Deutsche Banc Alex. Brown

US
Utilities

North America

May 12, 2000

Convergence Redefined

The Digital Economy and the Coming Electricity Capacity Emergency

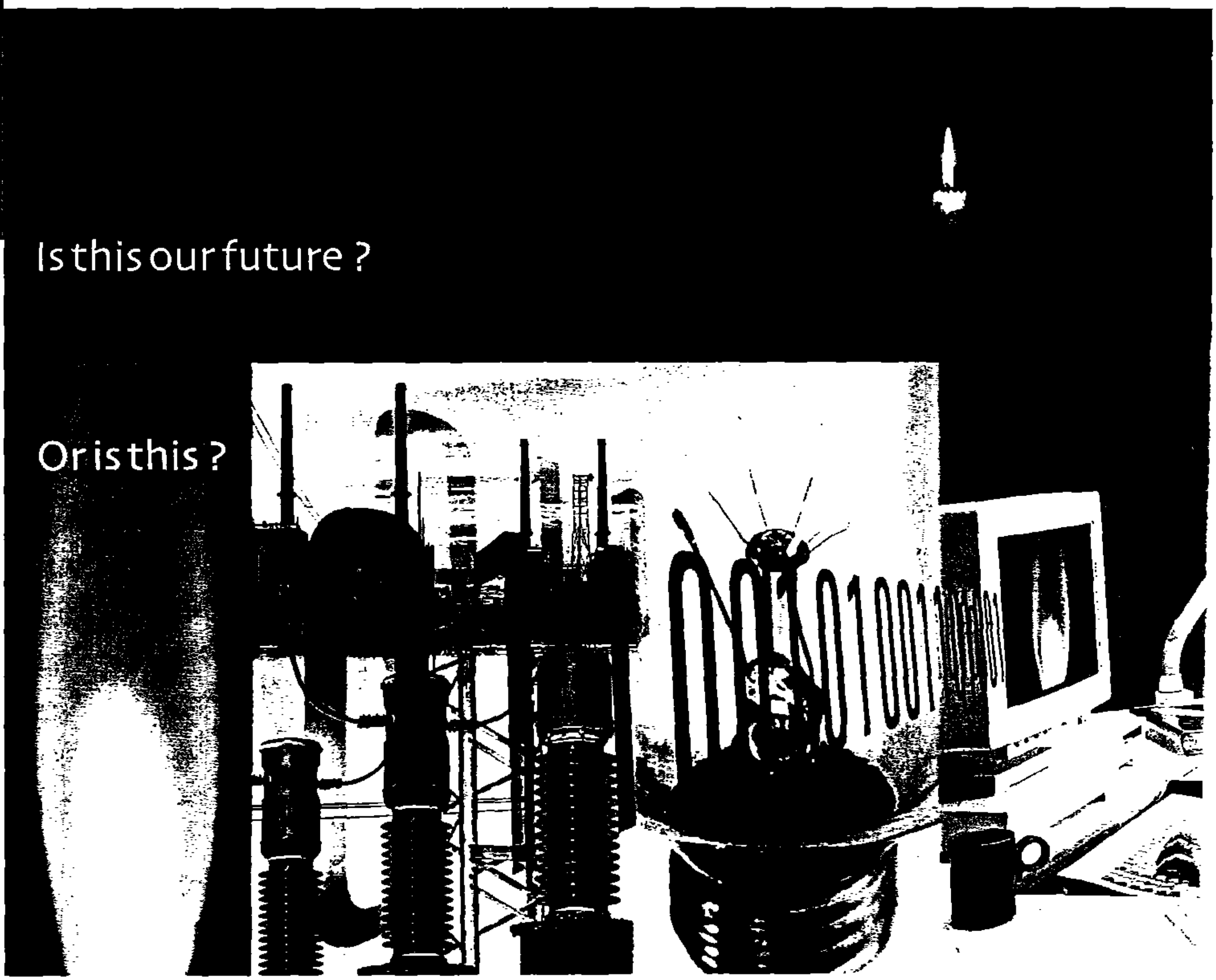

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Figure 1: **Deutsche Banc Alex. Brown Utilities Recommended List**

Rating	Company	Sym.	Price 5/12/2000	8-12 Mos. Price Target	Price Target Multiple (x) 2000 EPS	EPS 1999A	EPS 2000E	EPS 2001E	Div.	Yield	12-Mos. Total Return Potential	Mkt C ($)
Diversified Growth/Energy Services												
B	Equitable Resources	EQT	$47.50	$59.00	18.2	$2.01	$2.75	$3.25	$1.18	2.5%	26.7%	$1.
B	MDU Resources Group Inc	MDU	22.06	27.00	16.3	1.51	J 1.66	1.81	0.84	3.8%	26.2%	1.
B	New Jersey Resources Corp. (Sep.)	NJR	39.63	45.00	16.7	2.49	2.70	2.85	1.72	4.3%	17.9%	
SB	Northwestern Corporation	NOR	23.25	31.00	17.2	1.64	1.80	2.04	1.11	4.8%	38.1%	
SB	NUI Corporation (Sep.)	NUI	27.00	41.00	17.1	1.75	J 1.90	2.40	0.98	3.6%	55.5%	
B	Questar Corporation	STR	19.38	25.00	14.3	1.58	J 1.75	J 1.90	0.68	3.5%	32.5%	1.
SB	Western Resources Inc	WR	15.94	28.00	21.2	1.52	J 1.32	1.75	2.14	13.4%	89.1%	1.
Internet												
B	DQE Inc	DQE	40.81	55.00	19.1	2.55	J 2.88	3.00	1.60	3.9%	38.7%	3.
Independent Power Producers/ Nonutility Generation												
SB	AES Corporation (The)	AES	78.25	113.00	39.0	1.92	J 2.90	3.75	0.00	0.0%	44.4%	16.
SB	Calpine Corporation	CPN	106.00	158.00	#	1.73	J 2.32	2.85	0.00	0.0%	49.1%	6.
B	Cleco Corporation	CNL	34.44	37.00	14.2	2.37	2.60	2.75	1.70	4.9%	12.4%	
B	Edison International	EIX	19.75	30.00	15.0	2.03	2.00	2.25	1.12	5.7%	57.6%	6.
B	Entergy Corp	ETR	26.75	34.00	14.2	2.17	J 2.40	2.70	1.20	4.5%	31.6%	6.
SB	Northern States Power	NSP	22.44	44.00	@	1.73	J 1.90	2.15	# 1.45	6.5%	102.6%	3.
B	Public Service Enterprise Group Inc	PEG	36.00	44.00	12.6	3.29	3.50	3.70	2.16	6.0%	28.2%	7.
B	Unicom Corporation	UCM	42.09	44.00	13.8	2.96	J 3.20	3.50	1.60	3.8%	8.3%	9.
Industry Restructuring												
SB	CMS Energy Corporation	CMS	21.25	30.00	12.1	2.85	2.48	2.70	1.46	6.9%	48.0%	2.
B	FirstEnergy Corp.	FE	24.13	30.00	11.6	2.50	2.59	2.72	1.50	6.2%	30.6%	5.
SB	Reliant Energy	REI	27.06	36.00	14.8	2.11	J 2.43	2.71	1.50	5.5%	38.6%	8.
B	TXU	TXU	34.56	48.00	13.9	3.19	J 3.45	3.70	2.40	6.9%	45.8%	9.
Superior Utility Growth												
B	American Water Works Co. Inc.	AWK	22.94	33.50	18.0	1.53	J 1.69	1.86	0.88	3.8%	49.9%	2.
B	Atmos Energy Corporation (Sep.)	ATO	15.94	34.00	33.7	0.81	J 1.01	2.16	1.14	7.2%	120.5%	
B	Philadelphia Suburban Corp	PSC	23.94	31.00	24.8	1.09	J 1.19	1.25	0.72	3.0%	32.5%	
Telecommunications												
B	Conectiv	CIV	17.63	25.00	12.8	1.83	J 1.95	2.00	0.88	5.0%	46.8%	1.
B	Enron Corporation	ENE	75.56	96.00	70.1	1.18	J 1.37	1.60	0.50	0.7%	27.7%	55.
B	Montana Power Company	MTP	42.44	73.00	56.2	1.34	1.30	1.45	0.80	1.9%	73.9%	4.
SB	Williams Companies Inc. (The)	WMB	39.50	62.00	@	0.48	J 0.70	0.90	1.22	3.1%	60.1%	17.
Energy Trading/Marketing												
B	Constellation Energy Group Inc.	CEG	34.19	37.00	12.3	2.48	J 2.63	3.00	1.68	4.9%	13.1%	5.
SB	Dynegy Inc.	DYN	73.75	90.00	35.6	0.87	J 2.53	3.00	0.07	0.1%	22.1%	10.
B	El Paso Energy Corporation*	EPG	48.06	52.00	21.7	1.80	J 2.40	2.75	0.82	1.7%	9.9%	11.

Notes. 12-month total return calculation -- dividend yield + price appreciation.
Price targets are based on 2000 EPS estimates except for AWK, CEG, EQT, NUI and PSC which are based on our 2001 EPS estimates
Based on discounted cash flow analysis of projected 2004 EPS of $6.00 per share and a 30.0x valuation in 2003.
@ Based on sum of the parts analysis
J - Adjusted for nonrecurring items

Source: Deutsche Banc Alex. Brown Estimates

EXECUTIVE SUMMARY

After hearing Mark Mills, a well-known technology strategist and consultant speak at a company dinner presentation earlier in the year, we began an investigation into the future U.S. electricity markets. The technology strategist spoke of the tremendous impact that the Internet and Information technologies are having on the economy and the electricity market. We had already noticed anecdotal evidence of acceleration in electricity demand growth over the last decade, particularly over the last five years, and wondered if this strategist was on to something.

We had believed that the accelerating demand trend had come from the explosion in the Internet and its related equipment requirements. The trend is fairly evident in the increase in household and commercial electrical appliances installed over the last few years. Having received expert confirmation of our view, we decided to examine the ramifications of a continuation of this trend.

We discovered that none of the normal sources of energy demand forecasts had really examined the impact of microprocessor-based growth on electricity demand and therefore they had not adjusted their forecasts despite the recent evidence of a significant increase in demand growth. Not only did the electricity forecasters appear to ignore the existing trends, but so did the coal and natural gas analysts. The electric power plant equipment manufacturers did as well, hence the current shortage of combustion turbines.

The U.S. Department of Energy estimated that personal computers consumed approximately 3% of U.S. electricity in 1995. Mark Mills estimates that by 1999, the growth in Internet and related IT equipment now consumes 13% of our electricity supplies. Those estimates imply that the growth in microprocessor related electricity demand consumed almost 85,000 MW of additional electricity than just four years earlier. Coincidentally, that represents roughly the decline in electricity reserve margins experienced since the late 1980s when PCs and Microsoft Windows gained widespread acceptance (the beginning of the Internet Revolution as we see it).

Therefore, we decided to conduct a what-if analysis of the future electric generation market in the United States. Our analysis is based on the premise that a transformation based on information and computer technologies is sweeping the economy. This in turn is producing a profound change in the dynamics that impact electricity utilization.

We produced nine simple scenarios that model the potential supply and demand dynamics for electricity in the U.S. We assumed various levels of fundamental electricity demand growth, power plant retirements and economic displacements, reserve margin levels, existing plant capacity factors, fuel demand, and equipment demand. Our analysis reviews the aggregate national electricity market. We will leave a detailed analysis of regional markets for another time.

We came to some interesting conclusions based on the results of our nine scenarios. Our conclusions challenge much of the conventional wisdom circulating in the industry. Utilizing the results of the scenarios that we believe are most likely using reasonably logical assumptions, we conclude *that the U.S. is on the verge of an electricity capacity emergency unlike any in* our nation's history. The digital economy is rapidly draining our national electricity resources.

Our analysis suggests the potential need for 400,000-500,000 megawatts (MWs) of new electric generating capacity by 2010. This represents over 380,000 net new MWs of incremental generating capacity. The remainder of the capacity need represents the replacement of retired plants and the maintenance of a relatively modest reserve margin to ensure system reliability. We also determine that only about half of that potential new demand for capacity can be realistically met with new natural gas-fired combined-cycle technology. The deliverable supply of natural gas will simply not permit further construction.

Therefore, we also determine that new coal-fired generating capacity will also be necessary. While not politically or environmentally popular, the realities are that new hydroelectric and nuclear units would be less popular and less *practical alternatives and advanced coal technology is a relatively clean* solution. An interesting conclusion of our study is that the relevant supply of natural gas combustion turbines should be adequate to meet our growing generation needs despite recent tightness. We believe the recent press attention of the issue overstates the turbine issue. Overall, we conclude that demand should grow faster than our capability to add supply efficiently. This has broad implications for energy prices and volatility that are not currently anticipated by the conventional wisdom.

The conclusions of our investigation have some far-reaching implications, in our view. First, growth in the electric utility and electric generation markets could be far greater than anticipated. Our investigation also implies a significant need for new electric transmission and distribution assets to meet *accelerating demand and to support a vastly larger generation fleet and* wholesale energy transactions. Our investigation also has implications for incremental natural gas pipeline capacity, new natural gas storage and processing capabilities. Natural gas exploration and production companies also need to find, drill, develop, and produce at least 50% more natural gas to meet the demand for electric generation fuel alone. Wholesale energy traders and marketers also face the challenge of a significantly larger energy market and the growth in merchant energy transactions many orders of magnitude greater than experienced in 1999.

We believe the most important and interesting dynamic affecting electricity markets is the remarkable demand growth likely over the next decade. Instead of focusing on the changing dynamics of a deregulated market, we should focus on demand-pull dynamics. We believe industry participants have been asking the wrong questions. Instead of asking why merchant power plant developers were planning such a major expansion of generating capacity, analysts and utility industry participants have speculated when *oversupply will lead to depressed wholesale electricity prices. We should* also focus on how the President, Congress, state regulators, and federal energy policy makers can develop a coherent energy policy. That policy needs to enlighten market participants to the growing needs of the energy markets and encourage the participants to plan to meet that demand while building public support and alleviating the bottlenecks in the regulatory process that currently would prevent achieving the goal.

Based on the future electricity and natural gas markets depicted by conventional expectations for supply, demand, and price dynamics, we generally favor diversified, entrepreneurial energy companies with a strong comprehension of the wholesale energy markets, strong trading and marketing skills, excellent asset operating records, aggressive growth aspirations and a track record of meeting earnings growth and strategic business development targets. Selected diversified, electric and natural gas utilities and pipelines, wholesale energy marketers and traders, and merchant power generation developers meet this criteria. Generic electric and natural gas distribution utilities also present opportunities and special situations but competition generally will pose challenges that will require more precise stock selection.

Based on our more optimistic scenario for energy consumption, we believe that a rapidly rising tide will lift all boats significantly. All the new electricity, natural gas, coal, required to fuel the Internet growth will need to be produced, transported, transmitted, distributed, converted, etc. All market participants will benefit significantly, in our view. However, the market participants that will benefit the most are generally the same names we prefer under less robust market conditions. Many of these names straddle multiple elements of the energy value chain and would therefore benefit from more than one element of energy market growth. Some of these names will also be major participants in E-Commerce and telecommunications, benefiting directly from the Internet boom.

Clearly, power plant developers would sit at the top of our list. We believe the U.S. and Canada requires 900-1,000 new significantly sized power plants over the next decade. The power plant development game is dominated by a relatively modest number of significant players. Therefore, the power plant developers are probably best leveraged for very significant growth. Utilities have basically been out of the plant development business for 10-20 years. Currently, Calpine Corp (CPN, Strong Buy $106), The AES Corporation (AES, Strong Buy $78 1/4), Duke Energy (DUK, Market Perform $60 27/32), Dynegy Corporation (DYN, Strong Buy $73 3/4), Edison International (EIX, Buy $19 3/4), FPL Corporation (FPL Group, Market Perform $47 9/16), Northern States Power (NSP, Strong Buy $22 7/16), Public Service Enterprise Group (PEG, Buy, $36), Reliant Energy (REI, Strong Buy $27 1/16), PG&E Corp. (PCG, Market Perform $26 1/8), and Southern Company (SO, Market Perform $25 1/16) probably dominate this space.

The Wholesale traders and marketers would probably be the next to benefit most from our vision of the future markets. This group includes Constellation Energy Group (CEG, Buy $34 3/16), El Paso Energy (EPG, Buy $48 1/6), Enron Corp. (ENE, Buy $75 9/16), Duke, Dynegy, PG&E, Reliant, Southern Company, and Williams Cos. (WMB, Strong Buy $39 1/2). Diversified natural gas pipelines would also grow substantially, particularly due to the recent flurry of mergers that have concentrated that industry into a relatively small number of players. This group includes Dominion Resources (D, Market Perform $45 1/2), Duke Energy, Williams Cos, and NiSource Inc. (NI, Market Perform $18 3/16). These companies transport, store, process, and market the relevant energy products that will be used to fire the generation that fuels the Internet. The following table lists some of the names we favor in both a more modest and a high growth energy market. Our current ratings generally reflect 12-month investment horizons and do not necessarily reflect the optimistic long-term scenarios we present in our report. However, our view of the long-term opportunities in the energy markets may cause us to reevaluate our investment ratings on some of the companies that we believe will benefit most from our vision of the forward markets.

