

## **APPENDICES**

# Appendix A. Renewable Energy Manufacturers

## Top Ten Global Wind Energy Equipment Manufacturing Firms (based upon 2005 Market Share)

### 1 – Vestas<sup>11</sup>

- Headquarters: Denmark
  - Began manufacturing wind turbines in 1979, exclusively in wind energy since 1987
  - Production facilities in Denmark, Germany, India, Italy, Scotland, England, Spain, Sweden, Norway, Australia, and China
  - Acquired NEG Micon in 2004
  - Decreasing sales in Germany and North America; increasing Southern Europe, Oceania, and Asia
- Revenue/Size
  - 11,200 employees (June 2006)
  - Global market share of 35%; US market share of 28%
  - 204 MW delivered to North America in 2004; down 62% from 2003
  - Approximately 40,000 MW installed wind capacity

### 2 – GE Wind<sup>78</sup> (subsidiary of GE Industries)

- Headquarters: Atlanta, GA, United States
  - Major facilities in: Atlanta, GA; Greenville, SC; Houston, TX; Melbourne and Pensacola, FL; San Jose, CA; Schenectady, NY; Tehachapi, CA; Wilmington, NC; France; Italy; Hungary; Norway, Quebec; Germany
  - Vertically integrated wind turbine production, though heavily diversified beyond wind turbine manufacturing
- Revenue/Size (reflects GE Energy subsidiary totals – engaged in conventional equipment manufacturing in addition to wind)
  - \$16.5 billion in 2005
  - ~34,000 employees

### 3 – Enercon Gmbh<sup>79</sup>

- Headquarters: Aurich, Germany
  - Production facilities in: Turkey, Brazil, Sweden, India and three in Germany
  - Founded in 1984, and has retained ownership through the last 20 years (no major acquisitions)
  - Works exclusively in the wind sector; in-house production of most components(produce blades, turbines, towers)

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<sup>78</sup> GE Power Fact sheet: [http://www.gepower.com/about/info/en/downloads/05\\_fact\\_sheet\\_global.pdf](http://www.gepower.com/about/info/en/downloads/05_fact_sheet_global.pdf)

<sup>79</sup> Enercon Gmbh website: Facts and Figures: <http://www.enercon.de/en/home.htm>

- Revenue/ Size: 3<sup>rd</sup> largest by sales in 2005, 2<sup>nd</sup> largest amount of installed MW globally
  - \$88,100,000 annual sales<sup>80</sup>
  - 8,186 employees globally
  - 13.2% of global market share for sales in 2005
  - 10,200 MW installed wind capacity

#### 4 – Gamesa<sup>81</sup>

- Headquarters: Spain
  - Gamesa’s renewable energy segment makes wind turbines and operates wind farms. The company has sold many of its wind farms in Europe to Electrabel.
- Revenue/ Size: 4<sup>th</sup> in installed MW globally in 2005
  - 1,745,000 Euros Revenue in 2005
  - 8,186 employees
  - Has experienced positive growth in both sales and employment in the last year.
  - Gamesa Wind US carries out the manufacturing, sales and operation and maintenance of Gamesa’s wind turbines in the USA as well as in Canada

#### 5 – Suzlon

- Headquarters: Pune, India
  - Production facilities in India and the United States (explicitly stated to meet North American demand<sup>82</sup>), China and Belgium; Engineering R&D HQ in Germany, Blade R&D HQ in Netherlands, Global Expansion HQ in Denmark.
  - Founded in 1995, private equity placement in 2004, acquired Hansen in 2006.
  - Works exclusively in the wind sector
  - Vertically integrated: manufacturing of generators, towers, control systems (India), gearboxes (Hansen Transmissions - Belgium), and blades (India, US, China).
  - Provide services from project development, manufacturing, installation and service operation.
- Revenue/ Size: 5<sup>th</sup> largest by sales in 2005, 5<sup>th</sup> in installed MW globally
  - \$854,000,000 sales<sup>83</sup>
  - 5,300 employees globally (8,600 reported to investors 10/2006<sup>84</sup>)
  - 6.1% of global market share for sales in 2005
  - 4,253 MW installed wind capacity

<sup>80</sup> Hoovers:

<http://premium.hoovers.com.ezaccess.libraries.psu.edu/subscribe/basic/factsheet.xhtml?ID=yryykrkct>

<sup>81</sup> Gamesa Corporation Annual Report 2005:

<http://www.gamesa.es/gamesa/modules/idealportal/uploadlink/memoria2005ing.pdf>

<sup>82</sup> <http://www.suzlon.com/locations.htm>

<sup>83</sup> <http://www.suzlon.com/Investors%20Presentation.pdf>

<sup>84</sup> <http://www.suzlon.com/Investors%20Presentation.pdf>

## 6 – Siemens<sup>85</sup>

- Headquarters: Germany
  - Company not limited to wind; involved in automation products, controls, drives, instruments, and power distribution products
  - Acquired Bonus Energy A/S in Dec. 2004
- Revenue/Size
  - 5,800 installed turbines
  - 4,498 installed MW (of which 1400 MW are installed in Germany)
  - Net Sales of Siemens Power Generation 8,061 million Euro
  - 33,000 employees

## 7 – RePower Systems<sup>86</sup>

- Headquarters: Germany
- Revenue/Size: 7<sup>th</sup> largest by sales in 2005
  - 2004 Sales of \$411.1 (mil)<sup>R2</sup> [Positive growth in sales & employment]
  - 583 employees.

