OVERVIEW INTERNATIONAL ENERGY OUTLOOK 2006 AND BEYOND

The opening statement in Chapter 6 of the June 2006 report published by the Energy Information Administration (Report #: DOE/EIA-0484(2006)) states that;

> **"World electricity consumption doubles in the IEO2006 projections from 2003 to 2030."**

In the reference case cited, worldwide installed electricity generating capacity grows from 3,710 gigawatts in 2003 to 6,349 gigawatts in 2030, at an average rate of 2.0 percent per year. New construction to meet the projections for installed capacity includes replacement of plants that will be taken out of service during this period because of aging, changes in fuel economics and plant obsolescence.

The fuels needed to meet the demand projection will vary from region to region as a function of natural resources and market competition among fuel choices. Suppliers must decide how much capacity of each generation technology to build and when to use the different types in their generation fleets. As considerations of costs and flexibility come into play, generating technologies may well consider a balance between traditional central generation facilities with transmission of electricity over long distances and localized distributed generation capacity with much smaller generating units.

Smaller, modular generating plants in the 5 to 200 KW range are projected to account for about 20% of new generating capacity. Major factors driving this projection are:

- Significant reduction in transmission line costs,
- Reduced transmission losses,
- Quicker installation times,
- Generating efficiencies on the order of 80%,
- Ability to come on line in minutes rather than hours for larger installations

For example, a 2001 survey shows that distributed systems in California alone added up to 4000 back-up generators, with sizes ranging up to 200 KW. These are generally found in businesses (e.g., Meggitt Simi Facilities), hospitals, and large commercial buildings.

It has been estimated that about one-half of the added generating capacity will use natural gas turbines. IAEA projections for global growth in nuclear power capacity over the next 25 years range from a conservative 54 GW (45 plants) to an optimistic figure of 309 GW (257 plants). The lower figure is easily shown to be too low. Global industry projections for nuclear plant construction already include 28 plants under construction, 35 to 40 plants planned for China, 4 additional plants in South Korea, and 16 plants in the US.

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The projected distribution of generating capacity by fuel over the period of 2003 to 2030 is shown in Table 1.0. Note that this chart shows total capacity on line at any given time and does not reflect replacement capacity required to compensate of old units coming off line.

As an aid to equating generating capacity with the number of generating plants required the following figures may be used:

- Fossil fuel central generating plants may range from 500 MW to the 1,600 MW-Mohave Generating Station,
- Nuclear plants,
  - Westinghouse AP1000 at 1117 to 1154 MW and AP600 at 600 MW,
  - GE ABWR at 1150 MW,
- Co-generation plants at 10- 500 MW,
- Small combustion turbine generators at 30 to 400 KW

TABLE 1.0
WORLD TOTAL INSTALLED GENERATING CAPACITY BY FUEL

GIGAWATTS

	History	Projections					
Fuel Type	**2003**	**2010**	**2015**	**2020**	**2025**	**2030**	
OIL	374	418	409	411	419	433	
NATURAL GAS	1,007	1,491	1,591	1,771	1,922	2,077	
COAL	1,119	1,301	1,442	1,590	1,764	1,997	
NUCLEAR	362	251	403	421	434	437	
RENEWABLE	851	1,064	1,135	1,219	1,313	1,404	
TOTAL CAPACITY	**3,713**	**4,525**	**4,980**	**5,412**	**5,852**	**6,348**	

Sources:

History — *Derived from Energy Information Administration (EIA), International Energy Annual 2003 web site www.eia.gov/iea/*

Projections — *EIA, Annual Energy Outlook 2006 DOE/EIA-0383(2006) (Washington, DC February 2006) AEO2006 National Energy Modeling system web site www.eia.doe.gov/oiaf/aeo/ System for the Analysis of Global Energy Markets (2006)*

Use of renewable fuel sources during this growth period will be significant. There is already a non-trivial amount of power generation using renewable fuels, e.g., in the US approximately 2.4% of power generated is from renewable fuels. One of the earliest sources in the US, hydroelectric power dates back more than 125 years. Other sources in the mix include wind turbines, geothermal, biomass (usually with co-generation facilities), solar, tidal, etc. Economics will be the driving force in countries rich in these resources.

TIME LINE PROJECTIONS

Global projections for timing on generating capacity buildup by plant construction start dates or anticipated dates for coming on line are not readily available at this time for incorporation into this overview. However, US data on new construction by fuel type and time period, and nuclear plant life extension and construction forecasts in the US and South Korea are available through industry reports and active Meggitt client/partner sources.