Figure 2: Assuming Capacity Shortages - Our Preferred Investments

Company	Ticker	Rating	5/12/00 Price	Shares	Market Cap.	DBAB Estimates 1999A	DBAB Estimates 2000E	DBAB Estimates 2001E	P/E Multiple 2000	P/E Multiple 2001	Growth	2001 P.E G.
Merchant Power Developers												
The AES Corp.	AES	1	78.25	207.00	$16,198	1.92	2.90	3.75	27.0	20 9	30%	0.70
Calpine Corp.	CPN	1	106.00	63.70	$6,752	1.73	2.32	2.85	45.7	37 2	30%	1.24
Edison International	EIX	2	19.75	347.00	$6,853	2.03	2.00	2.25	9.9	8.8	9%	0.98
FPL Group Inc.	FPL	3	47.56	178.00	$8,466	3.88	4.25	4.50	11.2	10.6	7%	1.51
Northern States Power	NSP	1	13.06	157.00	$2,051	1.73	1.90	2.15	6 9	6.1	8%	0.76
Public Service Enterprise Grou	PEG	2	36 00	216.36	$7,769	3.29	3.50	3.70	10 3	9.7	7%	1.39
PG&E Corp.	PCG	3	26.13	385.00	$10,058	2.24	2.45	2.65	10.7	9.9	8%	1.23
Southern Co	SO	3	25 06	650.00	$16,289	1.90	2.04	2.20	12.3	11.4	7%	1.63
Average									**16.7**	**14.3**	**18.5%**	**1.18**
Merchant Energy Traders												
Constellation Energy Group	CEG	2	34.19	150.00	$5,128	2 48	2.63	3.00	13 0	11.4	6%	1.90
Duke Energy	DUK	3	60.84	367.00	$22,328	3.60	4.11	4.30	14 8	14.1	8%	1.77
Dynegy Inc	DYN	1	73.75	151.00	$11,136	0.87	2.53	3.00	29 2	24.6	25%	0.98
Enron Corp	ENE	2	75.56	725.00	$54,781	1.18	1.37	1.60	55.2	47.2	16%	2 95
Reliant Energy Inc.	REI	1	27.06	283.00	$7,658	2.11	2 43	2.71	11.1	10 0	10%	1.00
Average									**24.6**	**21.5**	**13.0%**	**1.72**
Diversified Natural Gas Companies												
Dominion Resources	D	3	45.50	238 00	$10,829	3 01	3.30	3.55	13.8	12.8	8%	1.60
El Paso Energy Corp.	EPG	2	48.69	237.00	$11,539	1.80	2.40	2.75	20 3	17.7	15%	1.18
NiSource Inc.	NI	3	18.19	125.00	$2,273	1.48	1.85	2.00	9 8	9.1	8%	1.14
Williams Companies Inc.	WMB	1	39.50	442.00	$17,459	0.48	0.70	0.90	56.4	43.9	15%	2.93
Average									**25.1**	**20.9**	**11.5%**	**1.71**

Source: Company information and Deutsche Banc Alex Brown estimates

SOME ILLUMINATING NUMBERS

Our Thoughts on the Future of Electricity in the U.S.

We recently sat down to contemplate the future market for electric generation in the U.S. We produced some what-if scenarios that explored some potential electricity demand growth outcomes and the potential need for incremental generation. We also analyzed the implications of that need for new generation for natural gas, new combined-cycle plant construction, and the demand for combustion turbines utilized in that construction. We utilized some of the elements of current conventional wisdom and some more radical ideas.

We began our investigation after attending Calpine's investor meeting recently. The dinner speaker at the conference was a physicist and technology assessment consultant named Mark Mills, from Mills-McCarthy & Associates, who postulated that technological innovation was having a profound impact on electricity demand growth in the world, particularly in the U.S. He suggested that the emerging digital economy and its related Internet/PC/Information Technology equipment growth was driving a major fundamental change in the previously humdrum market for electricity. We have noticed over the last several years that anecdotal evidence indicated that electricity demand growth has been running above trend and wondered whether Mark Mills' assessment rang true.

Most of us recognize that the world has rapidly evolved from one powered by water, steam, and combustion engines to one predominantly powered by electricity over the past century. Electricity has continued to grow in terms of its importance in powering modern devices. Service industries represent approximately 55% of U.S. GDP and are growing disproportionately as the digital economy grows rapidly. This sector of the economy also utilizes a majority of its energy in the form of electricity and its intensity is growing. In our view, that fundamental fact continues to fuel an accelerating trend in the domestic electricity markets.

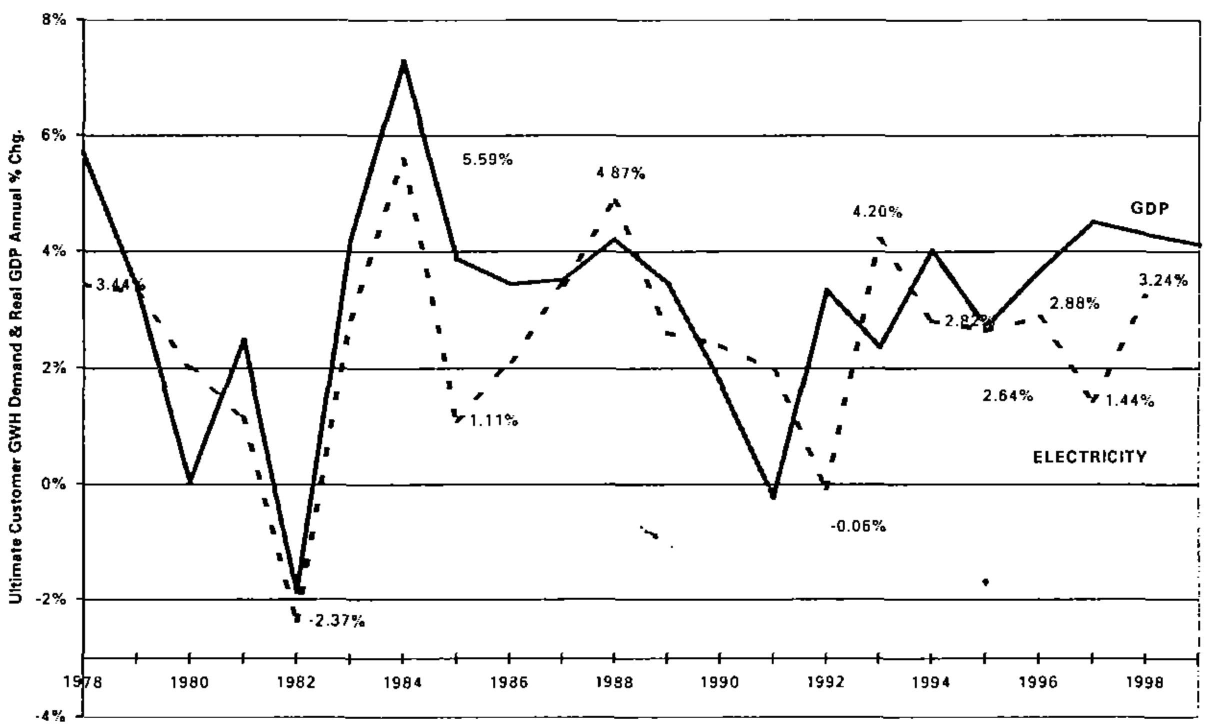
As a result of this investigation, we cannot help but wonder if much of the conventional wisdom regarding the future electric generation market is valid. We believe the data we have compiled may challenge some pre-conceived notions of future electricity demand growth and the implications for the electric generation market, and the energy sector in general.

Now the debate has hit the front page of *The Wall Street Journal*. On May 11, 2000, *The WSJ* ran an article entitled "Gloom and Doom" that posited that deregulation might cause electricity shortages this summer. After a week of freak extreme spring temperatures that exceeded 90 degrees, the public and energy policy makers are finally waking up to the reality that the U.S. is dangerously low on electricity capacity. The PJM and NEPOOL both put out power warnings last week that were unprecedented for springtime and only a recent phenomenon for the industry. Making matters worse, Energy Secretary Bill Richardson proclaimed that there would be outages and brownouts this summer.

The article focused on the deregulation of the industry as a principal culprit of our dire situation. We agree that deregulation has led to some confusion and delayed construction as competition approaches. Utilities have generally abandoned material new construction to avoid potentially stranded costs. However, the article fails to fully address the fundamental cause of the capacity shortage. None of the market participants anticipated the significant load growth and, in our view, still underestimate its impact.

We believe conventional wisdom currently holds that electricity demand is growing at a relatively modest 1.25%-1.75% per annum. Clearly, kWh demand statistics indicate that demand has slowed from respectable 5.0%+ growth in the 1950s to the 1960s. The current electric industry deregulation trend is also assumed to invigorate competition by unlocking monopoly generators and allowing free markets instead of rate-of-return regulation to set the price for electricity. This is expected to lead to significantly lower retail and wholesale prices for electricity as utilities, retail customers, and wholesale customers seek competitive bids for electricity. The current anticipated build of merchant generation plants is also assumed to eventually lead to overbuilding and hence lower prices.

Figure 3: **Rate of Change in Annual Utility Electricity Demand vs. Real GDP**



Source: Edison Electric Institute

However, what if some of these assumed outcomes are fundamentally incorrect? Our recently completed analysis prompts us to pose the following questions. What if the electric utility industry, the natural gas industry, the Street, and all the government agencies have grossly underestimated the growth in electricity demand? If the marginal demand for electricity is to be *met by natural gas-fired power plants, can our nation build them fast* enough? What if the growth in electricity demand outstrips the supply of natural gas-fired generating sets? What if the demand growth for natural gas *exceeds U.S. and Canadian supplies and their ability to deliver the gas? What* if the number of coal, nuclear, oil and gas, and hydroelectric powered generating retirements and economic displacements is far fewer than currently expected?

This report will be the first of what we expect to be a regular series of detailed topical studies to explore and evaluate the future of the electricity markets, natural gas markets, new electric generation, turbines/equipment, regional energy markets, pipeline capacity, natural gas deliverability, etc. We want to explore the various elements of the energy value chain as they apply to the supply and demand outlook for electricity and natural gas in the U.S. and Canada. The study that follows attempts to identify the relevant issues that will affect the supply and demand for electricity and we hope it will stimulate significant debate and discourse related to the future of energy in America.

ELECTRICITY IS AN INTERNET PLAY – THE OUTLOOK FOR THE DOMESTIC ELECTRICITY MARKET

The True Meaning of Convergence – Energizing Bandwidth

Btu ⇒ Electrons ⇒ kWh ⇒ bits ⇒ Megabytes ⇒ Bandwidth

Btu ⇒ Bandwidth

In our view, the true meaning of convergence is only now becoming evident. Electric utilities and natural gas pipelines have long extolled the virtuous synergies between electricity and the natural gas and telecommunications industries. The most frequently espoused convergence themes are the utilization of valuable rights of way, fuel arbitrage opportunities, *complimentary networking skills, etc.* ***The real fundamental theme that is*** **becoming more obvious is the convergence of the coal, natural gas, electric utility, and telecommunications industries as coal and natural gas are used** ***to fuel the incremental electric generation which in turn will produce the*** **additional electrons to fuel the Internet/telecommunications revolution sweeping the globe.** The developing digital economy is based on bits, bytes, megabytes, gigabytes, petabytes, and exabytes. All of these fundamental building blocks of the digital economy are based on electrons provided by electricity. As the number of bytes used by our global economies grows geometrically (or exponentially?), the demand for electric energy and the fuels to generate it will also grow rapidly.

Wholesale energy traders will continue to arbitrage fuels and electricity against time and geography. However, wholesale energy merchants will also begin to use their knowledge of bandwidth transactions to better understand energy demand in the years to come. Bandwidth is likely to be a leading fundamental indicator of energy demand and prices. Why do you think these *market participants are so eager to understand these products?*

THE PROFOUND IMPACT OF INTERNET/INFORMATION TECHNOLOGY ON ENERGY

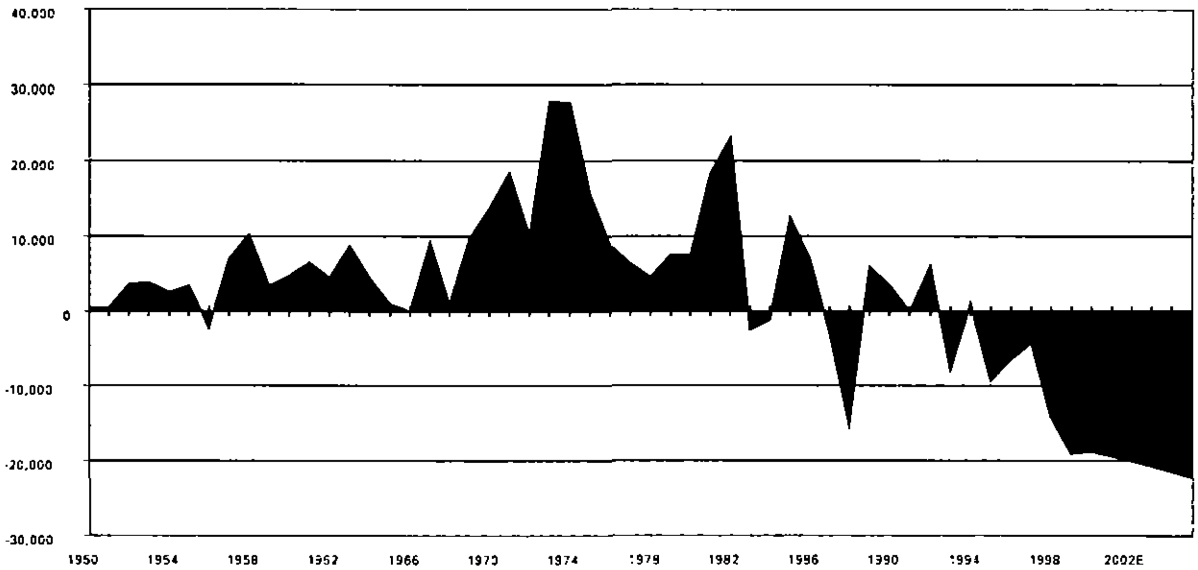
The Second American Revolution That Will Reinvigorate Energy Sector Growth

A profound structural change is remaking the U.S. and global economy. Call it the information age, digital age, digital economy, E-commerce age, Internet age, or whatever, nearly everyone agrees that the global economy is experiencing a radical transformation that can only be compared to the Industrial Revolution. In our view, the electric utility industry is also embarking on a remarkable transformation that will parallel the transformation in the economy. We believe that a technological disruption nearly equal to the introduction of electric lighting, refrigeration, or air conditioning is upon us. Integrated circuits and microprocessors are just like light bulbs. They are powered by electricity. The IT revolution could be considered akin to the rural electrification trend of the early 20th Century that brought millions of new light bulbs and appliances to residential consumers. The recent and potential increase in the equivalent of millions of electricity-consuming screw sockets should not be lost on the energy industries.

There were less than a million active Web sites on the Internet last year. In the coming decade, nearly every U.S. company and organization will have its own website, data traffic, and related equipment dedicated to this economic revolution. The problem has been that this economic transformation is such a new trend that few in the government or the energy industries have yet to fully recognize the full impact on the demand for energy. In each of the previous introductions of new transforming technologies utilizing electricity, demand growth spiked and the industry was forced to embark on a major construction binge. The energy sector, regulators, and energy policy makers have apparently missed the implications on energy consumption that the profound technological changes gripping the global economy will have. They are hopelessly focused on the relatively minor impact of industry deregulation that pales in comparison to the affect of the Internet Revolution and its indirect effects.

In the following chart, we show the difference between electricity demand and supply over the last half-century or so. After years of adding net capacity, the last several decades have witnessed a net reduction in reserve margin to the point that U.S. electricity supplies are now very tight. The chart also depicts our estimates for what we think is a very modest representation of electricity demand growth and the deficit created if new electric generation capacity is not added over the next few years. Most of this deficit will be created by new electronic information technology infrastructure being added to the U.S. economy.

Figure 4: **Summer Capability Capacity Additions Less Demand Growth**



Source. Deutsche Banc Alex Brown estimates, DOE's EIA Annual Energy Review data

The Internet is growing by several hundred percent per annum. Approximately 80% of that growth is taking place in the U.S. The Internet is essentially an American invention and most of the infrastructure and Web sites are currently housed here. Therefore, U.S. energy is used to fire most of the network.

The DOE's Digital Economy II report estimates that roughly a third of our domestic GDP is directly related to information technology related industries and that almost two-thirds of new capital investment is related to IT investment expenditures. The U.S. Department of Commerce also estimates that almost half of the U.S. workforce will be employed by industries that are either major producers or intensive users of information technology products and services.

The explosive growth in electronic equipment, computers, telecommunications, and bandwidth content will produce a dramatic shift in the demand for electricity. All elements of this dramatic shift in the economy driven by the digitization and interconnection and networking of commerce have only two elements in common. All the equipment and content utilized in this trend incorporate silicon based microprocessors and electricity. Everything is plugged in! PCs and servers are really nothing more than electron conversion devices that accept kWhs through a power source and convert, create, store, and transmit those kilowatts into digital bits. In the future, the implication of the information economy is that economic growth will be powered almost exclusively by electricity.