## 8 – Nordex<sup>87</sup>

- Headquarters: Norderstedt, Germany
  - Production Facilities: Germany, China
- Revenue/Size: 8<sup>th</sup> largest by sales in 2005
  - 308,000,000 Euro in 2005 - Turnover
  - 730 employees

## 9 – Ecotecnia<sup>88</sup>

- Headquarters: Spain
  - Production facilities: Spain
  - Founded in 1981; Acquired by Mondragon Corporation 1999 (the 7th largest business group in Spain, the world's largest worker cooperative owning 260 widely diverse companies (financial services, automotive, capital goods, construction, household goods, etc.)
  - Manufacturing in wind and solar sector, project development and construction
- Revenue/ Size: 9<sup>th</sup> largest by sales in 2005
  - 183, 000,000 Euros annual sales in 2005
  - 680 employees

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<sup>85</sup> Siemens website: [www.powergeneration.siemens.com/en/windpower/index.cfm](http://www.powergeneration.siemens.com/en/windpower/index.cfm)

<sup>86</sup> Repower Systems, Global Perspectives, Annual Report 2005.

<http://www.repower.de/index.php?id=372&L=1>

<sup>87</sup> Nordex website: Key Figures and Facts: <http://www.nordex-online.com/en/company-career-career/key-figures-and-facts.html>

<sup>88</sup> Mondragon Annual Report: <http://www.mcc.es/ing/magnitudes/memoria2005.pdf>

- 2.1% of global market share for sales in 2005
- 948 MW installed wind capacity

## 10 – Mitsubishi Power Systems

- Headquarters: Tokyo, Japan (parent) MPS HQ in Lake Mary, FL
  - Production facility in Lake Mary, FL
  - Subsidiary of Mitsubishi Heavy Industries: Work in many sectors of heavy industry, also in other power sectors: including gas, steam, geothermal, combined cycle power production.
  - In house production of turbines (Japan, US), joint venture with TPI Composites (US) to produce blades in Juarez, Mexico (formed “Vien Tek” in joint venture)<sup>89</sup>
  - Provides services including project management and design construction for power plants.
- Revenue/ Size: 10<sup>th</sup> largest by sales in 2005
  - \$319,600,000 annual sales<sup>90</sup>, including all other turbines manufactured in US facility
  - 2% of global market share for sales in 2005
  - 558 MW installed wind capacity

**Others** - BTM Consultants highlight two emerging companies as holding significant promise in coming years, the Chinese firm Goldwind and the Indian firm NPEC.<sup>91</sup> Other wind energy companies producing large wind turbines include winWind based in Finland and Fuhrlander based in Germany.

## Wind Energy Components Suppliers

**LM Glasfiber Group:** Largest Wind Turbine Blade Manufacturer in the world

HQ: Denmark

- Production Facility in South Dakota
- \$24,100,000 Revenue<sup>92</sup>
- Operating profit (EBIT) fell 6% from DKK 95 million to DKK 89 million. The lower profit is due in part to a greater proportion of sales in USD in H1 2005. This adversely impacted LM GlasFiber is still not able to procure all raw materials and components locally in USD. The other reason for the lower profit is raising prices of composite

<sup>89</sup> [http://www.mpshq.com/medialine\\_index.htm#news](http://www.mpshq.com/medialine_index.htm#news)

<sup>90</sup> Hoovers Online:

<http://premium.hoovers.com.ezaccess.libraries.psu.edu/subscribe/co/factsheet.xhtml?ID=rrrkfhftkstkshx>

<sup>91</sup> BTM Consult ApS: International Wind Energy Development World Market Update 2005 Forecast 2006-2010, Press Release: <http://www.btm.dk/Pages/wmu.htm>

<sup>92</sup> Hoovers Online:

<http://premium.hoovers.com.ezaccess.libraries.psu.edu/subscribe/basic/factsheet.xhtml?ID=ycrtyxcsj>

materials such as resin, carbon fibers and core materials (excerpt directly from NetComposites Website).<sup>93</sup>

**Hansen Transmissions** (acquired by Suzlon Wind)

Headquarters: Antwerp, Belgium  
○ Production Facilities: Belgium  
Leading gear manufacturer  
Acquired by Suzlon Energy

**Marlec Engineering Co LTD**<sup>94</sup>

Headquarters: Corby Northants, UK  
Component: Balance of System, Batteries, Small Wind Applications

**MG srl**<sup>95</sup>

Headquarters: Fossano, Italy  
Component: Manufacturer of plate bending machines for the construction of wind towers.

**Greenworld**<sup>96</sup>

Headquarters: Varna, Bulgaria  
Component: wind turbines (large), wind energy towers and structures (large), wind energy systems (large).