A report published by the Energy Information Administration and Department of Energy includes a forecast of new plant construction and generating capacity in the US as a function of fuel type for the period 2006 – 2010. This table is in Appendix A of this overview.

Nuclear plant license extensions and new construction planning in the US is in the tabulation in Appendix B. This information shows that there are 44 nuclear plants in the US that have already been granted 20 year extensions, 8 more filed and 26 more requests expected.. Our cable and analyzer experience is that those plants with approved license extensions are incorporating plant upgrade and purchasing new equipment.

Sixteen new plants in the US are currently in the planning stages with the first units expected to be online by 2015. As a result of streamlined licensing procedures, new plant construction in the US is expected to be on the order of 3 years.

There are currently 28 new nuclear plants under construction worldwide. Recent meetings with KHNP in South Korea show four units currently under construction and four more units in the pre-contract stage, all of which will be on line by 2015.

Getting Meggitt products designed into the new plant designs and being incorporated into existing plants as upgrade items is critical to increasing the product reach into the electrical generating marketplace.

GLOBAL NUCLEAR ENERGY BUILDUP

There is a revitalized global interest in building new nuclear power plants to provide for the energy requirements to support sustainable economic growth through the 21st century. This nuclear renaissance is being driven in part by political and economic factors, e.g., the rapidly growing economies of Asia, the need for fuel supply security and price stability and the Kyoto accords to reduce greenhouse gasses. More basic drivers to the movement are the fact that older nuclear plants will be retiring, and costs of electricity from fossil fuel plants versus nuclear generating plants greatly favors the latter, e.g., nuclear at 1.72 ¢/KwH vs. 2.2¢/KwH to 8.09 ¢/KwH for fossil fuels.

The International Atomic Energy Agency (IAEA) projections for global growth of nuclear generated electricity by the year 2030 ranges from a low of 54GW more electricity than the 2005 level (~45 plants) to a high of 309GW of increased capacity (~257 plants).

KEY ACTIVITY

The renewed interest in building up nuclear power generation capacity is evidenced by the following activities already underway;

- Individual companies are selecting designs for Combined Construction and Operating License (COL) development in the US,
- Several new reactor designs from GE and Westinghouse have been certified by the NRC, others are in pre-application review,
- New construction of 16 plants in the US is already in the approval cycle in the US, a total of 28 are active in the global statistics (Nuclear Energy Institute – NEI),
- China still has plans for construction of 35-40 plants (statement by Westinghouse).

Reactor manufacturers with advanced system designs in various stages of certification include Westinghouse and GE with NRC certified designs, and those listed that are in pre-application review by the NRC including;

- Atomic Energy of Canada (AECL), Advanced CANDU design,
- General Atomics, Gas Turbine Modular Helium Reactor,
- AREVA NP, US Evolutionary Power Reactor
- GE ESBWR,
- South Africa, PBMR.

International consortiums are developing new certifiable reactor designs, defining potential plant sites, moving forward with the construction and licensing processes (COL), and firming up teaming arrangements to support the projected growth. These include the following;

- Dominion Group,
  - GE Energy, Hitachi America and Bechtel Power Corporation,
- NuStart Energy Constellation Generation Group
  - Progress Energy, Duke Energy, Southern Company, EDF International N.A., GE Energy, Entergy, VA, Exelon, Westinghouse and Florida Power & Light
- TVA
  - GE Energy, Toshiba, USEC Inc., Global Fuel Americas, Bechtel Power Corporation

STATISTICS/FORECASTS

The Nuclear Energy Institute reports the following statistics on world wide nuclear power plant population.

- As of June, 2006, 30 countries worldwide were operating 442 nuclear reactors for electricity generation. See World Nuclear Power Plants in Operation and World Nuclear Generation and Capacity.

- Twenty-eight new nuclear plants were under construction in 12 countries. See Nuclear Units Under Construction Worldwide.

- Nuclear power plants provided some 16 percent of the world's electricity production in 2005. Countries generating the largest percentage of their electricity in 2005 from nuclear energy are tabulated here::

France, 78.5%	Lithuania, 69.6%	Slovakia, 56.1%
Belgium, 55.6%	Ukraine, 48.5%	Sweden, 46.7%
Republic of Korea, 44.7%	Bulgaria, 44.1%	Armenia, 42.7%
Slovenia, 42.4%	Hungary, 37.21%	Finland, 32.9%

In total, 16 countries relied on nuclear energy to supply at least one-quarter of their total electricity. See also Top 10 Nuclear Generating Countries.