Mark Mills

Mark Mills is a technology strategist and commentator who has produced the best analysis of the implication of current technology trends for the energy industries we have seen. Electricity provided approximately 25% of U.S. energy demand in 1975. That figure has risen to almost 37% in recent years and could expand considerably in the next few years. The importance of electric power to the economy continues to grow with the introduction and proliferation of electronics.

He makes an excellent point in one of his many articles. He suggested that deregulation of the U.S. electric utility industry has been such a critical issue in the industry not because of the dynamic changes that would transform the industry but because the market participants and regulators essentially assumed that electricity markets were saturated and that usage would be stagnant. He is right, stranded cost issues are only relevant if electricity demand is not growing materially. Customer losses are only relevant if the numbers of customers are assumed to remain fairly constant and customer switching is assumed to be a zero sum game. If electricity growth is assumed to be strong, deregulation becomes a relatively minor issue compared with the effects of demand growth.

Mr. Mills prepared a report entitled "The Internet Begins With Coal" in May, 1999 that concludes that all the equipment necessary to run the Internet consumed about 8% of U.S. electricity demand. This estimate includes all the electricity consumed by PCs, servers, routers, switches, microprocessors, integrated circuits, peripherals, etc. that are required to operate the Internet in the U.S. He also concluded that all information technology equipment consumed approximately 13% of our nation's electricity. This figure includes the telecommunications backbone and machines that include things like fax machines. Mr. Mills has estimated that Internet based electric demand alone consumed 290 billion kilowatt hours in 1999.

He also notes the interesting dynamic that incremental PCs and Web sites beget incremental growth for each other. The more E-commerce sites, MP3 sites, and cool new broadband Internet content that are developed create new demand for PCs and related IT devices. Likewise, more Internet nodes (PCs and wireless palm devices, etc.) create incremental content supplies as the size of the market increases. Historically, new home construction of incremental light fixtures and air conditioners did not beget other new construction. The virtuous cycle of the Internet alone suggests an acceleration in electric demand growth.

He also estimates that each PC microprocessor uses 50-100 watts on peak. Many PCs and other electronic devices utilize multiple microprocessors each. With over 200 million PCs installed in the U.S. in 1999, that is a lot of watts. Further, he estimates that the average Internet based PC installation consumes approximately 1,000 kWh/year based on what he considers conservative assumptions that we believe are a gross underestimation of PC usage. His estimate represents an analysis of all the electricity consumed by PCs themselves and the support equipment that represent the various connected intranets and the Internet. Each PC is supported by servers, routers, telecommunications equipment, etc.

Consider a generic Internet browsing session intending to locate and print a document. Your office PC is connected to a company intranet with all of its assorted backbone equipment and peripherals. To connect to an Internet site, you then utilize at least four sets of local/regional telephone systems and their respective switching systems utilizing several sets of T1s, DSLs, or modems. These connections are made using at least four digital router systems, a long haul telecommunications backbone carrier and all the associated equipment involved in these enterprises. Then you may be connected to the relevant website server(s) to complete your search.

With U.S. PC shipments running over 50 million annually, this represents the need for approximately 5,700 MW of new generating capacity per year from the PCs alone. Of course, some of these PCs represent replacement equipment, but the implication of new and existing PC installations for energy use is obvious.

Some industry observers have questioned Mr. Mills' estimate that the Internet and IT equipment consume 13% of electricity in the U.S. If you doubt the estimate, just ask yourself the following question. Does the IT and microprocessor based equipment in my household consume 13% of my electricity bill over a full year? We believe most people will answer in the affirmative. The U.S. has also been spending roughly $1 trillion of our $8 trillion GDP annually on information technology capital. This represents almost 13% of GDP and supports a view that IT equipment might consume a proportionate amount of U.S. electricity demand. Of course, the IT industries are more intensive users of electricity than average commercial users but the comparison is a valid check. Finally, the DOE estimated that PCs consumed approximately 3% of electricity demand (about 20,000 MWs) in 1995 with only 43 million PCs installed. With over 200 million PCs now installed, it is fair to roughly expect PC and related equipment based electricity demand to have grown proportionately (to about 100,000 MWs). We also note the growth implications of the Internet when PC installations nearly quintuple in a remarkably short four years.

Some other interesting facts: Four million servers were installed in the U.S. in 1999. Server farms that consist of several hundred servers can have loads of over 1 MW. Computer manufacturers are also selling hundreds of mainframes per year that can use up to 1 MW each. Computer chip fabs can utilize 10-15 MW each. This is equal to an equivalent medium sized industrial customer. Mr. Mills also estimates that a 2 MB download from the Internet consumes approximately ½ kWh. At that rate, it only requires about 15 billion downloads to consume all of the annual output of a new 1,000 MW combined-cycle power plant. How many 2 MB MP3 downloads alone will be done annually in 2-3 years? Clearly, the impact of the Internet is likely to be more than material to electricity demand growth.

Based on Mr. Mills' assessment of the proportion of electricity consumption related to Internet and IT equipment demand, the Internet/PC/IT related industries have attained a 13% share of demand in only about a decade. It was only about 1989-1990 when Microsoft Windows gained widespread acceptance and the popularity of the PC exploded. This share of electricity demand equates to roughly 100,000 MW of the U.S. generating fleet. In our view, this is phenomenal growth. Clearly, the Internet and technology related equipment could soon be the largest market for electricity while also being the fastest growing proportion of the economy and the fastest growing aggregate consumer of electricity. In electric utility terms, this is an ideal situation for growth. As a result, this has direct consequences for the suppliers and transporters of fuel used to generate electricity, power plant developers, wholesale energy marketers, energy equipment providers, etc.

Some forecasts we have seen predict that 350-400 million additional PCs and Internet appliances will be sold worldwide through 2002. Intel Corporation also forecasts a 25-fold increase in the number of server installations through 2005 related to increasing Internet capacity, rising Internet content sophistication, incremental services growth, and a dramatically rising Internet population. Intel also expects the number of Internet nodes to reach 1 billion sometime in the current decade.

The truly interesting element of this technology revolution is the self reinforcing growth created by the installation of microprocessing devices. Every palm device, PC, game, Internet connection, modem, server, etc. installed each year begets others. Every time a consumer adds an incremental PC or device to the digital network, it requires more peripherals and computing/telecommunications horsepower on the digital superhighway. This creates a geometric pattern of growth that is a significant difference from the introduction of air conditioning. Only one A/C device is required for the average home. But the digital revolution continues to produce incremental electricity consuming devices for the digital home and office.

The growing broadband content involved in the development of the Internet also produces incremental electricity usage intensity. How many of AOL's 22 millions of users alone are online 2 additional hours/day in 2000 downloading large MP3 files, chatting, and exploring the Web that were not doing so 5 years ago? How many homes have multiple web surfers on multiple PCs? How many downloads are completed in the office each day?

The unavoidable result of prior industrial revolutions has been an acceleration of economic activity. We believe few observers would deny that the most recent record economic expansion has been heavily influenced by this latest economic transformation. We have not experienced regular economic growth of 4-5% since the golden age of the 1950s. Clearly, the beginning of the digital age has only begun. If this is true, strong economic growth should continue for a protracted period if punctuated by brief contractions. The unintended result of this trend is an indirect wealth effect that we believe will also raise electricity demand.

A developing Internet trend is also likely to accelerate the electricity intensive nature of the Internet. Wireless Internet and telecommunications applications are growing at an even faster rate than basic Internet growth. Wireless applications are considerably less efficient than copper wire, coaxial cable, or fiber-optic cable in transporting broadband capacity and requires more electricity. Bits and bytes are transmitted in a 360° pattern and spread out as they are transmitted over distances. The degradation in efficiency is akin to the difference between local distribution of electricity and long distance transmission of electricity over hundreds or thousands of miles in peak summer heat.

INDUSTRY ELECTRICITY DEMAND FORECASTS

For years, energy policy makers and forecasters have predicted the end of electricity demand growth. Many predicted that electric appliance and equipment efficiency improvements would lead to a *decrease* in electricity consumption. Subsequently, electricity consumption grew by almost 61% since 1980 and over 26% in the 1990s.

Electricity forecasts continue to maintain a significant bias towards underestimating demand growth. Many utilities' own recent 5-year forecasts for growth have been exceeded 2-3 years early! The generals continue to fight the last war. Much of the low growth bias is based on environmental and energy policies that were and are skewed toward views that hope fossil fuel use will wither and die.

To date, we believe few industry forecasts of electricity demand growth have yet to address the above average kilowatt-hour volume demand growth experienced over the last several years. While the forecasting agencies and industry participants have failed to look beyond their own forecasts to the recent actual results and historic averages, they have also clearly failed to investigate the true causes of the above normal demand growth. We estimate that electricity demand growth has averaged better than 3.0% per year on a weather-adjusted basis for most of the last five years.

Figure 5: **Electricity Demand Growth Forecasts**

	Forecast	Date of
DBAB	3.5-4.0%	5/00
DOE/EIA	1.40%	12/99
NERC	1.80%	7/99

Source DOE, EIA, NERC, Deutsche Banc Alex. Brown estimates

Even fewer forecasts have been adjusted to reflect the fundamental changes in the U.S. economy being affected by the Internet revolution. The fact remains that electricity consumption has risen an average of 3.19% annually since 1987 and 2.72% annually over the last 6 years, including our estimate of 1999 growth.

We have observed that most current forecasts of electricity demand growth from reputable sources see demand increasing at a very modest 1.25%-1.75% per annum. Clearly, kWh demand statistics indicate that demand has grown nearly 3.0% annually over the last 10 years and has exceeded 2.6% over 20 years. In addition, demand growth has accelerated in recent years. NERC even admits in its "Reliability Assessment 1998-2007" that recent empirical evidence has exceeded its projections by as much as 70% (which we believe is generous).

In the DOE's EIA 2000 Energy Outlook report, it estimates that the U.S. will require 300 gigawatts of new generating capacity by 2020. We hate to point out that our economy bit off about 5-10% of that forecast in 1999 alone and it had not even turned the corner on the new millennium yet. We believe the

DOE's forecast may be in serious jeopardy! Further, the DOE estimates that 90% of that generation will be installed as combined-cycle technology.

Figure 6: **Installed Electric Generating Capacity in The United States C.A.G.R. 1980-1999**

	IOUs	Gov./Muni.s	Non-Utility	Total
20 yrs.	0.29%	1.94%	11.33%	1.55%
15 yrs.	-0.31%	1.51%	15.41%	1.31%
10 yrs.	-1.33%	1.57%	13.86%	0.83%
5 yrs.	-3.08%	2.88%	18.07%	0.66%
3 yrs.	-5.48%	4.21%	29.11%	0.49%

Source: Edison Electric Institute

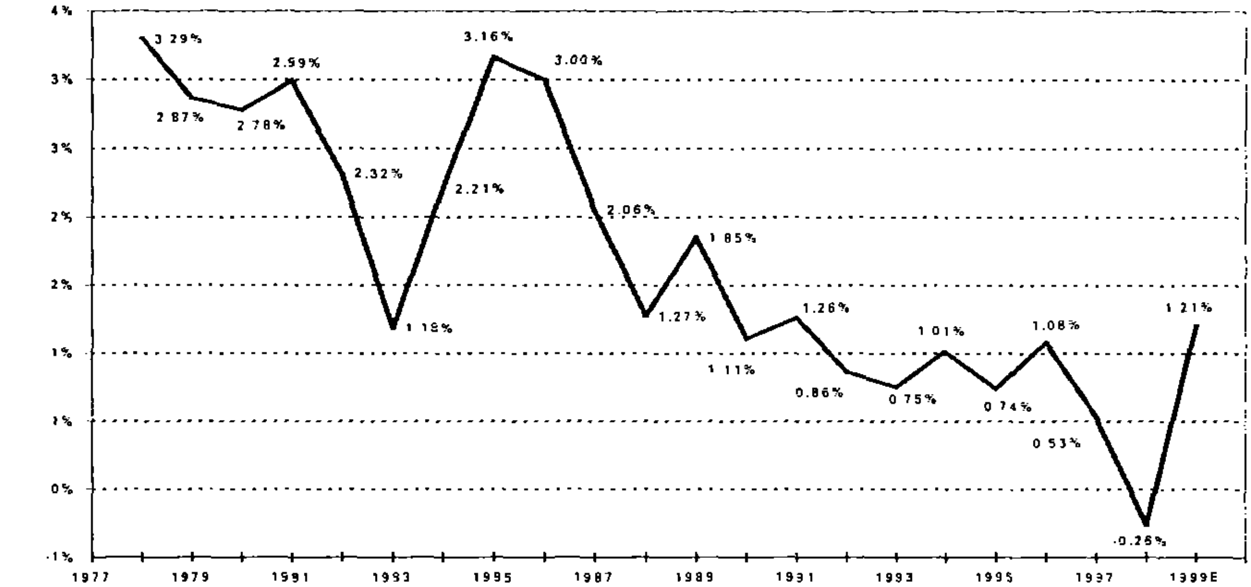
Most forecasts that we have seen assume that the U.S. needs to add approximately 150,000-200,000 MW to the generating fleet by 2010. We believe that based on the compound annual growth rates inherent in these forecasts, the capacity additions forecasted by these groups may grossly underestimate the need for new capacity.

Population growth is expected to be roughly 1% per annum alone. It would appear that most forecasters have hardly looked beyond new household formation for their forecasts. The forecasts also ignore the fact that the Generation Y generation is more than triple the size of Generation X and nearly the size of the Baby Boom generation. The members of this generation are between the ages of 3-24 and some are just beginning to enter their maximum electricity usage years. Demographics alone would suggest that electricity demand should accelerate due to the increase in the number of heavy electricity users.

We believe that the risk to electricity demand forecasts is in being conservative. Bandwidth content is expected to grow at a geometric rate over the next decade. All the bits involved in that bandwidth and the equipment related to the generation, transmission, and receipt of that bandwidth cannot even be fathomed at this point. In our view, electricity demand growth is more likely to accelerate than decelerate from recent or historical norms. This implies electricity demand growth of 3.0%-4.0% annually, in our view. Mark Mills also estimates that the IT revolution may add 2-3% to electricity demand growth.

In the U.S. Department of Commerce's June, 1999 report, "The Emerging Digital Economy II," we did not find one reference to the importance of electricity supplies or demand in relation to the successful exploitation of the digital economy. However, EIA's *Annual Energy Outlook 2000* report suggests that electricity demand growth should continue to approximate economic growth as measured by GDP. Based on the recent growth in the economy of better than 5.0%, we would have thought that energy policy makers and forecasters might have noticed the relevance of electricity in supporting continued economic strength. How can our Department of Energy recognize strong economic growth and the relationship to electricity demand growth and yet fail to incorporate these facts in its own electricity forecasts?

Figure 7: Annual Increase in U.S. Installed Generation Capacity



Source: DOE, Deutsche Banc Alex. Brown estimates

We believe electricity demand forecasts have ignored a fundamental paradigm shift in American industry and household electricity usage. Our observation has been that electricity usage is exploding in the household. The penetration of telecommunications equipment, computer equipment, electric appliances, and entertainment equipment in just the average U.S. home has been staggering. Through the early 1980s, the average household may have had two television sets, a small stereo, a VCR, and various kitchen, garage, and bathroom appliances. A long period of economic prosperity has propelled the growth of new electric devices. Today, the average household has multiple cellular phones, walkie-talkies, rechargable batteries, flashlights, various fume detectors, alarm systems, sprinklers, Jacuzzis, laptops, PCs, monitors, printers, modems, ZIP drives, fax machines, stereos, VCRs, DVDs, CD ROMs, Nintendo/Sega game appliances, etc. Braun, GE, Black & Decker, CuisineArt, and Kitchen Aide have endeavored to sell every possible electric kitchen and garden convenience and tool known to man. Now Ron Popeil is selling indoor rotisserie grills by the millions. To house all of these electricity gobbling machines, the size of American dwellings is also increasing. Due to the long period of prosperity, Americans have also become less sensitive to their electric and natural gas bills, increasing usage for heating and cooling. These are some of the indirect benefits of a strong economy created by the emerging digital economy.

Commercial and industrial consumers have also increased the intensity of their usage of electricity. Fifteen years ago, most offices were equipped with lights, a phone, and maybe a desk calculator or a typewriter. Today, most offices have at least a computer, a monitor, and multiple peripherals. That equipment is then supported by multiple electronic devices in the IT department. Throughout the average commercial office floor are dozens of fax machines, printers, copy machines, etc. Industrial consumers are likewise utilizing more electricity and electronic components to produce their products.

Other potential future electricity intensive industries could also develop. The transportation sector currently utilizes less than 1.0% of its energy consumption in the form of electricity. As urban areas add additional subways and consumer trains, and as electric or electric hybrid vehicles gain acceptance, electricity is likely to gain market share in this large and important sector. *Environmental concerns will simply require this trend.*

UNIVERSAL ASSUMPTIONS

The following are a number of the assumptions and key strategic drivers that we believe will impact the forward supply and demand curves for electricity. We use many of these assumptions in our supply/demand scenarios that follow. We believe that electricity supply is inherently a demand-pull proposition that was once heavily influenced by a portion of supply-push dynamics as a result of regulatory intervention. In our view, the capital-intensive nature of power plant construction requires a pretty clear vision of pending demand for the developer/utility to even begin to plan a new facility.