**Nascom**

Headquarters: Sindh Pakistan  
Component: Utility Grade (Large) Wind Towers

**Domestic Wind Power Manufacturers**

**Clipper Windpower**<sup>97</sup>

Headquarters: Carpentaria, CA  
○ Production facilities: California, Iowa  
○ Clipper Windpower is a conglomeration of subsidiaries formed in 2001 (first public offering in the European Alternative Investment Market in 2005), a vertically integrated company providing turbines primarily for the domestic market

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<sup>93</sup> Net Composites: <http://www.netcomposites.com/news.asp?3249>

<sup>94</sup> Energy Source Guides Wind Energy Wholesale Suppliers  
<http://energy.sourceguides.com/businesses/byP/wRP/byB/wholesale/byN/byName.shtml>

<sup>95</sup> Energy Source Guides Wind Energy Wholesale Suppliers  
<http://energy.sourceguides.com/businesses/byP/wRP/byB/wholesale/byN/byName.shtml>

<sup>96</sup> *Ibid*

<sup>97</sup> Clipper Windpower Plc 2005 Annual Report:  
[http://www.clipperwind.com/pdfs/2005\\_annual\\_report\\_web.pdf](http://www.clipperwind.com/pdfs/2005_annual_report_web.pdf)

- Clipper currently offers the largest turbine (2.5 MW) manufactured in North America
- Looking to expand into the European and Latin American markets

Revenue/ Size:

- \$15.9 million USD<sup>98</sup> (Clipper Windpower Plc actually posted a significant reduction in turnover revenue in 2005 of only \$2.7 million as a result of the selling off of large production facilities, Clipper posted a net loss for 2005 of \$ 19 million as a result of lower turnover and subsequent large capital investments in increased manufacturing capacity)<sup>99</sup>
- 127 employees

### **Trinity Structural Towers<sup>100</sup>**

Headquarters: Dallas, TX

- Subsidiary of Trinity Industries

One of largest producers of wind towers in North America

- 12.1 million in sales
- 160 employees

Also involved in turbine components, concrete and aggregates, product transportation and specialized coatings

Builds turbines as large as 2.5 MW

### **Wind Components Manufacturers in ARC Member States<sup>101</sup>**

#### **Maryland Wind Components Manufacturers<sup>102</sup>:**

Fibox, Inc.

Headquarters: Glen Burnie, MD

Component: Nema 4x non-metallic enclosures

#### **New York Wind Components Manufacturers<sup>103</sup>:**

GE Energy.

Headquarters: Schenectady, NY

Component: large wind turbines (1.500 - 3.600 kW), utility-scale wind turbine generators.

<sup>98</sup> Hoovers Online: Clipper Windpower Inc Information:

<http://premium.hoovers.com/subscribe/basic/factsheet.xhtml?ID=yCHFtrhx>

<sup>99</sup> Clipper Windpower Plc 2005 Annual Report:

[http://www.clipperwind.com/pdfs/2005\\_annual\\_report\\_web.pdf](http://www.clipperwind.com/pdfs/2005_annual_report_web.pdf)

<sup>100</sup> [www.trinitytowers.com](http://www.trinitytowers.com)

<sup>101</sup> These establishments are located within ARC member states, but are not necessarily located within the ARC's jurisdiction.

<sup>102</sup> Renewable Energy Source Guides, Large Wind Components Manufacturers:

<http://energy.sourceguides.com/businesses/byGeo/US/byP/wRP/lwindcomp/byS/WI/WI.shtml>

<sup>103</sup> Renewable Energy Source Guides, Large Wind Components Manufacturers:

<http://energy.sourceguides.com/businesses/byGeo/US/byP/wRP/lwindcomp/byS/WI/WI.shtml>

**Pennsylvania Wind Components Manufacturers<sup>104</sup>:**

Motors & Controls International

Headquarters: Hazleton, PA

Component: wind energy system Inverters (large), Variable Speed Generators (VSG)

SunEnergy Tehnologies, Inc.

Headquarters: Philadelphia, PA

Component: wind energy system components

**Ohio Wind Components Manufacturers<sup>105</sup>:**

Canton Drop Forge

Headquarters: Canton, OH

Component: wind energy system components (large)

Engineering Methods, Inc

Headquarters: Cincinnati , OH

Component: Engineering Software, FEA & Engineering Design Services and Consulting

Michael Byrne Manufacturing, Inc

Headquarters: Mansfield , OH

Component: wind energy system components (large)

Molded Fiberglass Company

Headquarters: Ashtabula, OH

Component: wind energy system components (large), large wind turbine rotor blades 20 meters and longer

National Electric Coil

Headquarters: Columbus, OH

Component: Windings for any generator above 1 MW, driven by any fuel or turbine type

Parker Hannifin Corporation

Headquarters: Cleveland, OH

Component: wind energy system components (large), hydraulic systems for large wind turbines, motion and control systems for large wind turbines

**Tennessee Wind Components Manufacturers<sup>106</sup>:**

Thomas & Betts Corporation

Headquarters: Memphis, TN

Component: wind energy system components (large), wind energy towers and structures (large), wind turbine support structures, lattice steel towers, tubular steel towers.

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<sup>104</sup> Renewable Energy Source Guides, Large Wind Components Manufacturers:

<http://energy.sourceguides.com/businesses/byGeo/US/byP/wRP/lwindcomp/byS/WI/WI.shtml>

<sup>105</sup> Renewable Energy Source Guides, Large Wind Components Manufacturers:

<http://energy.sourceguides.com/businesses/byGeo/US/byP/wRP/lwindcomp/byS/WI/WI.shtml>

<sup>106</sup> Renewable Energy Source Guides, Large Wind Components Manufacturers:

<http://energy.sourceguides.com/businesses/byGeo/US/byP/wRP/lwindcomp/byS/WI/WI.shtml>

**Virginia Wind Components Manufacturers<sup>107</sup>:**

Fiber Technology Corporation  
Headquarters: Lorton, VA  
Component: wind energy system components (large)

**Wind Components Manufacturers – U.S. Other**

**California Wind Components Manufacturers<sup>108</sup>:**

Access Energy  
Headquarters: Beverly Hills, CA  
Component: wind energy system components (large), wind energy systems (large), back up systems, distributed energy systems, solar cells, wind farm, Hydrogen and bio-ethanol systems.

