I. LS IS Photovoltaic Business
   I. New Start LS IS
   II. History and Achievements
   III. LS IS PV Business Frame

II. Why it has to be LSIS
   I. Stable Revenue Portfolio
   II. Total Solution Provider
   III. Quality Control System
   IV. Long-term Track Record

III. Various PV system solutions
   I. Mega Solar PV Plant
   II. Commercial/Residential PV system
   III. Water Floating System
   IV. Standard Off-grid System
   V. Photovoltaic Pump

IV. LSIS note
   i. News
   ii. Specification
   iii. Reference site
LS IS Photovoltaic Business

I. New Start LS IS
II. About LSIS
III. LS IS PV Business Frame
1. New Start LS IS

- Industrial Electric & Electronic
- Electronic & Chemical
- Construction Distribution Industry

SALES (unit: million dollars)

<table>
<thead>
<tr>
<th>Year</th>
<th>Sales (unit: million dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>'06</td>
<td>1,261</td>
</tr>
<tr>
<td>'07</td>
<td>1,392</td>
</tr>
<tr>
<td>'08</td>
<td>1,287</td>
</tr>
<tr>
<td>'09</td>
<td>1,133</td>
</tr>
<tr>
<td>'10</td>
<td>1,219</td>
</tr>
<tr>
<td>'11</td>
<td>1,280</td>
</tr>
</tbody>
</table>

Head Office in Korea

Meaning
- Industrial Systems
- Innovative Solution
- Infra Solution
- Intelligent Solution

CI

Signature
2. About LSIS

- **Leader in Power Solutions, Automation & Green Business**

<table>
<thead>
<tr>
<th>Company Name</th>
<th>LSIS Co., Ltd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vice-Chairman &amp; CEO</td>
<td>Ja-Kyun Koo</td>
</tr>
<tr>
<td>Founded</td>
<td>1974</td>
</tr>
<tr>
<td>Sales(2011)</td>
<td>1,402,034(million Won)</td>
</tr>
<tr>
<td>Employees</td>
<td>3,200</td>
</tr>
<tr>
<td>Headquarter</td>
<td>LS Tower, Anyang-si, Gyeonggi-do, Korea</td>
</tr>
<tr>
<td>Plants</td>
<td>Cheonju, Cheonan, Busan, Dalian, Wuxi, Hubei, Hanoi</td>
</tr>
<tr>
<td>Overseas subsidiaries</td>
<td>Shanghai, Dalian, Wuxi, Hubei, Dubai, Amsterdam, Tokyo, Chicago</td>
</tr>
<tr>
<td>Overseas branches</td>
<td>Shanghai, Beijing, Guangzhou, Qingdao, Chengdu, Shen Yang, Jinan, Tokyo, Hochiminh, Detroit, India</td>
</tr>
</tbody>
</table>
3. LS IS PV Business Frame

- PV modules, Inverters manufacturing

- Engineering / Feasibility Study

The solar installation in Bulgaria is very favorable (ranking the best in Europe) for the realization of solar plants. The territory of Bulgaria can be divided into three solar zones:
- Central and Eastern region: 1,200 kWh/m²/year
- Southeastern and Southern region: 1,250 kWh/m²/year
- Northern region: 1,150 kWh/m²/year

The photovoltaic power plant is based on the installation of 1,250 kWh/m²/year with an assumed performance factor of 0.78% (2020, 15 kWp, combined losses).
3. LS IS PV Business Frame

- Residential PV system

- PV System EPC work Solution (OFF-GRID & ON-GRID)
3. LS IS PV Business Frame

- Water floating PV system

- Special Purpose PV Solution (Solar pump)
Why it has to be LSIS

I. Stable Revenue Portfolio
II. Total Solution Provider
III. After Sales Service
IV. Long-term Track Record
I. Stable Revenue Portfolio

- LSIS has Sustainability Growth DNA with Strong Market Position Under Shaking Global Economy

Unstable Global PV Industry

ENF: Over 300 small Chinese solar companies stopped operating in 2012

ASP declines in 2012, driven by industry overcapacity throughout the PV supply chain, forced over 350 companies in China, from equipment suppliers, polysilicon producers to module manufacturers, to stop operations entirely, according to market research firm ENF.

ENF said that a significant influx of new entrants in 2011 led to the number of Chinese manufacturing companies directly involved in the PV industry increasing from 807 to 901.

However, in 2012 the number of companies exiting the sector due primarily to bankruptcy was close to 300, reducing the number of players to 704, according to ENF.