For most of this industry's existence, aggregate electricity demand has also been a relatively slow moving target even during periods of high growth. Utilities could afford to wait until demand was evident before constructing plants. We continue to believe that supply will rise to meet demand and not vice versa. In our view, electricity markets will not fully respond to demand until industry trade associations and government policy makers reflect more accurate growth assumptions in their forecasts.

Technology

We assume that a disruptive technological revolution is transforming the U.S. and Canadian economies. Electricity demand from computer/IT equipment and bandwidth will be at least orders of magnitude above 1999 levels. This segment of electricity demand (both households and businesses) will be the largest segment of consumption of kWhs and also the fastest growing. It has been some years since the largest consumer of electricity has also been the fastest growing. This has not occurred since the household formation/baby boom following the end of World War II. We assume that this change in our lifestyles and economy will lead to above trend electricity demand growth for at least the next decade. Electricity will be the incremental fuel that powers commerce, entertainment, and the economy.

Economy

While we do not forecast a recession over the next 11 years, we are certain one will occur. However, we believe that an economic downturn is unlikely to materially affect net general economic or Internet/technology related growth over the entire period. We also believe that the technological revolution sweeping the global (and particularly the U.S.) economy is a major paradigm shift that is likely to produce significantly higher than normal economic growth for a protracted period. We believe the indirect effect of this excess growth will promote higher electricity demand growth beyond the direct impact related to Internet and IT driven electricity demand growth.

Well-regarded Forbes technology columnist, and Mark Mills' colleague, Peter Huber, even postulates that a reduced reliance on physical inventories and traditional capital equipment reduces the cyclicality of economic activity. He also suggests that the greater availability or real time information afforded by technological innovation and the Internet may improve information flow that reduce the risk of recession. Maybe the Internet revolution accelerated economic growth and reduced the risk of economic contractions at the same time! Probably not.

We assume that real economic growth will average 3%-4% over the next decade as the installation and refinement of the infrastructure of the digital economy is completed. We also expect electricity demand growth to roughly equal real GDP growth. Electricity intensive industries are growing rapidly and becoming a larger proportion of the economy. It is also reasonable to expect that electricity demand growth will exceed a historic average that is almost 3%.

The following table shows that electricity demand growth has tended to mirror real GDP growth but has lagged by 100-150 basis points. We expect that spread to narrow. Electricity demand growth has tended to exceed GDP growth at other major inflection points in electric intensive technologies. We merely expect parity.

Figure 8: **Annual Energy Sales Growth - Total Electric Utility Industry**

	20 Yrs.	8 Yrs.	5 Yrs.	3 Yrs.
Mean	2.41%	2.39%	2.60%	2.52%
Median	2.63%	2.73%	2.82%	2.88%
CAGR	2.40%	2.38%	2.60%	2.52%
STD	1.72%	1.28%	0.68%	0.00%
# > 2.5%	11	4	4	2
# < 2.5%	9	4	1	1
# < 2.0%	6	3	1	1
# < 1.5%	5	2	1	1

U.S. Real GDP Growth

	20 Yrs.	8 Yrs.	5 Yrs.	3 Yrs.
Mean	3.20%	3.63%	3.86%	4.31%
Median	3.49%	3.84%	4.12%	4.30%
CAGR	3.21%	3.20%	3.30%	4.31%

Note: Based on GWH sales by utilities to ultimate customers.
Electric data through 1998, GDP through 1999.

Source: Edison Electric Institute

Efficiency Improvements

Electric appliances and PCs and their peripherals have clearly become more efficient over time. We are certain that the efficiency of lighting, HVAC, motors, fans, etc. will continue to improve as technology advances rapidly. However, we believe the sheer volume of demand growth will far outstrip any efficiency gains achieved. Therefore, we are ignoring technological efficiency gains as a major issue. Efficiency gains have not led to a decrease in electricity demand historically and we do not expect them to in the future.

Environment

We recognize that environmental groups and the government have espoused plans to significantly reduce fossil-fueled generation from the U.S. fleet. The Kyoto Protocol would also require the retirement of a significant portion of the coal-fired and oil-fired generation fleet or vast expenditures for the installation of pollution control devices. This would be very beneficial to new generation developers in terms of either replacing this retired generation or would allow new gas-fired generation major economic advantages over the retrofit coal and oil generation. We believe the demise of existing coal and fossil-fueled generation is greatly exaggerated. The sheer volume of plant capacity in question is too extreme to be practically retired. Economic growth would have to be jeopardized to meet the demands of the Kyoto Protocol or President Clinton's or Vice President Al Gore's aspirations. Nevertheless, some of our scenarios assume that plant retirements will be heavily influenced by environmental issues.

Retirements/Displacements

We also began our analysis with the conventional assumption that a significant number of existing coal, natural gas, and nuclear generation units would either be retired due to age or displaced due to economic necessity. The newest combined-cycle technology being installed is 30%-45% more fuel efficient than existing natural gas-fired power plants. Clearly, a significant number of legacy plants are either old, inefficient, or too dirty to remain economically viable.

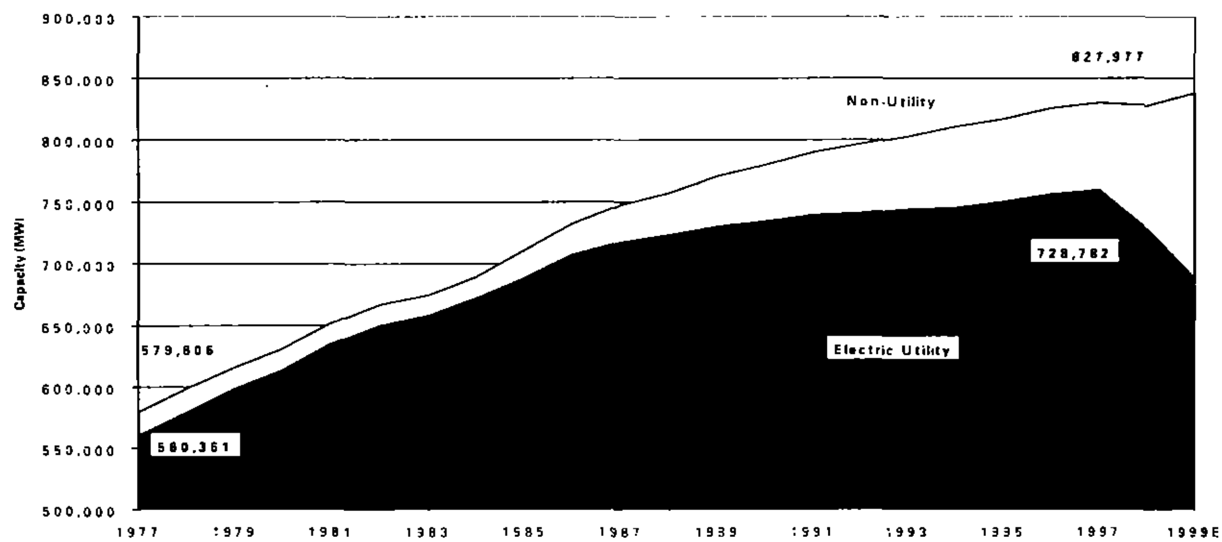
In our scenarios, we assume that the generation capacity displaced and retired is replaced by generation capacity equal to only about 70% of the nominal retired and displaced capacity. We assume that new generating units will operate at higher capacity factors and fuel efficiencies, requiring less nameplate generation to achieve the same output.

Generation

We believe that most industry participants expect natural gas-fired combined-cycle generation to be installed as the industry standard. Currently, only about 10%-11% of the U.S. electric generation fleet is fired by natural gas. We expect that proportion to grow significantly over the next decade.

We utilize Edison Electric Institute's data for our initial installed nameplate generation in the U.S. Our initial installed generation base includes investor owned utilities, municipal utilities, independent power generators, and co-operative utility owned generation capacity (summer capabilities). We reduce that national capacity of about 830,000 MW by a portion of the independently owned generation equal to approximately 40,000 MW. We assume that capacity is roughly the amount of industrial self-generation that will not participate materially in general economic growth.

Figure 9: **U.S. Electric Generation Capacity**

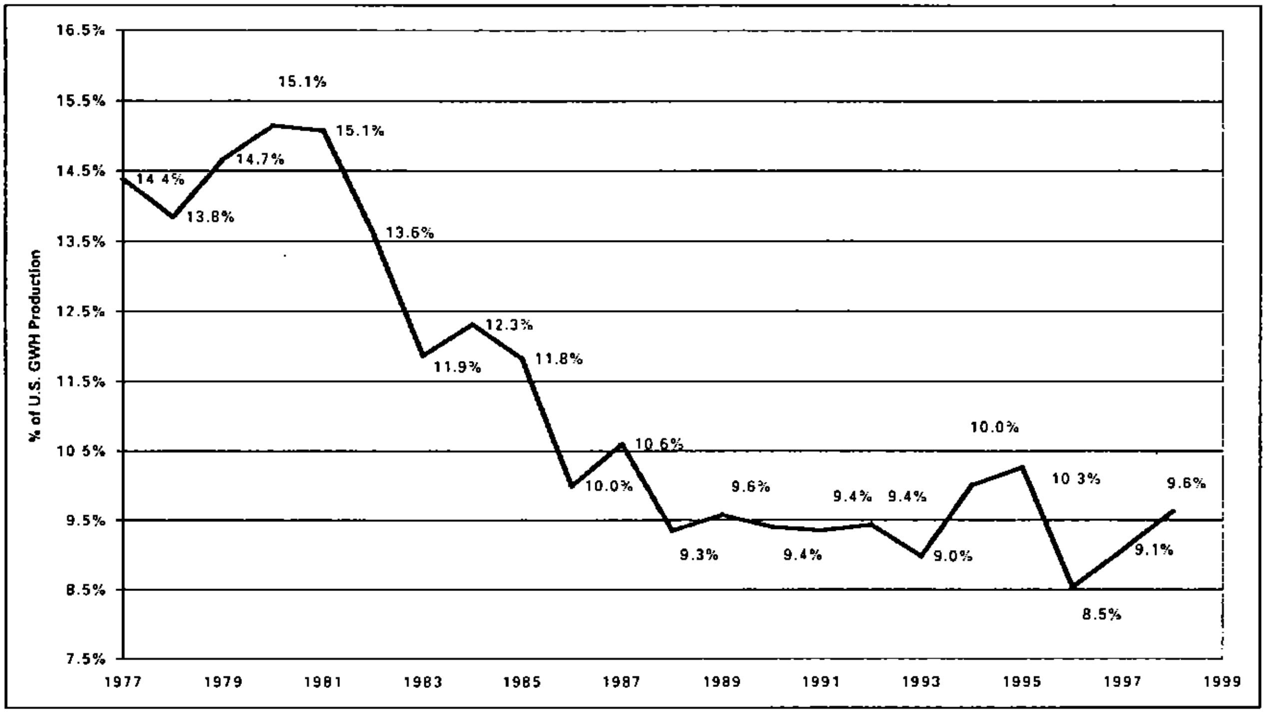


Source Edison Electric Institute

Figure 10: **Electric Utility Generation by Fuel Source**

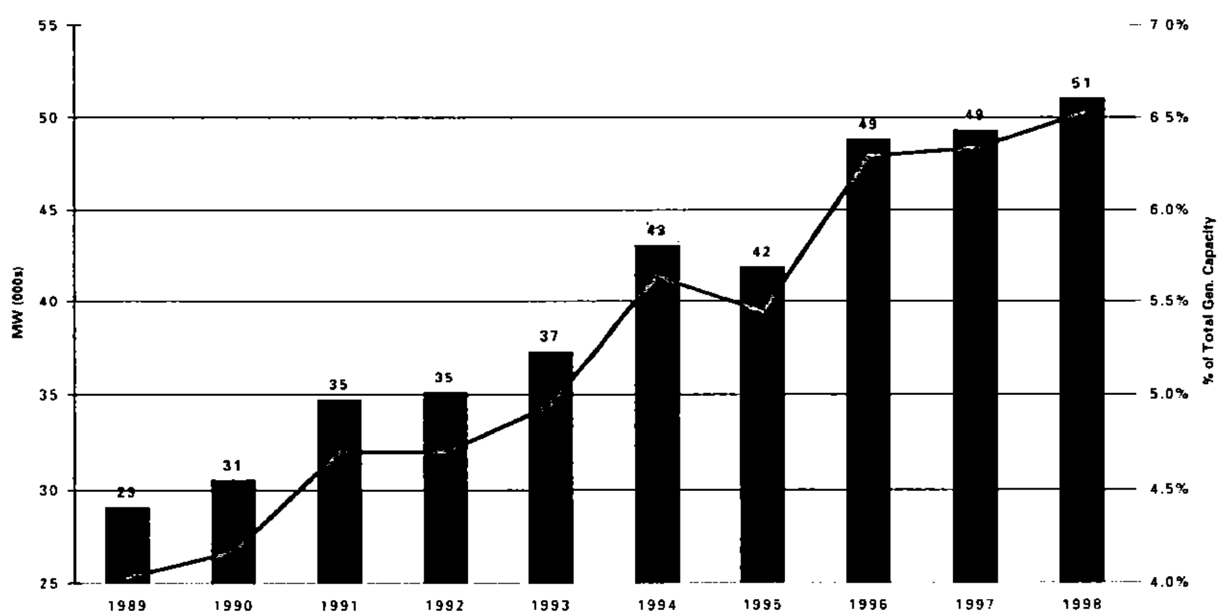
Source: Edison Electric Institute

Figure 11: **Natural Gas Share of U.S. Utility Electric Generation**



Source: Edison Electric Institute

Figure 12: **U.S. Natural Gas-Fired Generation Capacity**



Source. Edison Electric Institute

Distributed Generation

We do believe that the market for distributed generation (DG) will be very significant. Clearly, the market for microturbines and fuel cells will support hundreds of thousands of units over the next decade. However, we believe the rage over distributed generation has been overhyped.

Proponents, and particularly the press, have nearly canonized distributed generation as the savior of electricity production. They have suggested that fuel cells will be cleaner, cheaper, and more efficient than central station generation. Some proponents even suggest that fuel cells will free electricity from dependence on fossil fuels. The fact is that fuel cells eliminate the combustion of fossil fuels, but not their use. Microturbines however, do combust fossil fuels to generate electricity (and somewhat less efficiently in most cases). Also, just for the record, fuel cells are not currently the size of refrigerators either.

The Gas Research Institute's (GRI) Microturbine Market and Industry Study found that 'the market for microturbine products will total $2.4 billion to $8.0 billion' by 2010. Based on Capstone Turbine's 30 KW, $30,000 turbine, this implies an annual market for 80,000-267,000 microturbines. This also implies a capacity market of 2,400 MW-8,000 MW in 11 years. Similar projections for the growth in fuel cells predict major installations of the new technology. However, most fuel cells are targeted to residential applications of less than 10 kW. This implies the need to install hundreds of thousands of units to replace even a modest number of central station power plants.

We do not believe DG will replace central station generation in a material fashion. DG will attain a significant market share of incremental generation in the next decade of maybe 5-10%. However, most DG will complement the grid through backup generation, niche markets, and in international applications. Therefore, DG is not a major component of our analysis.

Backup Power

The technology revolution is also creating a significant demand for incremental electric reliability measures. While we believe utilities provide a very reliable electric grid with reliability that is measured at roughly 99.99%, new digital economy participants can ill afford reliability that is not almost perfect. Electric utility reliability standards generally require less than 10 hours of aggregate outages per year. For an equipment manufacturer, an Internet portal or a single microprocessor wafer FAB, 10 hours of lost electricity supply can be a tragedy.

Therefore, we expect a major trend in the installation of distributed backup power supplies and power conditioning equipment. We doubt that these digital economy participants will simply self-generate and drop off the grid, but some will. More likely, these consumers will have significant backup and conditioning equipment on site. This represents both a challenge and an opportunity. Utilities may lose some customers but we believe it is more likely that this trend will allow utilities, energy services providers, and power plant developers to provide multiple services to customers in the form of grid based and enhanced reliability support services. Therefore, we do not assume significant self-generation as a major element.

Peaking Generation

We recognize that a significant portion of natural gas-fired combustion peaking capacity is currently being installed and is planned for the next few years. This new capacity provides for additional optionality of supply and new generation products for wholesale marketers. Utilities are also installing peaking generation to meet higher peak demand as a temporary measure. However, we believe that the fundamental growth we expect in electricity demand and the baseload nature of technology related demand growth will require vastly more installation of baseload generation than peaking capacity.

Our analysis of the natural gas consumption of peaking plants also suggests that peaking generation has only a modest impact on natural gas fuel consumption. We estimate that it would take over 114,000 MW of peaking generation operating for 10% of available annual hours at a 10,000 Btu/kW heat rate to consume 1 Tcf of natural gas. This represents relatively minor competition for fuel compared to the potential demand generated by new CCGT generation. The competition for combustion turbines from new peakers is a more serious issue. Nevertheless, we essentially disregard incremental peaking capacity additions as a relatively modest impact on future generation capacity growth.