Dutch Pacific, LLC  
Headquarters: Westlake Village, CA  
Component: wind turbines (large).

RLH Industries, Inc.  
Headquarters: Orange, CA  
Component: wind turbines (large)

Solera Industries, Inc.  
Headquarters: Morgan Hill, CA  
Component: wind energy system components (large)

Thelen, Reid & Priest, Inc.  
Headquarters: San Francisco, CA  
Component: all system components (large)

Wind Energy Conversion Systems  
Headquarters: North Palm Springs, CA  
Component: Electrical distributor Wind energy Specialty

WindTesting.com  
Headquarters: Tehachapi, CA  
Component: wind energy system components (large), wind energy system components (small), wind turbines (large), wind turbines (small), wind energy systems (large)

Wind Energy Company  
Headquarters: Lancaster , CA  
Component: wind energy system components (large)

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<sup>107</sup> Renewable Energy Source Guides, Large Wind Components Manufacturers:  
<http://energy.sourceguides.com/businesses/byGeo/US/byP/wRP/lwindcomp/byS/WI/WI.shtml>

<sup>108</sup> Renewable Energy Source Guides, Large Wind Components Manufacturers:  
<http://energy.sourceguides.com/businesses/byGeo/US/byP/wRP/lwindcomp/byS/WI/WI.shtml>

### **Texas Wind Components Manufacturers<sup>109</sup>**

Nicholson-Paige Electric

Headquarters: Ransom Canyon, TX

Component: submersible pump wire and specialized cable, wind energy system components (large)

Trinity Structural Towers

Headquarters: Fort Worth, TX

Component: wind energy system components (large), wind energy towers and structures (large)

Barr Fabrication, LLC

Headquarters: Brownwood, TX

Component: wind energy towers and structures (large), wind energy system components (large)

### **Washington Wind Components Manufacturers<sup>110</sup>**

Global Energy Concepts, LLC

Headquarters: Kirkland, WA

Component: wind energy systems (large), wind energy systems (small), wind turbines (large), wind turbines (small), wind energy system components (large), wind energy system components (small), All aspects of wind energy)

Spin Trends, LLC

Headquarters: Walla Walla, WA

Component: Condition Monitoring and assessment of Bearings, gears and critical components of: wind power plants, wind energy system components (large)

Toray Composites (America), Inc

Headquarters: Tacoma, WA

Component: , wind energy system components (large)

### **Wisconsin Wind Components Manufacturers<sup>111</sup>**

Powertrain Engineers

Headquarters: Pewaukee, WI

Component: wind energy system components, wind energy systems (large)

Tower Tech Systems, Inc.

Headquarters: Manitowoc, WI

Component: wind energy towers and structures (large), wind turbines (large), wind energy system components

### **Florida Wind Components Manufacturers<sup>112</sup>**

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<sup>109</sup> Renewable Energy Source Guides, Large Wind Components Manufacturers:

<http://energy.sourceguides.com/businesses/byGeo/US/byP/wRP/lwindcomp/byS/WI/WI.shtml>

<sup>110</sup> Renewable Energy Source Guides, Large Wind Components Manufacturers:

<http://energy.sourceguides.com/businesses/byGeo/US/byP/wRP/lwindcomp/byS/WI/WI.shtml>

<sup>111</sup> Renewable Energy Source Guides, Large Wind Components Manufacturers:

<http://energy.sourceguides.com/businesses/byGeo/US/byP/wRP/lwindcomp/byS/WI/WI.shtml>

American Wire Group

Headquarters: , Hallandale, FL

Component: wind energy system components

USA Solar & Wind, Inc.

Headquarters: Tallahassee , FL

Component: wind energy system components, , wind power plants, wind energy towers and structures (large)

ElectricPowerforless.biz

Headquarters: Jacksonville Beach, FL

Component: wind energy system components

**Idaho Wind Components Manufacturers<sup>113</sup>**

Windland, Inc

Headquarters: Boise, ID

Component: refurbished wind turbines

Windpower Unlimited, LLC

Headquarters: Filer, ID

Component: wind energy system components

**Michigan Wind Components Manufacturers<sup>114</sup>:**

Citation Corporation

Headquarters: Novi, MI

Component: wind energy system components, wind power components from ductile iron, blade extenders, hubs, tower flanges and frame components

Danotec Motion Technologies, LLC

Headquarters: Ann Arbor, MI

Component: wind energy system components, Variable Speed Brushless Motors

K & M Machine Fabrication, Inc

Headquarters: Cassopolis, MI

Component: wind fabricated structures (large), wind energy system components (large), bedplates, hubs and gear boxes

**Minnesota Wind Components Manufacturers<sup>115</sup>**

SMI and Hydraulics

Headquarters: Porter, MN

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<sup>112</sup> Renewable Energy Source Guides, Large Wind Components Manufacturers:

<http://energy.sourceguides.com/businesses/byGeo/US/byP/wRP/lwindcomp/byS/WI/WI.shtml>

