at interconnection grid.
- Space Requirement: Approximately 13,617 m²
Safety Instructions

• For your safety, please read user's manual thoroughly before operating.
• Contact the nearest authorized service facility for examination, repair, or adjustment.
• Please contact a qualified service technician when you need maintenance.
  Do not disassemble or repair by yourself!
• Any maintenance and inspection shall be performed by the personnel having expertise concerned.

Floating Photovoltaic System Demonstration Site,
Hapcheon Lake(2012)
LSIS Photovoltaic Module makes a difference

LSIS has been manufacturing photovoltaic modules for more than 30 years. We are confident that this history-based experience can provide convenience and efficiency to make the best use of building solar power system. LSIS PV modules are all made in Korea with assuring credibility and the highest quality.

Adaptable PV module on the WATER SURFACE
- Pb free module to prevent water pollution
- Enhanced resistance against humidity
- High protection grade : IP67 (IEC Standard grade : IP65)
- Enforced insulation strength (Higher than 50MΩ)

LSIS values 'PID Free'
Mega-Scale PV Plants can be easily exposed PID effects that can lead to or accelerate module degradation through multiple factors. LSIS provides reliable PID Free Module tested and guaranteed.

Plus Power Tolerance
LSIS delivers only reliable products
Within a nominal power output tolerance from 0 to 3%.

Warranty
10 years Product Warranty for Mechanical Defect
10 years for 91.5% Power Warranty
25 years for 83% Power Warranty

Proper module for total solution system
LSIS Power Testing & Technology institute is recognized as a testing and certification laboratory of KEMA (Inspection of Electrical Materials of Netherland), IEC, CE, CB and CESI. LSIS PV Module obtained certification TUV, JET, J-PEC.
### DESCRIPTION

#### MECHANICAL DATA
- **Cell Type**: Mono-Crystalline
- **Cell Dimensions**: 156.75 x 156.75 mm (6 inch)
- **Cell Quantity per Module**: 72 ea
- **Number of Busbar**: 3 ea
- **Dimensions [L x W x T]**: 1,960 x 985 x 40 mm
- **Weight**: 23 kg
- **Bypass Diodes**: 3 ea
- **Connection Type**: MC4 Compatible
- **Length of Cable**: 1,200 mm
- **Maximum Load**: 5,400 pa

#### ELECTRICAL DATA
- **Nominal Power (Pmax)**: 320 Wp, 330 Wp
- **Performance Tolerance**: 0 ~ +3%, 0 ~ +3%
- **Module Efficiency**: 16.58%, 17.09%
- **Open Circuit Voltage (Voc)**: 46.22 V, 46.36 V
- **Short Circuit Voltage (Isc)**: 8.97 A, 9.14 A
- **Voltage at Maximum-Power Point (Imp)**: 39.06 V, 39.15 V
- **Current at Maximum-Power Point (Imp)**: 8.21 A, 8.44 A
- **Temperature Coefficient (Isc)**: 0.0386 [% / °C]
- **Temperature Coefficient (Voc)**: -0.3906 [% / °C]
- **Temperature Coefficient (Pmax)**: -0.5657 [% / °C]
- **Maximum System Voltage**: 1,000 V
- **Maximum Rated Current of Diode**: 20 A
- **Over Current Protection Rating**: 12 A

#### CERTIFICATION AND WARRANTY
- **Certification**: KS, TUV Rheinland, CE
- **Product Warranty**: 10 years
- **Output Warranty**: 10 / 91.5 [years/%], 25 / 83 [years/%]

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