Reliability/Transmission

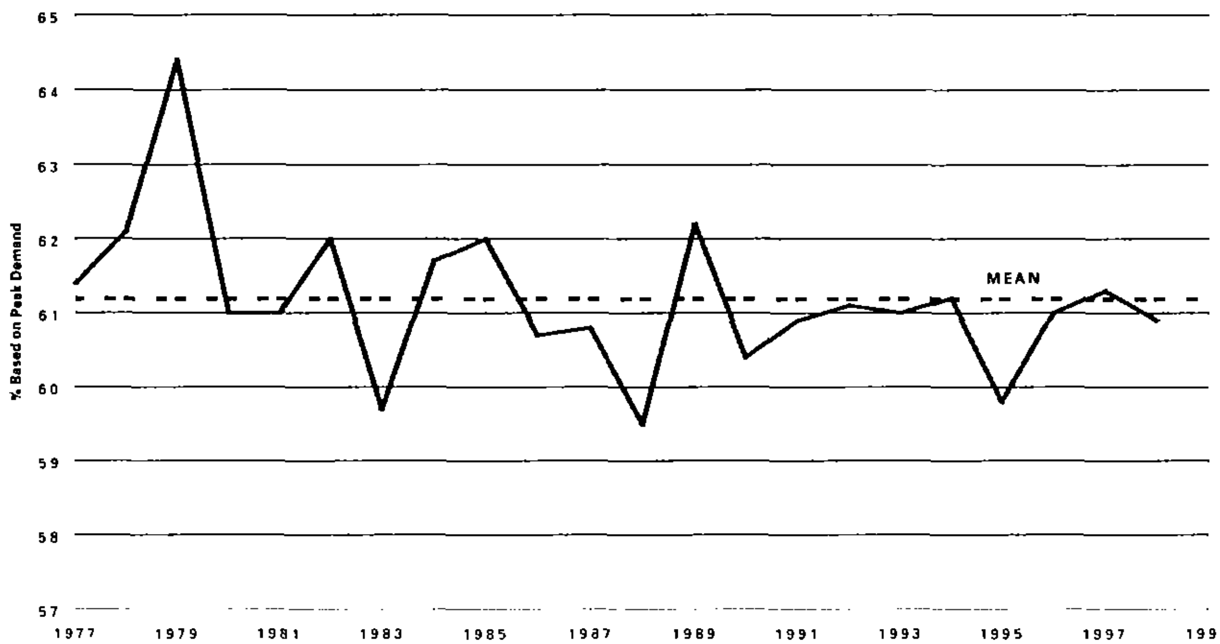
The recent unusual May, 2000 heatwave demonstrated the importance of electric reliability. NERC reports that only 6,588 miles of new transmission (230 kV or above) is planned to be added in North America over the next decade. This represents a 3.4% increase in transmission capacity to the roughly 196,000 miles installed at year-end 1998. We assume that significant new transmission capacity will be added to allow the construction and safe, effective transmission of new electric generation supplies. However, evidence of this effort has failed to materialize in any material fashion.

Failure to adequately address T&D expansion will severely hamper the ability of new merchant generation to meet demand. Utilities are already experiencing circuit overloads on their systems. Adding thousands of new MWs of generation supplies will not improve the situation in a vacuum. Our scenarios do not account for the needed transmission capacity to ensure system reliability. We focus on demand and the kWhs needed to meet new demand. It is fair to say that if the necessary T&D expenditures are not made, capacity shortages will be worse than that created by a shortage of new generation capacity alone.

Capacity Factor

A plant's or utility's capacity factor measures the utilization of assets relative to peak demand. Utilities would appear to have a lot of room to improve their asset utilization. The mean utility load factor consistently has averaged just over 61% for the last quarter century. We began our analysis believing that generators had a major opportunity to add new generating capacity by *merely increasing their utilization of existing plants and transmission.* The conventional wisdom has held that utilities have not been motivated to optimize resource utilization in a regulated market. The thinking has been that as generation was released to non-regulated subsidiaries, new generating capacity would materialize from the installed plants. Recent evidence has not borne out that assumption. Nevertheless, we have assumed that some net increase in generation capacity is achieved in some of our scenarios.

Figure 13: **Annual Peak Demand Load Factor U.S. Electric Utilities**



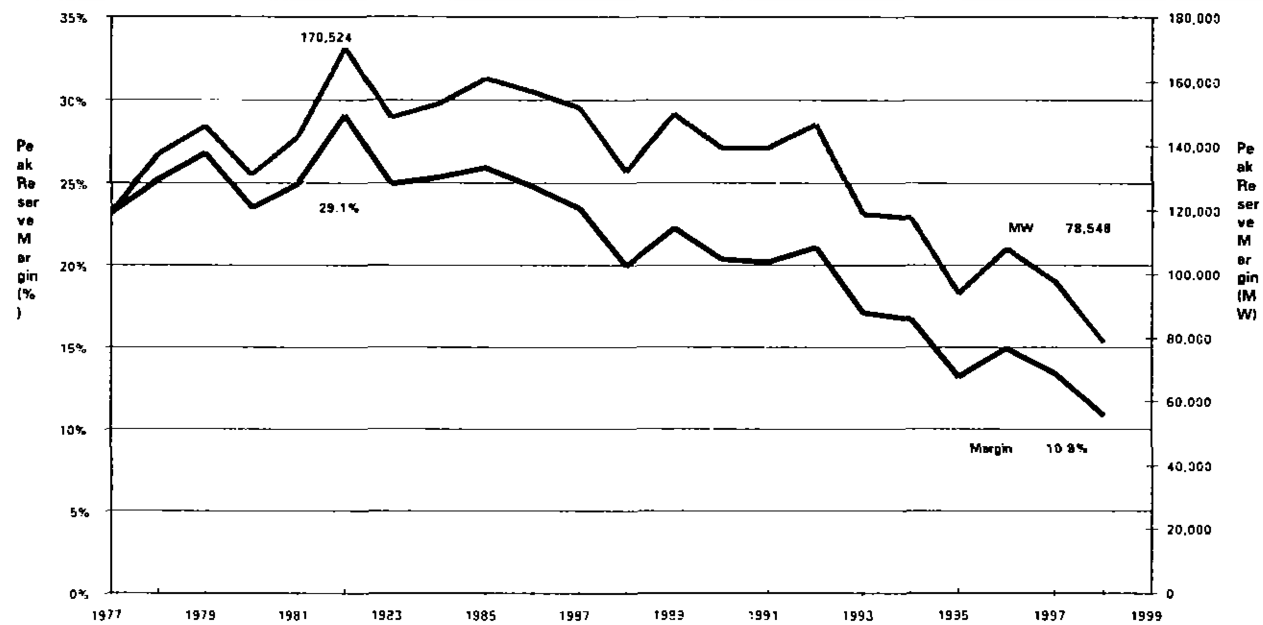
Source: Edison Electric Institute

Reserve Margin

We assume that the nationwide electric utility reserve margin declined to approximatley 10.0% in 1999 (actual results are not yet available). The national reserve margin declines further when one considers the non-utility generation maintained by IPPs, merchant generators, and industrial cogeneration and self-generation. These industry participants tend to run their facilities with less reserve margin and at higher capacity factors than utilities.

We also assume that roughly a 10% reserve margin will need to be maintained to ensure system integrity. As existing installed generation is pressed to its breaking point over the near-term, incremental forced outages are likely to increase in the future. New combined-cycle generation plants are also generally less reliable over the long-term than existing generation, of which the majority is very reliable coal generation. Combustion turbines just break more frequently. Normal maintenance, storm damage, transmission constraints, etc. will require the maintenance of a significant reserve margin, in our view. The only question remains whether that margin will be 5% or 10% or more. However, a significant reserve margin will need to be maintained. In some of our scenarios, we allow reserve margins to decline as a conservative assumption and in others, we maintain a constant reserve margin.

Figure 14: **Electric Utility Generation Peak Reserve Margins**



Source: Edison Electric Institute

CONSTRUCTION CONSTRAINTS

As we see it, there are generally five principal constraints to building new electric generation facilities: permits/siting, capital funding, fuel supply, power plant equipment availability, and plant construction. We analyzed each of these elements of plant construction as part of our scenarios.

Capital

Power plant construction is a very capital-intensive enterprise. A new natural gas fired combined-cycle power plant costs $450-$600/kW or about $500 million per 1,000 MW plant. We assume that capital will be available for successfully developed projects. The U.S. is awash in relatively cheap capital and the electricity supply is too critical to our future economic interest to be constrained by financing. Power plant developers also have numerous avenues for pursuing plant financing. Project level financing and corporate level debt are the traditional avenues for financing power plants. Leveraged operating leases are a popular and growing source of funds. Partnerships are also a popular method for financing and reducing risk. We know of few legitimate power plant projects supported by financially sound power plant developers being rejected by financial backing.

Natural Gas

We started our analysis with the conventional assumption that most new power plant construction will be fired by natural gas. Currently, most peaking combustion turbines and CCGTs are fired by natural gas and/or jet fuel. While many have multiple fuel capabilities, few are likely to utilize oil under most market conditions. Given the fact that fuel accounts for 80% or more of the costs of a generation facility, one of the principal constraints for building a power plant is the availability of economical sources of fuel.

The following table analyzes the natural gas fuel consumption of both combined-cycle plants and peaking units under various capacity factor and heat rate assumptions. We assume that state of the art installation of 20,000 MWs of combined-cycle power plant capacity will burn approximately 1 Tcf of natural gas annually. We assume a whole bunch of peaking plants would be required to compete for the same amount of gas. Therefore, we largely exclude peaking plants from our analysis. We also assume that the exisiting natural gas market consumed approximately 21-22 Tcf in 1999.

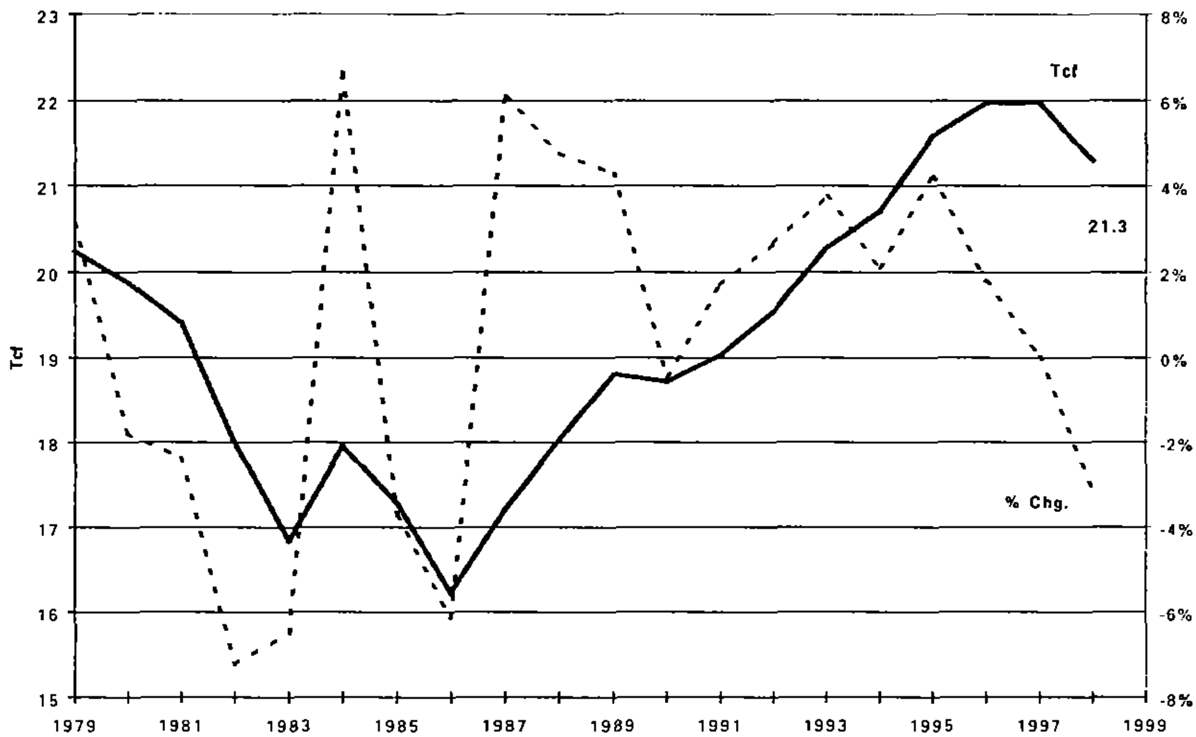
Figure 15: **Estimated Gas Demand from Incremental Natural Gas-Fired Electric Generation**

			CCGT			
Plant Capacity (MW)	1,000	1,000	1,000	1,000	1,000	1,000
Capacity Factor	**65.00%**	**85.00%**	**95.00%**	**65.00%**	**85.00%**	**95.00%**
KWHs Produced	5,694,000,000	7,446,000,000	8,322,000,000	5,694,000,000	7,446,000,000	8,322,000,000
Plant Heat Rate	**6,700**	**6,700**	**6,700**	**7,000**	**7,000**	**7,000**
Fuel Consumption						
MMBtu	38,149,800	49,888,200	55,757,400	39,858,000	52,122,000	58,254,000
Bcf	38.15	49.89	55.76	39.86	52.12	58.25
Tcf Consumed	0.0381	0.0499	0.0558	0.0399	0.0521	0.0583
MW/ 1 Tcf Gas Burn	**26,212**	**20,045**	**17,935**	**25,089**	**19,186**	**17,166**

			COMBUSTION TURBINE PEAKERS			
Plant Capacity (MW)	1,000	1,000	1,000	1,000	1,000	1,000
Capacity Factor	**8.00%**	**9.00%**	**10.00%**	**8.00%**	**9.00%**	**10.00%**
KWHs Produced	700,800,000	788,400,000	876,000,000	700,800,000	788,400,000	876,000,000
Plant Heat Rate	**10,000**	**10,000**	**10,000**	**11,000**	**11,000**	**11,000**
Fuel Consumption						
MMBtu	7,008,000	7,884,000	8,760,000	7,708,800	8,672,400	9,636,000
Bcf	7.01	7.88	8.76	7.71	8.67	9.64
Tcf Consumed	0.0070	0.0079	0.0088	0.0077	0.0087	0.0096
MW/ 1 Tcf Gas Burn	**142,694**	**126,839**	**114,155**	**129,722**	**115,308**	**103,778**

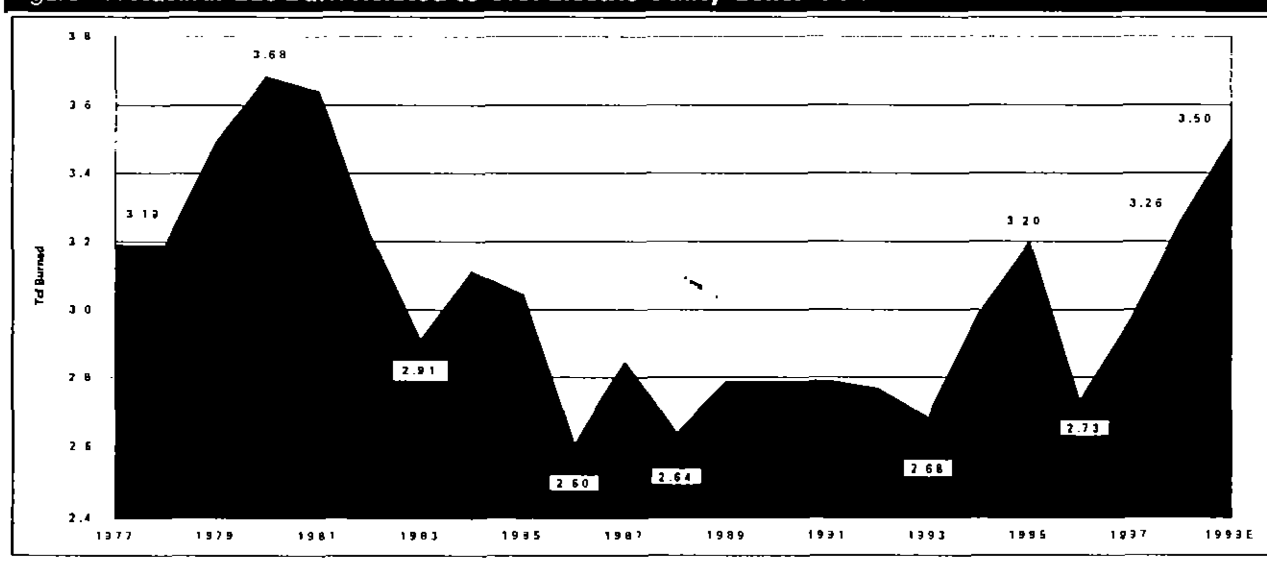
Source: Deutsche Banc Alex Brown estimates

Figure 16: **U.S. Natural Gas Consumption**



Source: Edison Electric Institute

Figure 17: **Natural Gas Burn Related to U.S. Electric Utility Generation**



Source: Edison Electric Institute

Coal

We began our investigation with the conventional wisdom that coal-fired generation was not the relevant fuel for incremental electric generation. We assumed that public opinion and environmental groups would not support new coal construction. In fact, we assumed that the EPA's recent actions against coal plants would lead to a significant net reduction in coal-fired generation. Likewise, we assumed that nuclear and hydroelectric generation had little support for new construction.