To view more information on the world's nuclear power plants check out the International Atomic Energy Agency's Power Reactor Information System database

The tabulation below presents a summary of currently operating plants and projections for the future that highlights a growing nuclear power plant base that will have significant potential for Meggitt PLC products.

WORLD WIDE STATUS

Position	Number of plants	Comments
Operating Plants	442	In 30 countries
Under Construction	28	
Projected by 2030	45 (Minimum) 257 (Maximum)	Adds 54 GW Adds 309 GW

US PLANT STATUS

Position	Number of Plants	Comments
Operating Plants	103	
License renewals approved	44	Upgrades in process
Renewal requests filed	8	
Requests expected	26	
New Construction Planned	16	1st wave on line 2015

MEGGITT PRODUCT MIX

The list below is a broad brush summary of Meggitt products designed, qualified, and installed in nuclear applications.

CABLES:

- Multiwire SiO2 cabling used connecting various instruments from containment penetrations,
  - In Core Instrumentation (ICI),
  - Head Lift Rig cables,
  - 6-1 and7-1 transition cable assemblies,
- Control Rod Drive Mechanism Power Cables,
- Heated Junction Thermocouple Cables,
- LPRM Cables.
- Coaxial and Triaxial Instrument cables (Low loss applications)
- Appendix R Cables (Fire Zone to 1950F)

ANALYZERS:

- Post LOCA Hydrogen and Oxygen Analyzers (Safety Related),
- Post LOCA Hydrogen and Oxygen Analyzers (Amended Rule),
- Inerting Oxygen monitors,

- Hydrogen and Oxygen Waste Gas and Off Gas monitoring,
- Dissolved Hydrogen and Oxygen,
- HLRW Storage Tank monitoring – Hydrogen

LOOSE PARTS MONITORING

SEISMIC ACCELEROMETERS

DYNAMIC PRESSURE TRANSDUCERS

STEAM GENERATOR VIBRATION AND DYNAMIC PRESSURE MONITORING

There may well be additional products in the Meggitt arsenal (e.g., networked smoke/fire detection) that could find application in nuclear plants and could also include applications in fossil fuel plants, hydrogen generators, fuel reprocessing, etc.

MEGGITT PARTICIPATION

The breadth of Meggitt products and technologies being supplied to highly regulated safety critical applications provides a strong argument that Meggitt fits extremely well into the nuclear requirements arena. Taking an early strategic approach to the potential business represented in this buildup of nuclear power plants should maximize incorporation of Meggitt hardware designs into all phases of the buildup, i.e., plant upgrades as well as new construction.

Entry into the nuclear cable market in the late 1970's was facilitated by teaming with then Combustion Engineering (now Westinghouse). The cables were designed to meet nuclear performance requirements and then were written into the plant specifications. At this juncture in the new plant design planning this would seem to be the way to go rather than waiting for requests for products. We should be dealing directly with the cognizant design teams to offer solutions to problems that probably have not been addressed at this time. – thus making someone's job easier. This belief was given significant creditability during our recent meeting with the Westinghouse design team for AP1000.

The buildup of worldwide nuclear power generating units offers a business potential that can be sustained through the middle of this century. Although it will be several years before domestic new plant construction results in orders for MSSI, we can still achieve significant benefit from the renewed interest in nuclear power. Specifically, plant upgrades to support plant life extension in the US and providing MSSI products for the rapid buildup of nuclear power in Asia.

APPENDICES

APPENDIX A: Energy Information Administration Report, Projected US Generating Capacity by Fuel Type

APPENDIX B: Energy Information Administration Report, US Nuclear Plant Licensing Status

APPENDIX A

Planned Capacity Additions from New Generators, by Energy Source

Electric Power Annual with data for 2005
Report Released: October 4, 2006
Next Release Date: October 2007

Table 2.5

Table 2.5. Planned Capacity Additions from New Generators, by Energy Source, 2006-2010 (Count, Megawatts)

Energy Source	Number of Generators	Generator Nameplate Capacity	Net Summer Capacity	Net Winter Capacity
2006				
U.S. Total	**223**	**14,573**	**12,979**	**13,937**
Coal[1]	5	602	564	566
Petroleum [2]	48	269	245	261
Natural Gas	89	10,657	9,156	10,093
Other Gases [3]	--	--	--	--
Nuclear	--	--	--	--
Hydroelectric Conventional	2	8	8	8
Other Renewables [4]	78	3,027	2,996	3,000
Pumped Storage	--	--	--	--
Other[5]	1	10	9	9
2007				
U.S. Total	**152**	**21,407**	**18,849**	**20,395**
Coal[1]	3	1,589	1,488	1,493
Petroleum [2]	2	78	71	73
Natural Gas	100	16,892	14,506	16,010
Other Gases [3]	2	391	336	370
Nuclear	--	--	--	--
Hydroelectric Conventional	1	3	3	3
Other Renewables [4]	44	2,454	2,445	2,447
Pumped Storage	--	--	--	--
Other[5]	--	--	--	--
2008				
U.S. Total	**109**	**18,133**	**15,730**	**17,224**
Coal[1]	5	1,056	988	993
Petroleum [2]	4	168	142	164
Natural Gas	81	15,050	12,911	14,281
Other Gases [3]	4	1,160	999	1,095
Nuclear	--	--	--	--
Hydroelectric Conventional	1	4	4	4
Other Renewables [4]	14	695	685	687
Pumped Storage	--	--	--	--