Solar Shakeout: Siliiken US subsidiaries file for bankruptcy

By Nilima Chowdhury - 05 January 2013, 11:14 | News

Two US-based subsidiaries of vertically integrated Spanish PV company Siliiken have filed for financial relief under Chapter 11 of the Bankruptcy Code. Siliiken Manufacturing USA and Siliiken USA filed petitions in the United States Bankruptcy Court for the Southern District of California. Chapter 11 offers a company the option to...

Solar Shakeout: 3S Soluciones announces bankruptcy

By Nilima Chowdhury - 03 October 2012, 06:46 | News

The bankruptcy of Spain-based 3S Soluciones has been announced in the Boletín Oficial del Estado (BOE) - the official gazette of the Spanish government. A resolution is yet to be made and no details of potential buyers have been released as yet. Proceedings will take place in Pamplona, Spain by...

Konarka Technologies GmbH files for bankruptcy

By Nilima Chowdhury - 03 July 2012, 16:40 | News

Following yesterday’s report that US-based Konarka Technologies is undergoing liquidation proceedings pursuant to Chapter 7 of the US Bankruptcy Code, it has now been announced that the thin-film company’s subsidiary in Germany has also filed for bankruptcy. Attorney Alexander Kabisch of national German insolvency administration firm CURATOR AG has been...
II. Total Solution Provider

1) LSIS Device coverage

[Extra-High Voltage]
- Power Transmission (more than 20kv) to substation
  - LBS : Open/Close Load Current
  - VCB : Main Circuit Breaker for Extra-high/High Voltage part

[Transformer, Low Voltage → Extra-High Voltage]
- Boost the 380 voltage of Low voltage to 20kV of Extra-high Voltage

[Low Voltage]
- ACB is the main Circuit breaker in Low Voltage
  - ACB : Circuit Breaker of under AC 600V Line, for under 8000A Rated Current
  - MCCB : Protect Low voltage inside Circuit under AC 600V or under DC 1000V

LSIS TOTAL SOLUTION, ALL PRODUCTS MANUFACTURED BY LSIS
LSIS offers the optimized service to customers through whole consulting process as below.

- Drawing up the budget
- Expecting effect of installation
- Optimal system suggestion
- Supporting the approval & authorization
- Designing electrical and civil work

- Suggestion for PV Module, BOS (Balance of System) & basic civil work
- Execution design
- Basic assessment of economy

- Manufacturing PV module, Inverter & Junction Box
- System test

- Trial Test
- Analyzing of the electric generation
- Assistance of the technical support
- Warranty

- Stabilization test of System
- Field Construction

II. Total Solution Provider

2) LSIS Solution coverage
III. After Sales Managing System

- LSIS has Special Organization only for after-sales service.

### Normal SI Companies Do

- Project Manager
- Electric Engineer
- Financial Manager
- Construction Engineer
- Procurement Manager
- Legal Adviser

### LSIS Do

- Handover Protocol
  - Supervisor Training
  - O&M Manual
  - Spare part preparation
- PM Monitoring
- After-sales service team
- Service claim via Internet /E-mail

#### Project Start

A site: Electric Engineer
B site: Project Manager
C site: Construction Engineer
D site: Financial Manager
E site: Procurement Manager
F site: Legal Adviser

#### Completion

- After completion
  - What if there is something wrong?
  - Who will charge After sales service?

#### Normal SI Companies Do

- Project Manager
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#### Completion

- After completion
  - What if there is something wrong?
  - Who will charge After sales service?

#### Normal Duration of After Sales Service

- “Less than a Week”
- The Day of Customer request After-sales Service at “Saturday”
- It’s only takes 3 days including Weekend.

---

Subject: Failure

Dear Mr. Kim,

Actually in this case you’d better replace failure inverters with spare inverters. Because of the logistical issue: do you want to leave the faulty inverter from Hanovo and the others faulty in Bezmere to make 2 shipment from Bezmere to RFPU?

Best regards,

Sung Hong Ryou CEO
www.anerbul.com
IV. Long-term Track Record

- In 1992, LSIS constructed 45kW PV power plant with 53W PV modules located in Pyoungsado, Korea. Those PV modules still have maintained over 85% power out as below.