Equipment/Turbines

Much of the recent analytical focus of the forward electricity supply market has centered on the availability of natural gas-fired combustion turbines for new electric generation projects. There is clearly a current shortage of combustion turbine equipment. Merchant generators are now signing supply contracts for combustion turbines that will be delivered in 2004-2005. Most of the supply of turbines for delivery in 2003-2004 has been locked up by the likes of Calpine, Duke, Dynegy, and Entergy.

We understand that GE currently produces approximately 180 F Class combustion turbines and Siemens-Westinghouse produces roughly 60 F Class turbines that are generally the basis of most new central station CCGT's. Additional turbines, in significantly smaller volumes may be supplied by other Japanese and European sources.

Generation growth in the rest of the developing world is expected to require new capacity additions of 3-4x that of the U.S. Therefore, U.S. turbine demand will have to compete with the rest of the world for equipment. U.S. projects will also have to begin competing for turbines now that the U.K. gas-fired generation moratorium appears to be nearing an end.

In its 1999 annual report however, GE Power Systems (GE's electric generating equipment subsidiary) indicated that its backlog of orders for turbines cannot deliver new turbines before 2004. However, it also said it will triple its gas turbine production volumes by 2001. We analyze turbine availability as a major component of our investigation.

Plant Construction

Power plant developers also require sufficient availability of engineering and construction resources. Given the number of infrastructure projects (and specifically power projects) being developed, the simple issue of constructability will be critical. Construction labor alone will be a major issue. With tight labor markets nationwide, finding enough labor to construct dozens of power plants annually in a very labor (and skilled labor at that) intensive business could be a significant constraint as an average of more than 80 new construction projects could be required each year for the next decade. This is also an important element of our analysis.

Permits/Sites

The final constraint that power plant developers face is siting and permitting new greenfield construction, brownfield development, and existing plant expansions and retrofits. Currently, this is perhaps the most difficult hurdle to overcome in new merchant power plant development. Unfortunately, we cannot quantify this constraint in our analysis, but it is fair to assume that permitting and siting is constraining generators' ability to meet demand.

Volatility/Prices

We began our analysis believing in the conventional wisdom regarding future electricity prices. Deregulation would create competition that would drive down retail and particularly wholesale electricity prices over time. The deregulating market would also follow the pattern of other deregulated industries. The construction of new merchant generation would eventually lead to overbuilding, excess capacity, and a glut of electricity that further reduces electricity prices. After completing our analysis, we are less convinced that this pattern will be replicated in the electricity market over the near-term.

OUR FUTURE GENERATION SUPPLY/DEMAND SCENARIOS

We assume that demand will beget supply. Essentially, our what-if scenarios examine demand and we assume that supplies are added to meet demand and produce market equilibrium. In our opinion, merchant power plant developers are not building new iron based on speculation. However, while we expect supply to match demand in our analysis, supply additions could lag or lead demand growth. Most analysts and industry participants assume that supply will exceed demand in the same manner experienced in other deregulated industries.

Our various scenarios represent projections of demand growth and the resulting need for new generation supply. Our analysis is based on aggregate national supply and demand. Our initial study does not explore the various regional market dynamics inherent in the market. In each of our scenarios, we present four separate tables: a capacity (MW) forecast for supply and demand that assumes supply matches demand growth, a table that depicts the number of CCGT plants and turbines that might be utilized to meet our capacity forecast, a table that assesses the natural gas fuel demands of our capacity forecast in CCGT mode, and a table that depicts capacity margins as a result of our capacity forecast.

SCENARIO #1 – THE WOW SCENARIO

Analysis

Our first scenario assumes a number of elements of the conventional wisdom and some of our own assumptions. Our first scenario assumes a 1.5% annual rate of electricity demand growth related to general economic growth. We also assume that Internet and Information Technology-related demand growth will add another 2.5% annually to electricity demand. Due to the current low level of reserve margins and due to the baseload nature of technology related electricity demand, we also assume that new generation demand requires the installation of new baseload generation to meet peak demand. While we admit that a significant portion of peaking generation will be installed over the next decade, it is less likely to materially affect our analysis than baseload generation.

We also assume a 1.5% annual rate of existing generation capacity retirements (as of year end 1999 levels) and a 2.0% annual rate of economic displacement due to the superior economic efficiency of new installed generation. We then assume that the generation capacity displaced and retired is replaced by generation capacity equal to only 70% of the nominal retired and displaced capacity (MWs) as new generating units will operate at higher capacity factors and efficiency. Our initial installed generation base includes investor owned utilities, municipal utilities, independent power generators, and co-operative utility owned generation capacity (summer capabilities). We reduce that nationwide capacity of about 830,000 MW by a portion of the independently owned generation equal to approximately 40,000 MW that we assume is roughly industrial self-generation that will not participate materially in general economic growth. We also assume that installed generation at the beginning of each year includes the addition of prior year growth and new incremental reserve margin from the prior year required to maintain a constant 10% reserve.

We do not assume any capacity additions from increased capacity factors on existing installed generation. We exclude any capacity additions for reliability measures. Nameplate additions may also underestimate the actual summer capacity required to meet peak summer demand due to lower summer capabilities and line losses. Reserve margins (in MW) could actually increase as plants get closer to actual demand areas, to provide for currently interruptible load, and to provide a margin of reliability.

We utilize the EEI and U.S. Department of Energy, Energy Information Administration data for the current installed U.S. generation fleet. We then add and reduce to that baseline 1999 generation portfolio to derive the potential future market for generating capacity. We then apply our estimates for fuel consumption and power plant construction. We also assume that the nationwide reserve margin declined to approximately 10.0% by year end 1999.

Figure 18: **Potential Baseload Electric Generation Supply/Demand Growth '00-'10**

	Total Generating Capacity MW	Economic Add 1.5%	Internet/IT Add 2.5%	Normal Retire.s 1.5%	Economic Displace. 2.0%	Increased Capacity Factor	New Reserve Addition	Total Net Peak Add.	New Capacity Need
1999	**790,000**								
2000	821,161	11,850	19,750	8,295		0	3,116	43,011	5.44%
2001	853,707	12,317	20,529	8,295		0	3,255	44,396	5.41%
2002	887,700	12,806	21,343	8,295		0	3,399	45,843	5.37%
2003	917,936	13,315	22,192	8,295	11,060	0	3,024	57,887	6.52%
2004	949,517	13,769	22,948	8,295	11,060	0	3,158	59,231	6.45%
2005	982,501	14,243	23,738	8,295	11,060	0	3,298	60,634	6.39%
2006	1,016,951	14,738	24,563	8,295	11,060	0	3,445	62,100	6.32%
2007	1,052,932	15,254	25,424	8,295	11,060	0	3,598	63,631	6.26%
2008	1,090,512	15,794	26,323	8,295	11,060	0	3,758	65,230	6.20%
2009	1,129,763	16,358	27,263	8,295	11,060	0	3,925	66,901	6.13%
2010	1,170,758	16,946	28,244	8,295	11,060	0	4,100	68,645	6.08%
Total Add	**380,758**	**157,390**	**262,317**	**91,245**	**88,480**	**0**	**38,076**	**637,508**	**80.7%**
'00-'10									
Average		14,308	23,847	8,295	11,060	0	3,461	57,955	
Median		14,243	23,738	8,295	11,060	0	3,399	60,634	
CAGR	3.6%							5.5%	

Notes:
Analysis assumes 1.5% annual rate of electricity demand related to general economic growth translates into an equivalent rate of new baseload generation supply. Also assumes Internet and related IT technology growth adds 2.5% to annual electricity demand and hence baseload generation supply. We also assume a 1.5% annual rate of retirement for existing generation capacity (as of year end 1999) and a 2.0% rate of economic displacement due to economic inefficiency. We then assume that only 70% of retired and displaced MWs need to be replaced as new generating units will operate at higher capacity factors and efficiency. Our initial installed generation base includes IOU, municipal, independent, and co-op owned generation capacity less a portion of independently owned generation equal to approximately 40,000 MW that we assume will not grow materially. Installed generation at beginning of year includes addition of new incremental reserve margin from prior year to maintain 10% reserve.

Excludes increased capacity for reliability measures. Reserve margin (in MW) could actually increase as plants get closer to actual demand areas, to provide for interruptible load, and to provide a margin of reliability.

Source. EEI & DOE data, DB Alex. Brown estimates

Conclusions of Scenario

This scenario concludes that the U.S. needs approximately 381,000 new net MWs of peak generating capability, a 3.6% compound annual increase in capacity. This includes roughly 420,000 MW of new incremental demand growth, and 38,000 from reserve additions, offset by a roughly 78,000 MW net reduction of capacity due to retirements and economic displacements (we assume that fewer nameplate MWs will be required to meet the same demand due to higher capacity factors and efficiency). Total new power plant additions are then roughly 638,000 MW, a 5.5% compound annual addition to capacity. This scenario involves adding an average of nearly 58,000 new megawatts of capacity each year from 2000 through 2010.

Assuming that all the additional capacity requirements are met with the construction of natural gas fired combined-cycle power facilities, we estimate that the U.S. needs to add approximately 1,275 new power plants to meet peak demand in 2010. Then assuming that each CCGT is constructed in a 2x1 configuration utilizing 2 F series combustion turbines, this number of new power plants would require 2,550 turbines for construction. This implies that the U.S. will consume roughly 88%-98% of the current global supply of F-series combustion turbines.

Utilizing our estimates of natural gas utilization for new combined-cycle plants (Figure #15), we assume that 20,000-26,000 MW of new CCGTs will burn approximately 1 Tcf of natural gas in a year based on different capacity factors and heat rates. This implies a potential incremental demand for natural gas from power generation of approximately 22-29 Tcf annually. We even assume that 70% of existing natural gas-fired generation is displaced, releasing roughly 2.5 Tcf of the existing 3.5 Tcf of natural gas burned in installed generation. This then implies that the natural gas market could grow to almost 50 Tcf annually from roughly 22 Tcf in 1999. We do not suggest that the demand for this outrageous amount of natural gas will actually develop or that the natural gas industry could realistically deliver this amount of gas. This merely reflects the potential natural gas demand if all new electricity was generated with natural gas in new CCGTs. If no additional reserve capacity is added over the forecast period, the reserve margin would decline to 6.75%.

Figure 19: **Domestic Natural Gas-Fired Combustion Turbine Demand '00-'10**

	Total Capacity MW	Economic Add 1.5%	Internet/IT Add 2.5%	Normal Retire.s 1.5%	Economic Displace. 2.0%	Increased Capacity Factor	New Reserve Margin	Total Add
Total Add	380,758	157,390	262,317	91,245	88,480	0	38,076	637,508
# 500 MW CCGTs	762	315	525	182	177		76	1,275
Comb. Turbine Demand (2x1 Configuration)	1,523	630	1,049	365	354		152	2,550
Global Comb. Turbine Supply								2,600-2,900
U.S. Share of Supply								87.9%-98.1%

Notes:
Assumes all incremental generation installed is natural gas-fired CCGTs. GE currently produces approximately 180 F-Class combustion turbines and Siemens-Westinghouse produces 60 F Class Turbines which are generally the basis of most new central station CCGT's. Additional turbines may be supplied by other Japanese and European sources. Also assumes CCGT's are built in a 2x1 configuration that utilizes 2 combustion turbines and 1 steam turbine.

Source: Calpine Corp. estimates, Deutsche Banc Alex. Brown estimates

Figure 20: Potential CCGT Incremental Natural Gas Demand '00-'10

	Economic Add 1.5%	Internet/IT Add 2.5%	Total Capacity Additions MW	Normal Retirements	Economic Displacement	New Reserve Margin	Existing Gas Burn Displaced	Total Incremental Build
Total Add	157,390	262,317	380,758	91,245	88,480	38,076		637,508
Tcf 85% Capacity	7.87	13.12	19.04	4.56	4.42	0.00	(2.45)	29.43
Tcf 65% Capacity	6.05	10.09	14.64	3.51	3.40	0.00	(2.45)	22.07

Notes:
Assumes all incremental generation installed is natural gas-fired CCGTs with heat rates of approximately 6,700 Btu/kWh, and 1 Mcf of natural gas equates to a heat content of 1 million Btu. Therefore, approximately 20,000 MW of new CCGT generation would burn 1 Tcf of natural gas at an 85% capacity factor, and approximately 26,000 MW at a 65% capacity factor. Also assumes 70% of existing gas-fired generation is retired.

Source: Deutsche Banc Alex. Brown estimates

Figure 21: Potential Impact on Reserve Margins '00-'10

	Total Utility Capacity MW*	Current Peak Reserve Margin	Forward Peak Reserve Margin	Constant 10% Reserve Margin	Incremental Reserve Margin Needed
1999	790,000	79,000	10.00%		
2000	821,161	79,000	9.62%	82,116	3,116
2001	853,707	79,000	9.25%	85,371	3,255
2002	887,700	79,000	8.90%	88,770	3,399
2003	917,936	79,000	8.61%	91,794	3,024
2004	949,517	79,000	8.32%	94,952	3,158
2005	982,501	79,000	8.04%	98,250	3,298
2006	1,016,951	79,000	7.77%	101,695	3,445
2007	1,052,932	79,000	7.50%	105,293	3,598
2008	1,090,512	79,000	7.24%	109,051	3,758
2009	1,129,763	79,000	6.99%	112,976	3,925
2010	1,170,758	79,000	6.75%	117,076	4,100
Total Add	380,758	0		38,076	

Notes:
Analysis assumes 1.5% annual rate of electricity demand related to general economic growth translates into an equivalent rate of new baseload generation supply. Also assumes Internet and related IT technology growth adds 2.5% to annual electricity demand and hence baseload generation supply.
* Assumes new reserve margin from prior year added to capacity.

Source. DOE/EIA data, Deutsche Banc Alex. Brown estimates

Implications of Scenario

We believe that the growth assumptions reflected in this scenario are realistic on the upside but are probably quite aggressive. Certainly the retirements and economic displacements assumed in this scenario are considerably higher than recent experience would suggest but are within the realm of conventional expectations. Some projections we have seen assume the retirement of thousands of megawatts of nuclear plants over the next decade alone. We believe that the assumption that the maintenance of a 10% reserve margin is reasonably valid.

Nevertheless, we believe this scenario is a relatively unlikely outcome. Based on current turbine supplies, this scenario would require the U.S. to consume the vast majority of combustion turbines. Electricity demand in the remainder of the developing world is too great to allow the U.S. to monopolize turbine supplies. Clearly, the implications for natural gas demand cannot be realistically delivered. If this scenario was realistically approached, alternative sources of generation would need to be utilized to meet demand. It would be quite a stretch to achieve half of the incremental natural gas-fired generation this scenario envisions. The only alternative fuel we can envision that could realistically meet the remaining demand is coal.

SCENARIO #2

Analysis

Our second scenario takes our first scenario and adds more conservative assumptions while maintaining our fundamental economic growth assumptions. Our second scenario also assumes the same 1.5% annual rate of electricity demand growth related to general economic growth. We also assume that Internet and Information Technology-related demand growth will add 2.5% annually to electricity demand. Due to the current low level of reserve margins and due to the baseload nature of technology related electricity demand, we also assume that new generation demand requires the installation of new baseload generation to meet peak demand.

We reduce the levels of retirements and economic displacements of currently installed generation plants and also assume that they begin later in the decade. We assume a 1.0% annual rate of existing generation capacity retirements (as of year-end 1999 levels) and a 1.0% annual rate of economic displacement due to the superior economic inefficiency of new installed generation. We then assume that the generation capacity displaced and retired is replaced by generation capacity equal to only 70% of the nominal retired and displaced capacity (MWs) as new generating units will operate at higher capacity factors and efficiency. Our initial installed generation base includes investor owned utilities, municipal utilities, independent power generators, and co-operative utility owned generation capacity (summer capabilities). We reduce that nationwide capacity of about 830,000 MW by a portion of the independently owned generation equal to approximately 40,000 MW that we assume is roughly industrial self-generation that will not participate materially in general economic growth. We <u>do not</u> assume the installation of new incremental reserve margin from the prior year required to maintain a constant 10% reserve in this scenario.

We do not assume any capacity additions from increased capacity factors on existing installed generation. We exclude any capacity additions for reliability measures. Nameplate additions may also underestimate the actual summer capacity required to meet peak summer demand. Reserve margins (in MW) could actually increase as plants get closer to actual demand areas, to provide for currently interruptible load, and to provide a margin of reliability. We utilize the same data sources, 1999 reserve margin assumption, and initial installed U.S. generation fleet from our initial scenario.