Other[5]	--	--	--	--
2009				
U.S. Total	**79**	**24,850**	**22,525**	**23,419**
Coal[1]	25	15,287	14,256	14,369
Petroleum[2]	2	817	751	772
Natural Gas	46	8,511	7,306	8,055
Other Gases[3]	--	--	--	--
Nuclear	--	--	--	--
Hydroelectric Conventional	--	--	--	--
Other Renewables[4]	6	236	212	223
Pumped Storage	--	--	--	--
Other[5]	--	--	--	--
2010				
U.S. Total	**46**	**15,466**	**13,909**	**14,558**
Coal[1]	17	9,350	8,654	8,789
Petroleum[2]	1	300	255	294
Natural Gas	24	5,815	4,999	5,474
Other Gases[3]	--	--	--	--
Nuclear	--	--	--	--
Hydroelectric Conventional	4	1	1	1
Other Renewables[4]	--	--	--	--
Pumped Storage	--	--	--	--
Other[5]	--	--	--	--

[1] Anthracite, bituminous coal, sub bituminous coal, lignite, waste coal, and synthetic coal.
[2] Distillate fuel oil (all diesel and No. 1, No. 2, and No. 4 fuel oils), residual fuel oil (No. 5 and No. 6 fuel oils and bunker C fuel oil), jet fuel, kerosene, petroleum coke (converted to liquid petroleum, see Technical Notes for conversion methodology), and waste oil.
[3] Blast furnace gas, propane gas, and other manufactured and waste gases derived from fossil fuels.
[4] Wood, black liquor, other wood waste, municipal solid waste, landfill gas, sludge waste, tires, agriculture byproducts, other biomass, geothermal, solar thermal, photovoltaic energy, and wind.
[5] Batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, and miscellaneous technologies.
Notes: Projected data are updated annually, so revision superscript is not used. Capacity by energy source is based on the capacity associated with the energy source reported as the most predominant (primary) one, where more than one energy source is associated with a generator. These data reflect plans as of January 1, 2006. Totals may not equal sum of components because of independent rounding.
Source: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."