<sup>113</sup> Renewable Energy Source Guides, Large Wind Components Manufacturers:

<http://energy.sourceguides.com/businesses/byGeo/US/byP/wRP/lwindcomp/byS/WI/WI.shtml>

<sup>114</sup> Renewable Energy Source Guides, Large Wind Components Manufacturers:

<http://energy.sourceguides.com/businesses/byGeo/US/byP/wRP/lwindcomp/byS/WI/WI.shtml>

<sup>115</sup> Renewable Energy Source Guides, Large Wind Components Manufacturers:

<http://energy.sourceguides.com/businesses/byGeo/US/byP/wRP/lwindcomp/byS/WI/WI.shtml>

Component: wind energy system components (large), wind energy towers and structures Wind Tower Footing Material, Anchor Bolts, Imbed Rings and Rebar.

### **Montana Wind Components Manufacturers<sup>116</sup>**

LineHaul Logistics, Inc

Headquarters: Missoula, MT

Component: wind energy system components (large), wind turbines

Planetary Systems, Inc

Headquarters: , Ennis, MT

Component: wind energy system components

### **Solar PV Manufacturers**

*The following information was gathered from a base of Corporate Annual Reports and from resources such as Hoovers Online.*

Kyocera<sup>117</sup>

Head Quarters- Kyoto, Japan

US Division- Scottsdale, AZ

Total Revenue \$- 10,098,000

US/ Solar Revenue\$- '06 \$117mm product group containing solar cells

Employees- 58,559

Components/NAICS- PV cells (335311, 42172, 333611)

Products- Solar & Hybrid Power Systems, Solar Panels, Solar Water Pumping, Solar Modules, Investors, Controllers, Batteries, Solar Electricity, Solar Power Solar, Wind Turbine, Solar Company

US Manufacturing- None

Sharp<sup>118</sup>

Head Quarters- Osaka, Japan

US Division- Mawah, NJ

Total Revenue \$- 24,113 mm

US/ Solar Revenue\$- 291billion (total for groupings of “other electronics”)

Employees- 46,741 – 54,900

Components/NAICS- PV cells, Inverters

US Manufacturing- Memphis, Tennessee

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<sup>116</sup> Renewable Energy Source Guides, Large Wind Components Manufacturers:

<http://energy.sourceguides.com/businesses/byGeo/US/byP/wRP/lwindcomp/byS/WI/WI.shtml>

<sup>117</sup> Hoovers Online:

<http://premium.hoovers.com.ezaccess.libraries.psu.edu/subscribe/co/factsheet.xhtml?ID=ffffcrxktjsfhkjt&ticker=KYO>

<sup>118</sup> Hoovers Online:

<http://premium.hoovers.com.ezaccess.libraries.psu.edu/subscribe/co/factsheet.xhtml?ID=ffffcrxhjsfhyjsth>

## Solar World

Head Quarters- Bonn, Germany

US Division- Camarillo, CA

Total Revenue \$- 272.7mm

US/ Solar Revenue\$- 26.9mm

Employees- 616

Components/NAICS- PV cells, Solar film, inverters, Batteries

2006 acquisition of Shell Solar (100% of crystalline solar activities of the shell group.) With this merger, SolarWorld will be the largest US producer of solar products. SolarWorld parent company, Duetchse Solar AG, has signed a 10 year silicon wafer agreement with Suntech China's #1 solar company and number 8 globally. SolarWorld is both a customer and competitor of Suntech.

## Conergy<sup>119</sup>

Head Quarters- Hamburg, Germany

US Division- Santa Fe, NM

Total Revenue - \$629,000,000 sales in 2005

US/ Solar Revenue: \$ 25mm

Employees- 724

Components/NAICS- PV Cells, Inverters

Products- The company makes components such as photovoltaic modules, mounting systems, and both off-grid and grid-connected inverters. It also makes solar collectors, control units, pumps, storage tanks, and other solar thermal products

US Manufacturing- None

50/50/08 plan: 50% rev abroad, 50% renewable. This comment is a "Strategy/Vision" and illustrates the desire of Conergy to grow abroad, especially in the US. '08: Voltwerk, PA location is a channel for distribution. This shows an interest in locating facilities in the US and this is location is an ARC county; R&D and engineering potential.

#2 worldwide sales (#1 Germany) this is the companies own statement

Built largest solar plant = 10MW

Conergy is one of Suntech's largest customers

## Sanyo

Head Quarters-Osaka, Japan

US Division- San Diego, CA, and Detroit, MI

Total Revenue: \$21,804 mm

US/ Solar Revenue \$- Semiconductor Branch in Saddle Brooke NJ, 75.7MM

Employees- 106,389

US Manufacturing- San Diego, CA Detroit, Michigan

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<sup>119</sup> Hoovers Online:

<http://premium.hoovers.com.ezaccess.libraries.psu.edu/subscribe/co/factsheet.xhtml?ID=rysyrsyrjryjfy>

In 1994 Sanyo "combined forces" with Soltec, a solar PV cell company since the '70s. Demonstration of large firms gaining markets through acquisition.

#### SunPower

Head Quarters- Sunnyvale, CA

US Division- Sunnyvale, CA

Total Revenue \$- 65.3 MM (the third quarter ended September 30, 2006 was \$65.3 million, up 19% from the prior quarter's revenue of \$54.7 million and up 198% from the third quarter 2005 revenue of \$21.9 million.)