Figure 22: **Potential Electric Baseload Generation Supply/Demand Growth '00-'10**

	Total Generating Capacity MW	Economic Add 1.5%	Internet/IT Add 2.5%	Normal Retire.s 1.0%	Economic Displace. 1.0%	Increased Capacity Factor	Needed Reserve Margin	Total Net Peak Add.	New Capacity Need
1999	790,000								
2000	821,600	11,850	19,750	0	0	0	0	31,600	4.00%
2001	854,464	12,324	20,540	0	0	0	0	32,864	4.00%
2002	888,643	12,817	21,362	0	0	0	0	34,179	4.00%
2003	924,188	13,330	22,216	0	0	0	0	35,546	4.00%
2004	956,416	13,863	23,105	5,530	5,530	0	0	48,028	5.20%
2005	989,932	14,346	23,910	5,530	5,530	0	0	49,317	5.16%
2006	1,024,790	14,849	24,748	5,530	5,530	0	0	50,657	5.12%
2007	1,061,041	15,372	25,620	5,530	5,530	0	0	52,052	5.08%
2008	1,098,743	15,916	26,526	5,530	5,530	0	0	53,502	5.04%
2009	1,137,953	16,481	27,469	5,530	5,530	0	0	55,010	5.01%
2010	1,178,731	17,069	28,449	5,530	5,530	0	0	56,578	4.97%
Total Add	**388,731**	**158,217**	**263,694**	**38,710**	**38,710**	**0**	**0**	**499,331**	**63.2%**
'00-'10									
Average		14,383	23,972	3,519	3,519	0	0	45,394	
Median		14,346	23,910	5,530	5,530	0	0	49,317	
CAGR	**3.7%**							**4.6%**	

Notes:
Analysis assumes 1.5% annual rate of electricity demand related to general economic growth translates into an equivalent rate of new baseload generation supply. Also assumes Internet and related IT technology growth adds 2.5% to annual electricity demand and hence baseload generation supply. We also assume a 1.0% annual rate of retirement for existing generation capacity (as of year end 1999) and a 1.0% rate of economic displacement due to economic inefficiency. We then assume that only 70% of retired and displaced MWs need to be replaced as new generating units will operate at higher capacity factors and efficiency. Our initial installed generation base includes IOU, municipal, independent, and co-op owned generation capacity less a portion of independently owned generation equal to approximately 40,000 MW that we assume will not grow materially. There is no addition to reserve margins.

Excludes increased capacity for reliability measures. Reserve margin (in MW) could actually increase as plants get closer to actual demand areas, to provide for interruptible load, and to provide a margin of reliability.

Source: EEI & DOE data, Deutsche Banc Alex. Brown estimates

Conclusions of Scenario

This scenario concludes that the U.S. needs approximately 389,000 new net MWs of peak generating capability, a 3.7% compound annual increase in capacity. This includes roughly 422,000 MW of new incremental demand growth, offset by a roughly 33,000 MW net reduction of capacity due to retirements and economic displacements (we assume that fewer nameplate MWs will be required to meet the same demand due to higher capacity factors and efficiency). Total new power plant additions over the next decade are then roughly 499,000 MW, a 4.6% compound annual addition to capacity.

This scenario involves adding an average of nearly 45,000 new megawatts of capacity each year from 2000 through 2010.

Assuming that all the additional capacity requirements are met with the construction of natural gas fired combined-cycle power facilities, we estimate that the U.S. needs to add approximately 1,000 new power plants to meet peak demand in 2010. Then assuming that each CCGT is constructed in a 2x1 configuration utilizing 2 F series combustion turbines, this number of new power plants would require almost 2,000 turbines for construction. This implies that the U.S. will consume roughly 69%-77% of the current global supply of F-series combustion turbines.

Utilizing our estimates of natural gas utilization for new combined-cycle plants (Figure #15), we assume that 20,000-26,000 MW of new CCGTs will burn approximately 1 Tcf of natural gas in a year based on different capacity factors and heat rates. This implies a potential incremental demand for natural gas from power generation of approximately 17-23 Tcf annually. We even assume that 70% of existing natural gas-fired generation is displaced, releasing roughly 2.5 Tcf of the existing 3.5 Tcf of natural gas burned in installed generation. This then implies that the natural gas market could grow to 39-45 Tcf annually from roughly 22 Tcf in 1999. If no additional reserve capacity is added over the forecast period, the reserve margin would decline to 6.7%.

Figure 23: **Domestic Natural Gas-Fired Combustion Turbine Demand '00-'10**

	Total Capacity MW	Economic Add 1.5%	Internet/IT Add 2.5%	Normal Retire.s 1.0%	Economic Displace. 1.0%	Needed Reserve Margin	Increased Capacity Factor	Total Add
Total Add	388.731	158.217	263.694	38,710	38,710	0	0	499,331
# 500 MW CCGTs	777	316	527	77	77	0	0	999
Comb. Turbine Demand (2x1 Configuration)	1,555	633	1,055	155	155	0	0	1,997
Global Comb. Turbine Supply								2,600-2,900
U.S. Share of Supply								68.9%-76.8%

Notes:
Assumes all incremental generation installed is natural gas-fired CCGTs. GE currently produces approximately 180 F Class combustion turbines and Siemens-Westinghouse produces 60 F Class Turbines which are generally the basis of most new central station CCGT's. Additional turbines may be supplied by other Japanese and European sources. Also assumes CCGT's are built in a 2x1 configuration that utilizes 2 combustion turbines and 1 steam turbine.

Source: Calpine Corp., Deutsche Banc Alex. Brown estimates

Figure 24: Potential CCGT Incremental Natural Gas Demand '00-'10

	Economic Add 1.5%	Internet/IT Add 2.5%	Total Capacity Additions MW	Normal Retirements	Economic Displacement	Existing Gas Burn Displaced	Total Incremental Build
Total Add	158,217	263,694	421,911	38,710	38,710		499,331
Tcf 85% Capacity	7.91	13.18	21.10	1.94	1.94	(2.45)	22.52
Tcf 65% Capacity	6.09	10.14	16.23	1.49	1.49	(2.45)	16.76

Notes:
Assumes all incremental generation installed is natural gas-fired CCGTs with heat rates of approximately 6,700 Btu/kWh, and 1 Mcf of natural gas equates to a heat content of 1 million Btu. Therefore, approximately 20,000 MW of new CCGT generation would burn 1 Tcf of natural gas at an 85% capacity factor, and approximately 26,000 MW at a 65% capacity factor. Also assumes 70% of existing gas-fired generation is retired.

Source: Deutsche Banc Alex. Brown estimates

Figure 25: Potential Impact on Reserve Margins '00-'10

	Total Utility Capacity MW	Current Peak Reserve Margin	Forward Peak Reserve Margin	Constant 10% Reserve Margin	Incremental Reserve Margin Needed
1999	**790,000**	79,000	10.00%		
2000	821,600	79,000	9.62%	82,160	3,160
2001	854,464	79,000	9.25%	85,446	3,286
2002	888,643	79,000	8.89%	88,864	3,418
2003	924,188	79,000	8.55%	92,419	3,555
2004	956,416	79,000	8.26%	95,642	3,223
2005	989,932	79,000	7.98%	98,993	3,352
2006	1,024,790	79,000	7.71%	102,479	3,486
2007	1,061,041	79,000	7.45%	106,104	3,625
2008	1,098,743	79,000	7.19%	109,874	3,770
2009	1,137,953	79,000	6.94%	113,795	3,921
2010	1,178,731	79,000	6.70%	117,873	4,078
Total Add	**388,731**	**0**		**38,873**	

Notes:
Analysis assumes 1.5% annual rate of electricity demand related to general economic growth translates into an equivalent rate of new baseload generation supply. Also assumes Internet and related IT technology growth adds 2.5% to annual electricity demand and hence baseload generation supply.
* Assumes new reserve margin from prior year added to capacity.

Source: DOE/EIA data, Deutsche Banc Alex. Brown estimates

Implications of Scenario

We believe that our second scenario is considerably more realistic than our first scenario. Based on current turbine supplies, this scenario would still require the U.S. to consume the vast majority of combustion turbines but it is closer to recent experience. Clearly, the implications for natural gas demand cannot be realistically delivered in this scenario either. If this scenario was realistically approached, alternative sources of generation would still need to be utilized to meet demand. It would still be a significant stretch to achieve half of the incremental natural gas-fired generation even the second scenario envisions.

SCENARIO #3

Analysis

Our third scenario takes our second scenario and reflects even more conservative assumptions while maintaining our fundamental economic growth assumptions. Essentially, we eliminate plant retirements and displacements while only maintaining basic economic growth. Our third scenario also assumes the same 1.5% annual rate of electricity demand growth related to general economic growth. We also assume that Internet and Information Technology-related demand growth will add 2.5% annually to electricity demand. Due to the current low level of reserve margins and due to the baseload nature of technology related electricity demand, we also assume that new generation demand requires the installation of new baseload generation to meet peak demand.

We do not assume any existing generation capacity retirements or economic displacements due to the superior economic inefficiency of new installed generation. We do not assume the installation of new incremental reserve margin from the prior year required to maintain a constant 10% reserve in this scenario.

We do not assume any capacity additions from increased capacity factors on existing installed generation. We exclude any capacity additions for reliability measures. Nameplate additions may also underestimate the actual summer capacity required to meet peak summer demand. Reserve margins (in MW) could actually increase as plants get closer to actual demand areas, to provide for currently interruptible load, and to provide a margin of reliability. We utilize the same data sources, 1999 reserve margin assumption for 1999, and initial installed U.S. generation fleet from our initial scenario.

Figure 26: **Potential Electric Baseload Generation Supply/Demand Growth '00-'10**

	Total Generating Capacity MW	Economic Add 1.5%	Internet/IT Add 2.5%	Normal Retire.s 0.0%	Economic Displace. 0.0%	Increased Capacity Factor	Needed Reserve Margin	Total Net Peak Add.	New Capacity Need
1999	**790,000**								
2000	821,600	11,850	19,750	0	0	0	0	31,600	4.00%
2001	854,464	12,324	20,540	0	0	0	0	32,864	4.00%
2002	888,643	12,817	21,362	0	0	0	0	34,179	4.00%
2003	924,188	13,330	22,216	0	0	0	0	35,546	4.00%
2004	961,156	13,863	23,105	0	0	0	0	36,968	4.00%
2005	999,602	14,417	24,029	0	0	0	0	38,446	4.00%
2006	1,039,586	14,994	24,990	0	0	0	0	39,984	4.00%
2007	1,081,170	15,594	25,990	0	0	0	0	41,583	4.00%
2008	1,124,416	16,218	27,029	0	0	0	0	43,247	4.00%
2009	1,169,393	16,866	28,110	0	0	0	0	44,977	4.00%
2010	1,216,169	17,541	29,235	0	0	0	0	46,776	4.00%
Total Add	**426,169**	**159,813**	**266,355**	**0**	**0**	**0**	**0**	**426,169**	**53.9%**
'00-'10									
Average		14,528	24,214	0	0	0	0	38,743	
Median		14,417	24,029	0	0	0	0	38,446	
CAGR	**4.0%**							**4.0%**	

Notes:
Analysis assumes 1.5% annual rate of electricity demand related to general economic growth translates into an equivalent rate of new baseload generation supply. Also assumes Internet and related IT technology growth adds 2.5% to annual electricity demand and hence baseload generation supply. Assumes no retirements or economic displacements of existing plants. Our initial installed generation base includes IOU, municipal, independent, and co-op owned generation capacity less a portion of independently owned generation equal to approximately 40,000 MW that we assume will not grow materially. Assumes no incremental addition of reserve margin.

Excludes increased capacity for reliability measures. Reserve margin (in MW) could actually increase as plants get closer to actual demand areas, to provide for interruptible load, and to provide a margin of reliability.

Sources: EEI & DOE data, DB Alex. Brown estimates

Conclusions of Scenario

Our third scenario concludes that the U.S. needs approximately 426,000 new net MWs of peak generating capability, a 4.0% compound annual increase in capacity. This includes roughly 426,000 MW of new incremental demand growth only. Due to the fact that we do not reduce additions by retirement/displacements and we do not add to reserve margins, total new gross power plant additions over the next decade equal net additions. This scenario involves adding an average of nearly 39,000 new megawatts of capacity each year from 2000 through 2010.

Assuming that all the additional capacity requirements are met with the construction of natural gas fired combined-cycle power facilities, we estimate that the U.S. needs to add approximately 850 new power plants to meet peak demand in 2010. Then assuming that each CCGT is constructed in a 2x1 configuration utilizing two F series combustion turbines, this number of new power plants would require just over 1,700 turbines for construction. This implies that the U.S. will consume roughly 59%-66% of the current global supply of F-series combustion turbines.

Utilizing our estimates of natural gas utilization for new combined-cycle plants (Figure #15), we assume that 20,000-26,000 MW of new CCGTs will burn approximately 1 Tcf of natural gas in a year based on different capacity factors and heat rates. This implies a potential incremental demand for natural gas from power generation of approximately 16-21 Tcf annually. We do not assume that any of the existing natural gas-fired generation is displaced. This then implies that the natural gas market could grow to between 38-43 Tcf annually from roughly 22 Tcf in 1999. If no additional reserve capacity is added over the forecast period, the reserve margin would decline to 6.5%.

Figure 27: **Domestic Natural Gas-Fired Combustion Turbine Demand '00-'10**

	Total Capacity MW	Economic Add 1.5%	Internet/IT Add 2.5%	Normal Retire.s 0.0%	Economic Displace. 0.0%	Needed Reserve Margin	Increased Capacity Factor	Total Add
Total Add	426,169	159,813	266,355	0	0	0	0	426,169
# 500 MW CCGTs	852	320	533	0	0	0	0	852
Comb. Turbine Demand (2x1 Configuration)	1,705	639	1,065	0	0	0	0	1,705
Global Comb. Turbine Supply								2,600-2,900
U.S. Share of Supply								58.8%-65.6%

Notes:
Assumes all incremental generation installed is natural gas-fired CCGTs GE currently produces approximately 180 F Class combustion turbines and Siemens-Westinghouse produces 60 F Class Turbines which are generally the basis of most new central station CCGT's. Additional turbines may be supplied by other Japanese and European sources. Also assumes CCGT's are built in a 2x1 configuration that utilizes 2 combustion turbines and 1 steam turbine

Sources: Calpine Corp., DB Alex. Brown estimates

Figure 28: **Potential CCGT Incremental Natural Gas Demand '00-'10**

	Economic Add 1.5%	Internet/IT Add 2.5%	Total Capacity Additions MW	Normal Retirements 0.0%	Economic Displacement 0.0%	Existing Gas Burn Displaced	Total Incremental Build
Total Add	159,813	266,355	426,169	0	0		426,169
Tcf 85% Capacity	7.99	13.32	21.31	0.00	0.00	0.00	21.31
Tcf 65% Capacity	6.15	10.24	16.39	0.00	0.00	0.00	16.39

Notes:
Assumes all incremental generation installed is natural gas-fired CCGTs with heat rates of approximately 6,700 Btu/kWh, and 1 Mcf of natural gas equates to a heat content of 1 million Btu. Therefore, approximately 20,000 MW of new CCGT generation would burn 1 Tcf of natural gas at an 85% capacity factor, and approximately 26,000 MW at a 65% capacity factor.

Source: Deutsche Banc Alex. Brown estimates

Figure 29: **Potential Impact on Reserve Margins '00-'10**

	Total Utility Capacity MW	Current Peak Reserve Margin	Forward Peak Reserve Margin	Constant 10% Reserve Margin	Incremental Reserve Margin Needed
1999	**790,000**	79,000	10.00%		
2000	821,600	79,000	9.62%	82,160	3,160
2001	854,464	79,000	9.25%	85,446	3,286
2002	888,643	79,000	8.89%	88,864	3,418
2003	924,188	79,000	8.55%	92,419	3,555
2004	961,156	79,000	8.22%	96,116	3,697
2005	999,602	79,000	7.90%	99,960	3,845
2006	1,039,586	79,000	7.60%	103,959	3,998
2007	1,081,170	79,000	7.31%	108,117	4,158
2008	1,124,416	79,000	7.03%	112,442	4,325
2009	1,169,393	79,000	6.76%	116,939	4,498
2010	1,216,169	79,000	6.50%	121,617	4,678
Total Add	**426,169**	**0**		**42,617**	

Notes:
Analysis assumes 1.5% annual rate of electricity demand related to general economic growth translates into an equivalent rate of new baseload generation supply. Also assumes Internet and related IT technology growth adds 2.5% to annual electricity demand and hence baseload generation supply.
* Assumes no new reserve margin added to capacity.

Source: DOE/EIA data, Deutsche Banc Alex. Brown estimates

Implications of Scenario

We believe that our third scenario is considerably more realistic than scenario two and could prove conservative. Based on current turbine supplies, this scenario would still require the U.S. to consume the vast majority of combustion turbines but it is closer to recent experience. Clearly, the implications for natural gas demand cannot be realistically delivered in this scenario either. If this scenario was realistically approached, alternative sources of generation would still need to be utilized to meet demand. It would still be a significant stretch to achieve half of the incremental natural gas-fired generation even the third scenario envisions.

SCENARIO #4 – OUR BASELINE SCENARIO

Analysis

Our fourth scenario takes our **second** scenario and adds more conservative growth assumptions while reintroducing reserve margin additions. Our fourth scenario assumes the same 1.5% annual rate of electricity demand growth related to general economic growth. We also assume that Internet and Information Technology-related demand growth will add 2.0% annually to electricity demand, while reducing the annual rate from 2.5%. Due to the current low level of reserve margins and due to the baseload nature of technology related electricity demand, we also assume that new generation demand requires the installation of new baseload generation to meet peak demand.