APPENDIX B

US Plants, Life Extension Status

- **Reactors with 20-year license extensions: 44**

Calvert Cliffs-2 units, Lusby, MD (60 miles south of Baltimore), March 23, 2000 (Constellation Energy Group),
Oconee-3 units, Seneca, SC (near Greenville), May 23, 2000 (Duke Energy)
Arkansas Nuclear One Unit 1, Russellville, AR (five miles northwest of Russellville, AR, on the Peninsula of Lake Dardanelle on the Arkansas River) June 2001 (Entergy Operations Inc.)
Edwin E. Hatch 1 & 2, Baxley, GA (67 miles west-south west of Savannah) January 2002 (Georgia Power Co.)
Turkey Point 3 & 4, Florida City, FL (24 miles south-southwest of Miami) June 2002 (Florida Power & Light)
Surry 1 & 2, Surry, VA (8 miles south of Williamsburg, VA) March 2003 (Dominion Energy)
North Anna 1 & 2, Mineral, VA (40 miles north-northwest of Richmond, VA) March 2003 (Dominion Energy)
Peach Bottom 2 & 3, York County, PA (4 miles northeast of Delta, PA) May 2003 (Exelon Nuclear)
St. Lucie 1 & 2, Hutchinson Island, FL (7.5 miles southeast of Ft. Pierce, FL) October 2003 (Florida Power & Light)
Ft. Calhoun Unit 1, Blair, NE (5 miles northwest of Ft. Calhoun, NE) November 2003 (Omaha Public Power District)
Catawba 1 & 2, York County, SC (19 miles southwest of Charlotte, NC) December 2003 (Duke Energy)
McGuire 1 & 2, Huntersville, NC (17 miles northwest of Charlotte, NC) December 2003 (Duke Energy)
Robinson Unit 2, Hartsville, SC (5 miles west-northwest of Hartsville, SC on 2,250 acre man-made Lake Robinson) April 2004 (Carolina Power & Light)
V.C. Summer, Jenkinsville, SC (26 miles north of Columbia, SC) April 2004 (SCANA Corp.)
R.E. Ginna, Ontario, NY (on south shore of Lake Ontario) May 2004 (Rochester Gas & Electric Co.)
Dresden 2 & 3, Morris, IL (12 miles east of Morris, IL, where the Kankakee, Des Plaines and Illinois Rivers converge) October 2004 (Exelon Nuclear)
Quad Cities 1 & 2, Cordova, IL (3 miles north of Cordova, IL, on the east bank of the Mississippi River) October 2004 (Exelon Nuclear)
Farley 1 & 2, Ashford, AL (8 miles east-northeast of Ashford, AL, on the west bank of the Chattahoochee River separating Alabama and Georgia) May 2005 (Southern Nuclear)
Arkansas Nuclear One Unit 2, Russellville, AR (five miles northwest of Russellville, AR, on the Peninsula of Lake Dardanelle on the Arkansas River) July 2005 (Entergy Operations Inc.)
Cook 1 & 2, St. Joseph, MI (10 miles southwest of St. Joseph, MI, on the eastern shore of Lake Michigan)August 2005 (American Electric Power)
Millstone 2 & 3, Waterford, CT (3.2 miles west-southwest of New London, CT, on a peninsula extending into Niantic Bay-Long Island Sound) November 2005 (Dominion)
Point Beach 1 & 2, Green Bay, WI (10 miles north of Two Rivers, Wisconsin, on the western shore of Lake Michigan) December 2005(NMC)
Browns Ferry 1, 2 and 3, Athens, AL (10 miles northwest of Decatur, AL) May 2006 (Tennessee Valley Authority)
Brunswick 1 & 2, Southport, NC (2 miles north of Southport, NC, 1.75 miles west of the Cape Fear River and 5 miles from the Atlantic Ocean) October 2004 (Carolina Power and Light)

- **Reactors filed for license renewal: 8**

Nine Mile Point 1 & 2, Oswego, NY (7 miles northwest of Oswego, NY on the southeastern shore of Lake Ontario) May 2004 (Constellation Energy Group)
Monticello (30 miles northwest of Minneapolis, MN) March 2005 (NMC)

Palisades (5 miles south of South Haven, MI) April 2005 (Consumer Energy)
Oyster Creek (10 miles south of Toms River, NJ. 2.5 miles inland from the Barnegat Bay of the Atlantic Ocean.) July 2005 (Emergent)
Pilgrim (4 miles southwest of Plymouth, MA) January 2006 (Entergy Operations Inc.)
Vermont Yankee (5 miles south of Brattleboro, VT) January 2006 (Entergy Operations Inc.)
James A. Fitzpatrick (8 miles northeast of Oswego, NY) August 2006 (Entergy Operations Inc.)

- **Reactors expected to apply for license renewal: 26**

Plant	Licensee	Application Date
Susquehanna 1 & 2	PPL Susquehanna LLC	July-September 2006
Wolf Creek	Wolf Creek Nuclear Oper. Corp.	September 2006
Harris 1	Progress Energy	October-December 2006
Entergy Plant	Entergy Operations Inc.	January 2007
Beaver Valley 1 & 2	FirstEnergy Nuclear	January-March 2007
Vogtle 1 & 2	Southern Nuclear Operating Co.	June 2007
TMI 1	Exelon Generating Co.	January-March 2008
Kewaunee	Dominion Energy Kewaunee, Inc.	April-June 2008
Prairie Island 1 & 2	Nuclear Management Co.	April - June 2008
Cooper	Nebraska Public Power District	September 2008
Strategic Teaming and Resource Sharing	STARS	October-December 2008
Duane Arnold	Nuclear Management Co.	October-December 2008
Davis-Besse	FirstEnergy Nuclear	December 2008
Entergy Plant	Entergy Operations Inc.	January 2009
Exelon Plant	Exelon Generating Co.	January-March 2009
Crystal River 3	Progress Energy Florida Inc.	January-March 2009
Strategic Teaming and Resource Sharing	STARS	October-December 2009
Entergy Plant	Entergy Operations Inc.	January 2010
Perry	FirstEnergy Nuclear	September 2010
Exelon Plant	Exelon Generating Co.	July-September 2011
Exelon Plant	Exelon Generating Co.	July-September 2011
Exelon Plant	Exelon Generating Co.	January-March 2015