Variation of PV Module Power

- 1992: 53W (100%)
- 2002: 48W (90.57%)
- 2012: 45.4W (85.6%)
IV. Long-term Track Record

2) LSIS System Reference

1986
Setting about the Photovoltaic Power System business

1989
Agreement contract with Korea Energy Management Corporation

1993
Localization of a photovoltaic power module (50kW class)

2001
Execution of study for BIPV

2007
Ewha womans univ. (BIPV Silicone Type)

2009
Lunched photovoltaic product in Japan (Certification: JET, J-PEC, J-MIC)

2014
Providing Total Solution with own photovoltaic products

2010 ~
LSIS’s PV SYSTEM in the World
- Japan, Austria, Greece,
- Bulgaria, Vietnam,
- Korea, Belgium

The first overseas exportation (Mongolia 200kW)
Development of BIPV module 180W module

Execution of study for BIPV
Research project on alternative energy

Setting about the Photovoltaic Power System business
Various PV System Solution

I. Mega Solar PV Plant
II. Commercial / Residential PV System
III. Water Floating System
IV. Standard Off-grid System
V. Photovoltaic Pump
I. Mega Solar PV Plant

- LSIS built 14.5MW PV plant in Bulgaria at August 2012

**LSIS completes solar plant in Bulgaria**

By Kim Yoo-chul

LSIS, the nation’s top supplier of industrial components, said Thursday that its massive solar plant in Bulgaria has been completed.

In a statement, LSIS said the brand-new facility, located in the Bulgarian city of Yambol, can produce 14.5 megawatts of solar electricity.

The plant will produce solar electricity for use in some 4,800 households per month, according to company spokesman Kim Bong-kyu.

LSIS formed a consortium with China’s CHINT group for the project and the Korean firm invested some 30 million euros or 44 billion won for the construction.
LSIS provides total solution for PV power plant not only PV materials but all kinds of electric power equipment.
II. Commercial/Residential PV System

- LSIS provides grid connected PV power system with all system equipment such as PV panel, PV inverter, connection box, monitoring system, metallic structure, etc.

**Applications**

- **Rooftop Arrays**
  - On Residential Buildings
- **Rooftop Arrays**
  - On Commercial & Industrial Buildings
- **Ground Mounted Installations**
II. Commercial/Residential PV System

- LSIS has major achievement for rooftop PV Home System Kit in Japan.

It is easy for you to install PV home system kit on your house.
II. Commercial/Residential PV System

LSIS Breaks into Japanese Solar Module Market

LS IS has become the first Korean firm delivering more than 80MW PV systems to Japanese market. LS IS will provide a whole PV Home System - modules, inverters, switch gear systems.

Every Single Month
More than 600 Home system Kit(4kW) in Japan
III. Water floating system

100KW, Hapchun Dam in Korea

500KW, Hapchun Dam in Korea
Part 3  III. Water floating system

- **Wet proof J-Box & Connector**
  - Wet proof specialized PV Module Junction Box
  - Humidity proof specialized PV Module Connector
  - Obtain high protection grade IP Grade 67

- **Corrosion-resisting, Wet proof Frame**
  - Wet humidity, Corrosion-resisting Anodizing
  - Design for reinforced anti-twist frame against wind pressure.

- **Humidity Proof Technology**
  - Block humidity off through back and side

- **Water Humidity Proof Technology**
  - Prevent short circuit, and grounding from water penetration to electrical point.

- **Insulation Technology**
  - Prevent electric leakage due to insulation resistance in moisture environment

- **Contamination Proof**
  - Prevent contamination of frontal glass

- **Corrosion Resisting and Structural Solidity Technology**
III. Water floating system

• **↓ Save Installation Cost**

HOW - by using public water surface installation

**NO** - land formation, construction, steel-frame structure.

• **↑ Increase Electricity generation (10% ↑)**

HOW - Natural cooling effect on water surface.

More than 10% additional power.

**NO** - Energy lost by heating
III. Water floating system
Off-grid system for various applications including local autonomous entities, households, schools, communication, cars, ships, military equipment, rural electricity, livestock industry, agriculture, rural development, street lamps, street stalls, leisure, events, etc.
## IV. Standard Off-grid System (Example)