Employees- 788 (1yr growth 89.4%)

Components/NAICS- A-300, SPR series and STM series, solar cells and panels

In 2002, Cypress Semiconductor company purchased a majority interest in SunPower and subsequently funded much of the mass production for A-300 solar cells (press release 10/18/06); For the year 2007, the contract calls for SunPower to purchase approximately \$20 million of silicon ingots from REC SciTech. This contract builds on previous ingot supply agreements and purchase orders between the two companies. SunPower's silicon supply for 2007 remains sufficient to produce 110 megawatts of cell production.

#### Matrix Solar

Head Quarters- Albuquerque NM

US Division- Albuquerque NM

Total Revenue \$- 52.5mm

Employees- 300

Components/NAICS- Assembles Solar PV Modules

Parent Company Automation Tooling Systems (ATS) (largest Turn Key based in Canada)

Matrix subsidiary Photowatt International Europe PV cell manufacturer.

#### Evergreen Solar

Head Quarters- Marlboro, MA

US Division- Marlboro, MA

Total Revenue: \$36 MM (87% growth)

US/ Solar Revenue: \$ 90% of sales

Employees- 290 (16% growth)

Components/NAICS- String ribbon wafer technology (develops and manufactures solar power cells and panels.)

#### Spire Solar

Head Quarters- Bedford, MA

US Division- Bedford, MA

Total Revenue: \$22.4 mm

US/ Solar Revenue: \$\*0.3MM

Employees- 118

Components/NAICS- Solar Manufacturing equipment, Turnkey production lines, wafer and module systems/installation  
Company press release states that 3rd quarter sales increase is due to increase in solar cell production and manufacturing base sales

EPV (Energy Photovoltaic Inc.)

Head Quarters- Lawrenceville, NJ  
US Division- Lawrenceville, NJ  
US/ Solar Revenue\$- 1mm  
Employees- 50

InnovaLight

Head Quarters- Santa Clara, CA  
US Division- Santa Clara, CA  
Total Revenue \$- 1.5mm  
US/ Solar Revenue\$- 1.5mm  
Employees- 15  
Components/NAICS- Ultra thin silicon PV, very flexible and can capture new UV wave levels

GreenMountain Engineering

Head Quarters- San Francisco, CA  
US Division- San Francisco, CA  
US/ Solar Revenue: \$0.3mm  
Employees- 20  
Components/NAICS- raw material production (LLC).(541330)

UniSource Energy

Head Quarters- Tucson, AZ  
US Division- Tucson, AZ  
Total Revenue \$- 1,229.5MM  
Employees- 1,947  
Components/NAICS- Electric Power Transmission, Control, and Distribution  
US Manufacturing-  
Sold its Global Solar Energy (subsidiary) in 2006 to Solon AG for 16MM.  
UniSource gains most of its revenue from utility subsidiaries.

MEMC Electronic Materials

Head Quarters- St. Peters MO  
US Division- St. Peters MO  
Total Revenue \$- 1107.4mm  
US/ Solar Revenue\$- 10% polysilicon  
Employees- 5,500

Components/NAICS- Makes silicon wafers, and also solar grade polysilicon for PV cells

US Manufacturing- Hillsborough MT, San Jose CA, Maryland Heights MT

Largest customer is Samsung Electronics, which also includes Texas Instruments.

### Konarka

Head Quarters- Lowell, MA

US Division- Lowell, MA

Total Revenue \$- .5mm (2003)

US/ Solar Revenue\$- .5mm (2003)

Employees-

Components/NAICS- OV cells, thin converters

Founded 2001, former military project, this company has over 200 global patents. Like Innovalight, their cells can capture energy from all light sources not just visible.

### BP Solar

Head Quarters- London, England

US Division- Frederick, MD

Total Revenue: \$245,486 mm

Employees- >106,000

Components/NAICS- BP solar manufactures cells, wafers, and complete systems - starting to sell ready to install PV modules at Home Depot.

BP has recently allocated 1.6 Billion dollars to an alternative energy campaign. This includes solar wind and biofuels. However, 1.6 billion is more than most other solar companies have even accounted for in sales.

### Suntech Power Holdings, Co. Ltd

Head Quarters- Jiangsu, China

Total Revenue: \$226 mm

Employees- 1374

Components/NAICS- PV sells and solar electric systems for both on and off grid

Suntech is the number eight company in the world and the leader in China.

They have recently purchased MSK corp. of Japan. This acquisition will gain them access to the difficult-to-enter Japanese solar market. The company has also signed 10-year silicon wafer cell agreements with both SolarWorld and MEMC

### Photowatt (Part of ATS Automation—Acquired by Matrix Solar in 1997)

Head Quarters- France, Cambridge, Canada

Total Revenue: \$121.9 mm

US/ Solar Revenue: \$121.9 mm

Employees- 711  
Components/NAICS- photovoltaic, solar energy, products including installation kits and solar power system designs

#### Q Cells

Head Quarters- Thalheim, Germany  
Total Revenue: \$351mm  
US/ Solar Revenue: \$351MM  
Employees- 500  
Components/NAICS- PV Cells

#### BTU International

Head Quarters- N. Billerica, MA  
US Division- N. Billerica, MA.  
Total Revenue \$- 66.4mm  
US/ Solar Revenue\$- 66.4mm  
Employees- 177  
Components/NAICS- supplier of semiconductor wafers for solar and thermal process equipment  
In 2006, purchased RTC Radiant Technology corp. which adds a new line for furnaces used in the manufacturing of photovoltaic systems