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
<th>Supplier</th>
<th>Number</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV module</td>
<td>PVM S250</td>
<td>LSIS</td>
<td>72EA</td>
<td>250W X 3(Series) X 24(parallel) = 18KW</td>
</tr>
<tr>
<td>DC Charger</td>
<td>DC charger</td>
<td>LSIS</td>
<td>6EA</td>
<td>3kW</td>
</tr>
<tr>
<td>Island Inverter</td>
<td>Island inverter</td>
<td>LSIS</td>
<td>3EA</td>
<td>6kW</td>
</tr>
<tr>
<td>DC combiner box</td>
<td>DC combiner box</td>
<td>LSIS</td>
<td>6EA</td>
<td>4-IN &amp; 1-OUT</td>
</tr>
<tr>
<td>Bypass &amp; battery panel</td>
<td>Bypass panel, Battery panel</td>
<td>LSIS</td>
<td>3SET</td>
<td>Bypass</td>
</tr>
<tr>
<td>battery</td>
<td>Battery</td>
<td>LSIS</td>
<td>72EA</td>
<td>2V / 3000AH</td>
</tr>
<tr>
<td>Steel structure &amp; Installation</td>
<td>H or C shaped steel pile</td>
<td>Local</td>
<td>1set</td>
<td>MUST check the local regulation of Structure</td>
</tr>
<tr>
<td>Electric cable &amp; Electric Work</td>
<td>Grounding work, Connecting work (DC cables, AC cables, Modules, Inverters, Combiner boxes)</td>
<td>Local</td>
<td>1set</td>
<td>MUST check the local regulation of cabling work</td>
</tr>
<tr>
<td>Supervising</td>
<td>Technician’s supervising cost (For design, technical support, training, etc)</td>
<td>LSIS</td>
<td>1set</td>
<td>Airfare, Staying cost included</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Monitoring</td>
<td>solar monitoring</td>
<td>LSIS</td>
<td>1set</td>
<td>Web server for all solar school</td>
</tr>
<tr>
<td>Generator</td>
<td>generator</td>
<td>Local</td>
<td>1EA</td>
<td>20KW</td>
</tr>
</tbody>
</table>
This drawing is just reference drawing. It can be changed by local regulations or site situation.
V. Photovoltaic Pump

- Operating as much as solar power generation (Avg. 4 hours a day)
- Battery-less system (Compact and durable)
- Pumping of water from ponds and lakes remotely
- Off-Grid system: Installable anywhere

System Architecture

1. Dewatering pump: Maximum 50m
2. Deepwell Pump: Minimum 30m
LSIS Update

i. LSIS Award

ii. Exhibition

iii. LSIS Press
PHOTOVOLTAIC SYSTEMS

I. LSIS Award

4 DEC 2012

THOMSON REUTERS NAMES THE WORLD’S TOP 100 MOST INNOVATIVE ORGANIZATIONS FOR 2012

Top 100 organizations outperform the S&P 500 by 3 percent in market cap weighted revenue and add nearly 125,000 jobs

PHILADELPHIA, PA, (December 4, 2012) – The IP & Science business of Thomson Reuters, the world’s leading provider of intelligent information for businesses and professionals, today announced its 2012 Top 100 Global Innovators list, honoring 100 corporations and institutions around the world that are at the heart of innovation as measured by a series of proprietary patent-related metrics. The full report is available at http://www.top100innovators.com.

Financial analysis of the acknowledged companies gives credence to their significance in that these organizations outperformed the S&P 500 by three percent in their market cap weighted revenue (15 percent versus 12 percent). This year’s winners also added 124,214 new jobs over their prior year employment figures.

“Innovation is the foundation for economic prosperity and technological advancement,” said David Brown, managing director, Thomson Reuters IP Solutions. “Our Top 100 Global Innovator methodology demonstrates the insight that can be gleaned from the analysis of patent data and confirms the fact that companies focused on innovating drive growth and financial success.”

SOUTH KOREA

LSIS / Semiconductor & Electronic Components

Also known as LSIS, the company is a provider of power systems, automations, green car solutions, smart grid solutions, and photovoltaic systems.

DOWNLOAD THE FULL REPORT TO LEARN MORE
II. LSIS Exhibition
### Photovoltaic Module Long-term reliability Ranking

<table>
<thead>
<tr>
<th>Rank</th>
<th>Maker (origin)</th>
<th>Score</th>
<th>Track record</th>
<th>Durability</th>
<th>Product Warranty Condition</th>
<th>Third party Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Over 20 years</td>
<td>Thermal cycle</td>
<td>Dump heat</td>
<td>Product</td>
</tr>
<tr>
<td>1</td>
<td>Solarworld (Germany)</td>
<td>25</td>
<td>8</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Suntech (China)</td>
<td>22</td>
<td>8</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>LSIS (Korea)</td>
<td>21</td>
<td>8</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Panasonic (Japan)</td>
<td>17</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Mitsubishi (Japan)</td>
<td>17</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Yingli (China)</td>
<td>17</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>
Leading Solution, LS
Always with Our Customers, LS
Green Innovators of Innovation, LSIS

Thank You