#### Advanced Silicon /REC

Head Quarters- Silver Bell, MT  
US Division- Silver Bell, MT  
Total Revenue \$- 89.6mm  
US/ Solar Revenue\$- 89.6mm  
Employees- 410  
Components/NAICS- produces polycrystalline silicon not a PV maker  
US Manufacturing- Washington  
Norway's Renewable Energy Corporation (REC) now has a 75% stock in advanced silicon

Thirteen additional solar energy materials suppliers were located abroad with facilities in the following countries: United Kingdom (3), Japan (2), Italy (1), Germany (2), France (1), China (2), Austria (1), and Argentina (1).<sup>120</sup>

### **Solar Materials Suppliers and Solar Cell Manufacturers in ARC States**<sup>121</sup>

AFG Industries, Inc.

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<sup>120</sup> SolarBuzz, Fast Solar Energy Facts: <http://www.solarbuzz.com/FastFactsIndustry.htm>

<sup>121</sup> SolarBuzz, Fast Solar Energy Facts: <http://www.solarbuzz.com/FastFactsIndustry.htm>

Facility: US, Kingsport TN  
Components: Tin oxide coated glass for thin film solar cells

DuPont Tedlar

Facility: US, Buffalo NY  
Components: Tin oxide coated glass for thin film solar cells

Ferro

Facility: US, Cleveland, OH  
Components: Thick film paste

Torpedo Specialty Wire, Inc.

Facility: US, Rocky Mount, NC  
Components: PV tabbing and bus ribbon products

Ulbrich

Facility: US, Westminster, SC  
Components: Solar cell tabbing and bus ribbon

Solar Power Industries

Facility: US, Vernon, PA  
Components: Multicrystalline silicon

**Additional Solar Energy Materials Suppliers in the US**<sup>122</sup>

Asahi Glass Corporation Electronic Materials

Facility: US, Hillsboro, OR  
Components: Glass Frits

Cermet Materials, Inc.

Facility: US, Wilmington, DE  
Components: Thick film paste

Crane Nonwovens

Facility: US, Dalton, MA  
Components: Craneglas glass fibre matting

Global Wedge, Inc.

Facility: US, Riverside, CA  
Components: Glass, Tedlar, EVA, tabbing and glass fibre mat

Madico

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<sup>122</sup> SolarBuzz, Fast Solar Energy Facts: <http://www.solarbuzz.com/FastFactsIndustry.htm>

Facility: US, Woburn, MA  
Components: PVF composite films for module backing

Specialized Technology Resources, Inc.  
Facility: US, Enfield, CA  
Components: EVA

Sputtering Materials, Inc.  
Facility: US, Reno, NV  
Components: Thin film planar and ratable target materials for solar cells

### **Additional Solar Cell Manufacturers in the US**<sup>123</sup>

Energy Conversion Devices, Inc.  
Facility: US, Rochester Hills, MI  
Components: Amorphous silicon thin film

First Solar LLC  
Facility: US, Phoenix, AZ  
Components: Cadmium Telluride

GE Energy (Solar Division)  
Facility: US, Newark, DE  
Components: Monocrystalline silicon

Iowa Thin Film Technologies  
Facility: US, Boone, IA  
Components: Amorphous silicon thin film on plastic substrate

Terra Solar, Inc  
Facility: US, Carson, CA  
Components: Monocrystalline silicon

United Solar Ovonic  
Facility: US, Auburn Hill, MI  
Components: Amorphous silicon thin film

There are over 62 solar cell manufacturers abroad located in over 18 countries. China leads with over 14 manufactures, India has 11 and Japan has 10.<sup>124</sup>

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<sup>123</sup> SolarBuzz, Fast Solar Energy Facts: <http://www.solarbuzz.com/FastFactsIndustry.htm>

<sup>124</sup> SolarBuzz, Fast Solar Energy Facts: <http://www.solarbuzz.com/FastFactsIndustry.htm>

## **Biomass – Ethanol Production**

Abengoa, S.A.<sup>125</sup>

Location: Seville, Spain

Employment: 11,082

Sales: \$2,396,400,000

Product: Biofuels for transport, bioethanol, and biodiesel

Description: Subsidiary is Abengoa Bioenergy which is headquartered in St. Louis, MO

Archer Daniels Midland<sup>126</sup>

Location: Decatur, Illinois

Employment: 25,641

Sales: \$36,596,100,000

Product: Processes crops to make food, animal feed, renewable fuels, and natural alternatives to industrial chemicals.

Description: Global distributor of quality foods.

Aventine Renewable Energy Holdings, Inc.<sup>127</sup>

Location: Pekin, Illinois

Employment: 280

Sales: \$935,500,000

Product: Makes ethanol, bioproducts, and feed products.

Description: A leading producer and marketer of ethanol in the United States.

Danisco A/S Genencor International<sup>128</sup>

Location: Copenhagen, Denmark (Genencor - Palo Alto, CA)

Employment: 10,636

Sales: \$3,540,400,000

Product: Produces food ingredients.

Description: Among the technological leaders in converting biomass - starch and non-starch materials - into ethanol. Enzymes such as STARGENTM and SPEZYMETM have made the production of bioethanol a cost-effective proposition.

Harvest Biofuels BV

Location: Austria

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<sup>125</sup> Hoovers Online: January 16, 2007:

<http://premium.hoovers.com.ezaccess.libraries.psu.edu/subscribe/co/factsheet.xhtml?ID=rfrcshcjyrfkjh>

<sup>126</sup> Hoovers Online: January 16, 2007:

<http://premium.hoovers.com.ezaccess.libraries.psu.edu/subscribe/co/factsheet.xhtml?ID=rfrtcffryfkxj>

<sup>127</sup> Hoovers Online: January 16, 2007:

<http://premium.hoovers.com.ezaccess.libraries.psu.edu/subscribe/co/factsheet.xhtml?ID=rcsrttssttxys>

<sup>128</sup> Ibid:

<http://premium.hoovers.com.ezaccess.libraries.psu.edu/subscribe/co/factsheet.xhtml?ID=sfshcyfjrxktyx>

Description: Harvest Biofuels BV is a subsidiary of Harvest Energy Limited, one of the largest suppliers of high quality gasolines and diesel road fuels to the U.K. independent sector and one of the market leaders for supply of bio-ethanol and bio-diesel road fuels in the United Kingdom

Caltex Australia Limited<sup>129</sup>

Location: Sydney, 2000, Australia

Employment: 3,046

Sales: \$8,939,900,000

Product: It is engaged in the refining, distribution and marketing of fuels and lubricants across the country

Description: Australia Limited is the largest refiner and marketer of petroleum products in Australia with operations in all states and territories

CHS, Incorporated<sup>130</sup>

Location: Inver Grove Heights, MN

Employment: 6,370

Sales: \$11,941,100,000.00

Product: CHS trades grain and sells supplies to members through its stores. It also processes soybeans for use in food and animal feeds, and markets petroleum.

Description: CHS is one of the nation's largest suppliers of ethanol-enhanced gasoline and a leading marketer of biodiesel products. CHS is an owner of US BioEnergy, a premier ethanol manufacturer, distributor and marketer.

CSR Limited<sup>131</sup>

Location: Chatswood, New South Wales, Australia

Employment: 6,363

Sales: \$2,037,800,000

Product: CSR Limited is now heavy into construction materials such as plasterboard, cement fiber products, roof tile, clay brick, and insulation.

Description: CSR has operations in sugar milling, sugar refining, and ethanol production and is expanding its capacity to generate commercially renewable electricity.

Cargill, Inc.<sup>132</sup>

Location: Wayzata, MN

Employment: 149,000 in 63 countries

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<sup>129</sup> Hoovers Online, January 18, 2007:

<http://premium.hoovers.com.ezaccess.libraries.psu.edu/subscribe/co/factsheet.xhtml?ID=rtfycykhftrkjc>

<sup>130</sup> Hoovers Online, January 18, 2007:

<http://premium.hoovers.com.ezaccess.libraries.psu.edu/subscribe/co/factsheet.xhtml?ID=hktrxfjrcrkk>

<sup>131</sup> Hoovers Online, January 18, 2007:

<http://premium.hoovers.com.ezaccess.libraries.psu.edu/subscribe/co/factsheet.xhtml?ID=hjtkhkhfkytjyx>

<sup>132</sup> Hoovers Online, January 18, 2007:

<http://premium.hoovers.com.ezaccess.libraries.psu.edu/subscribe/co/factsheet.xhtml?ID=cffksffjtcxsxs>

Sales: \$75,208,000,000

Product: Cargill's diversified operations include grain, cotton, sugar, and petroleum trading; financial trading; food processing; futures brokering; and agricultural services including animal feed and fertilizer production.

Description: manufactures ethanol at two production facilities in the heart of the cornbelt: Eddyville, IA; and Blair, NE; makes biodiesel in Iowa Falls, IA

#### Matrix Service Company<sup>133</sup>

Location: Tulsa, OK 74116

Employment: 2,092

Sales: \$493,900,000

Product: ethanol and petroleum refining

Description: provides construction, and repair and maintenance services primarily to the downstream petroleum and power industries in the United States and Canada

#### VeraSun Energy Corporation<sup>134</sup>

Location: Brookings, SD 57006

Employment: 160

Sales: \$236.4 million

Product: The Company is one of the nation's leading producers of ethanol,

Description: The Company is selling a branded fuel, VE85, at service stations in the Midwest

#### Hawkeye Holdings Inc<sup>135</sup>

Location: Iowa Falls, IA

Employment: 85

Sales: \$89,100,000

Product: 1) Product ethanol 2) Produce and sell distillers grains as ethanol co-products

Description: Like most ethanol producers, Hawkeye also markets distiller grains (a by-product of the manufacturing process) as animal feed

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<sup>133</sup>Hoovers Online, January 18, 2007:

<http://premium.hoovers.com.ezaccess.libraries.psu.edu/subscribe/co/factsheet.xhtml?ID=rfjffrrhrfhxk>

<sup>134</sup>Hoovers Online, January 18, 2007:

<http://premium.hoovers.com.ezaccess.libraries.psu.edu/subscribe/co/factsheet.xhtml?ID=rcsrtrfjktfjrjc>

<sup>135</sup>Hoovers Online, January 18, 2007:

<http://premium.hoovers.com.ezaccess.libraries.psu.edu/subscribe/co/factsheet.xhtml?ID=rhfcchrjrhftjyy>