We maintain the levels of retirements and economic displacements of currently installed generation plants but further assume that they begin later in the decade than scenario #2. We assume a 1.0% annual rate of existing generation capacity retirements (as of year-end 1999 levels) and a 1.0% annual rate of economic displacement due to the superior economic efficiency of new installed generation. We then assume that the generation capacity displaced and retired is replaced by generation capacity equal to only 70% of the nominal retired and displaced capacity (MWs) as new generating units will operate at higher capacity factors and efficiency. We also assume that installed generation at beginning of year includes the addition of prior-year growth and new incremental reserve margin from the prior year required to maintain a constant 10% reserve.

We do not assume any capacity additions from increased capacity factors on existing installed generation. We exclude any capacity additions for reliability measures. Nameplate additions may also underestimate the actual summer capacity required to meet peak summer demand. Reserve margins (in MW) could actually increase as plants get closer to actual demand areas, to provide for currently interruptible load, and to provide a margin of reliability. We utilize the same data sources, 1999 reserve margin assumption, and initial installed U.S. generation fleet for all of our scenarios.

Figure 30: Potential Electric Baseload Generation Supply/Demand Growth '00-'10

	Total Generating Capacity MW	Economic Add 1.5%	Internet/IT Add 2.0%	Normal Retirements 1.0%	Economic Retirements 1.0%	Increase Existing Capacity Factor	Needed Reserve Margin	Total Net Peak Add.	New Capacity Need
1999	790,000								
2000	820,722	11,850	15,800	0	0	0	3,072	30,722	3.89%
2001	852,639	12,311	16,414	0	0	0	3,192	31,917	3.89%
2002	885,797	12,790	17,053	0	0	0	3,316	33,158	3.89%
2003	920,245	13,287	17,716	0	0	0	3,445	34,448	3.89%
2004	956,032	13,804	18,405	0	0	0	3,579	35,787	3.89%
2005	993,211	14,340	19,121	0	0	0	3,718	37,179	3.89%
2006	1,026,570	14,898	19,864	5,530	5,530	0	3,336	49,158	4.95%
2007	1,061,225	15,399	20,531	5,530	5,530	0	3,466	50,455	4.91%
2008	1,097,228	15,918	21,225	5,530	5,530	0	3,600	51,803	4.88%
2009	1,134,632	16,458	21,945	5,530	5,530	0	3,740	53,203	4.85%
2010	1,173,490	17,019	22,693	5,530	5,530	0	3,886	54,658	4.82%
Total Add	**383,490**	**158,075**	**210,766**	**27,650**	**27,650**	**0**	**38,349**	**462,490**	**58.5%**
'00-'10									
Average		14,370	19,161	2,514	2,514	0	3,486	42,045	
Median		14,340	19,121	0	0	0	3,466	37,179	
CAGR	**3.7%**							**4.3%**	

Notes:
Analysis assumes 1.5% annual rate of electricity demand related to general economic growth translates into an equivalent rate of new baseload generation supply. Also assumes Internet and related IT technology growth adds 2.0% to annual electricity demand and hence baseload generation supply. We also assume a 1.5% annual rate of retirement for existing generation capacity (as of year end 1999) and a 2.0% rate of economic displacement due to economic inefficiency. We then assume that only 70% of retired and displaced MWs need to be replaced as new generating units will operate at higher capacity factors and efficiency. Our initial installed generation base includes IOU, municipal, independent, and co-op owned generation capacity less a portion of independently owned generation equal to approximately 40,000 MW that we assume will not grow materially. Installed generation at beginning of year includes addition of new incremental reserve margin from prior year to maintain 10% reserve.

Excludes increased capacity for reliability measures. Reserve margin (in MW) could actually increase as plants get closer to actual demand areas, to provide for interruptible load, and to provide a margin of reliability.

Sources. EEI & DOE data, DB Alex. Brown estimates

Conclusions of Scenario

This scenario concludes that the U.S. needs approximately 383,000 new net MWs of peak generating capability, a 3.7% compound annual increase in capacity. This includes roughly 369,000 MW of new incremental demand growth and approximately 38,000 MW from incremental reserve margin, offset by a roughly 63,000 MW net reduction of capacity due to retirements and economic displacements. Total new power plant additions over the next decade are then roughly 462,000 MW, a 4.3% compound annual addition to capacity. This scenario involves adding an average of over 41,000 new megawatts of capacity each year from 2000 through 2010.

Assuming that all the additional capacity requirements are met with the construction of natural gas fired combined-cycle power facilities, we estimate that the U.S. needs to add approximately 925 new power plants to meet peak demand in 2010. Then assuming that each CCGT is constructed in a 2x1 configuration utilizing two F series combustion turbines, this number of new power plants would require almost 1,900 turbines for construction. This implies that the U.S. will consume roughly 63-70% of the current global supply of F-series combustion turbines.

Utilizing our estimates of natural gas utilization for new combined-cycle plants (Figure #15), we assume that 20,000-26,000 MW of new CCGTs will burn approximately 1 Tcf of natural gas in a year based on different capacity factors and heat rates. This implies a potential incremental demand for natural gas from power generation of approximately 16-21 Tcf annually. We even assume that 50% of existing natural gas-fired generation is displaced, releasing roughly 1.8 Tcf of the existing 3.5 Tcf of natural gas burned in installed generation. This then implies that the natural gas market could grow to between 38-43 Tcf annually from roughly 22 Tcf in 1999. If no additional reserve capacity is added over the forecast period, the reserve margin would decline to 6.7%.

Figure 31: **Domestic Natural Gas-Fired Combustion Turbine Demand '00-'10**

	Total Capacity MW	Economic Add 1.5%	Internet/IT Add 2.0%	Normal Retirements	Economic Displacement	Needed Reserve Margin	Total Add
Total Add	383,490	158,075	210,766	27,650	27,650	38,349	462,490
# 500 MW CCGTs	767	316	422	55	55	77	925
Comb. Turbine Demand (2x1 Configuration)	1,534	632	843	111	111	153	1,850
Global Comb. Turbine Supply							2,600-2,900
U.S. Share of Supply							62.7%-69.9%

Notes:
Assumes all incremental generation installed is natural gas-fired CCGTs. GE currently produces approximately 180 F Class combustion turbines and Siemens-Westinghouse produces 60 F Class Turbines which are generally the basis of most new central station CCGT's. Additional turbines may be supplied by other Japanese and European sources. Also assumes CCGT's are built in a 2x1 configuration that utilizes 2 combustion turbines and 1 steam turbine

Sources: Calpine Corp., and DB Alex. Brown estimates

Figure 32: **Potential CCGT Incremental Natural Gas Demand '00-'10**

	Economic Add 1.5%	Internet/IT Add 2.0%	Total Capacity Additions MW	Normal Retirements	Economic Displacement	Needed Reserve Margin	Existing Gas Burn Displaced	Total Incremental Build
Total Add	158,075	210,766	383,490	27,650	27,650	38,349		462,490
Tcf 85% Capacity	7.90	10.54	19.17	1.38	1.38	1.92	(1.75)	21.37
Tcf 65% Capacity	6.08	8.11	14.75	1.06	1.06	1.47	(1.75)	16.04

Notes:
Assumes all incremental generation installed is natural gas-fired CCGTs with heat rates of approximately 6,700 Btu/kWh, and 1 Mcf of natural gas equates to a heat content of 1 million Btu. Therefore, approximately 20,000 MW of new CCGT generation would burn 1 Tcf of natural gas at an 85% capacity factor, and approximately 26,000 MW at a 65% capacity factor. Also assumes 50% of existing gas-fired generation is retired.

Sources: Deutsche Banc Alex. Brown estimates

Figure 33: **Potential Impact on Reserve Margins '00-'10**

	Total Utility Capacity MW	Current Peak Reserve Margin	Forward Peak Reserve Margin	Constant 10% Reserve Margin	Incremental Reserve Margin Needed
1999	**790,000**	79,000	10.00%		
2000	820,722	79,000	9.63%	82,072	3,072
2001	*852,639*	*79,000*	*9.27%*	*85,264*	*3,192*
2002	885,797	79,000	8.92%	88,580	3,316
2003	920,245	79,000	8.58%	92,025	3,445
2004	956,032	79,000	8.26%	95,603	3,579
2005	993,211	79,000	7.95%	99,321	3,718
2006	1,026,570	79,000	7.70%	102,657	3,336
2007	1,061,225	79,000	7.44%	106,123	3,466
2008	1,097,228	79,000	7.20%	109,723	3,600
2009	1,134,632	79,000	6.96%	113,463	3,740
2010	1,173,490	79,000	6.73%	117,349	3,886
Total Add	**383,490**	**0**		**38,349**	

Notes: Analysis assumes 1.5% annual rate of general economic growth in electricity demand translates into an equivalent rate of new generation supply. Also assumes Internet and related IT technology growth adds 2.0% to annual electricity demand and hence generation supply.
* Assumes no new reserve margin added to capacity.

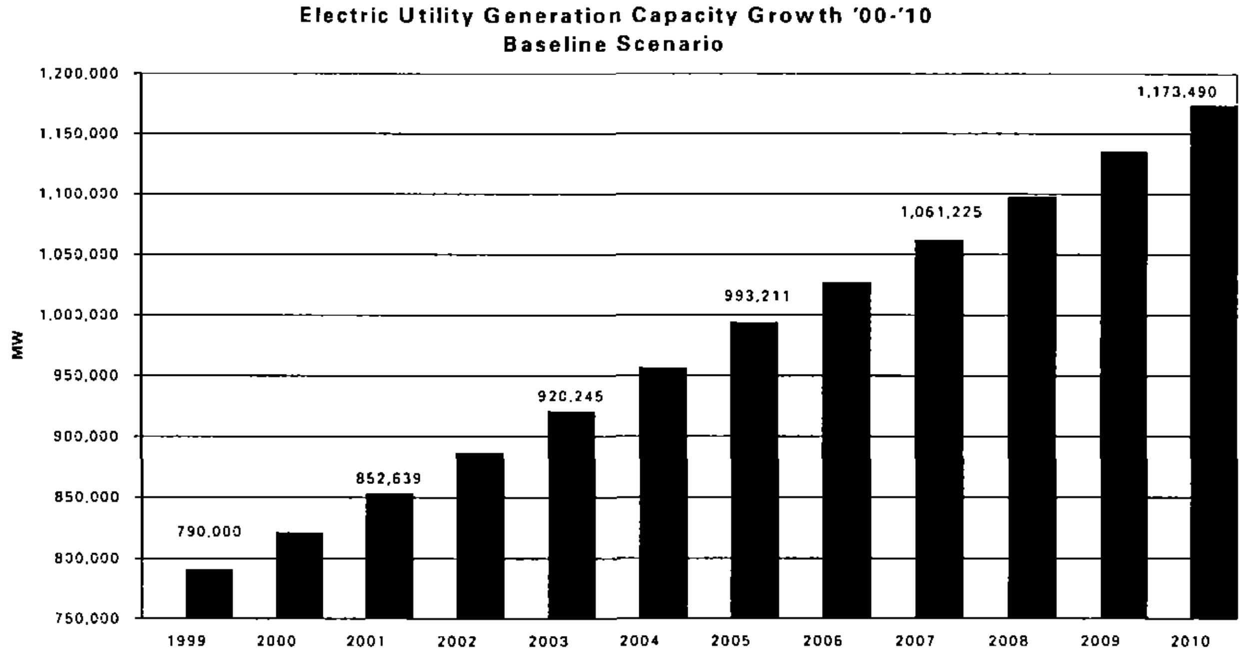
Source: DOE/EIA data, Deutsche Banc Alex. Brown estimates

Implications of Our Base Scenario

We believe that our baseline scenario is a realistic representation of the potential future supply and demand for electricity over the next decade. Based on current turbine supplies, this scenario would still require the U.S. to *consume a very significant proportion of global combustion turbine supplies* but it is close recent experience. Clearly, the implications for natural gas demand cannot be realistically delivered in this scenario either. Several natural gas forecasts we have seen forecast natural gas demand of 30-35 Tcf by 2010. These forecasts assume significantly lower demand from electric *generation but still recognize that their forecasts represent significant* deliverability challenges. If this scenario is reasonably accurate, alternative sources of generation would still need to be utilized to meet demand. It would still be a significant stretch to achieve half of the incremental natural gas-fired generation even this scenario envisions.

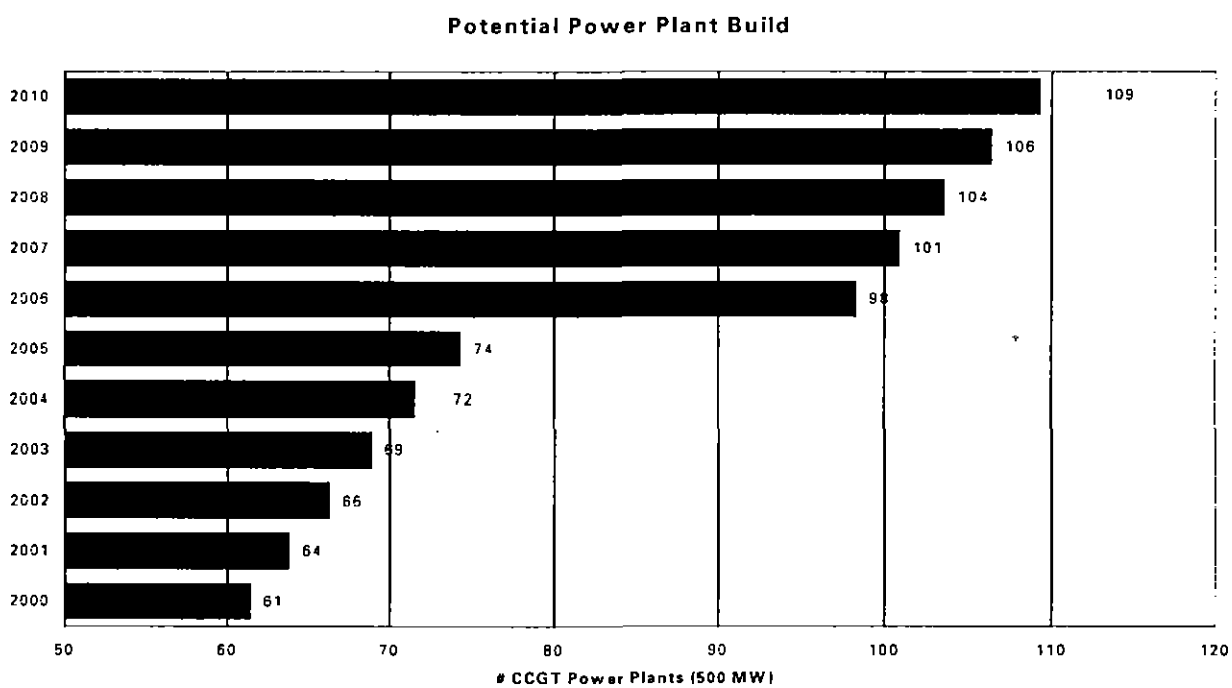
The two charts that follow in Exhibits 34 & 35 represent the net MW of capacity installed at the end of each year of our scenario and the number of plants we estimate would be required to meet the capacity scenario.

Figure 34: **Two Charts from Scenario**



Source: DOE/EIA data, Deutsche Banc Alex. Brown estimates

Figure 35: **Two Charts from Scenario**



Source: Deutsche Banc Alex. Brown estimates

SCENARIO #5

Analysis

Our fifth scenario takes our baseline scenario and adds more conservative economic growth assumptions while introducing increased capacity factors into the analysis. Our fifth scenario assumes a reduction in the annual rate of electricity demand growth related to general economic growth to 1.0% from 1.5%. We also assume that Internet and Information Technology-related demand growth will add 2.0% annually to electricity demand. Due to the current low level of reserve margins and due to the baseload nature of technology related electricity demand, we also assume that new generation demand requires the installation of new baseload generation to meet peak demand.

We maintain the levels of retirements and economic displacements of currently installed generation plants and but further assume that they begin somewhat earlier in the decade than in our baseline scenario. We assume a 1.0% annual rate of existing generation capacity retirements (as of year-end 1999 levels) and a 1.0% annual rate of economic displacement due to the superior economic inefficiency of new installed generation. We then assume that the generation capacity displaced and retired is replaced by generation capacity equal to only 70% of the nominal retired and displaced capacity (MWs) as new generating units will operate at higher capacity factors and efficiency. We also assume that installed generation at beginning of year includes the addition of prior-year growth and new incremental reserve margin from the prior year required to maintain a constant 10% reserve.

We then assume that capacity is added from increasing capacity factors on existing installed generation of approximately 2.0% annually for 5 years beginning in 2004. We exclude any further capacity additions for reliability measures. Nameplate additions may also underestimate the actual summer capacity required to meet peak summer demand. Reserve margins (in MW) could actually increase as plants get closer to actual demand areas, to provide for currently interruptible load, and to provide a margin of reliability. We utilize the same data sources, 1999 reserve margin assumption, and initial installed U.S. generation fleet for all of our scenarios.

that the U.S. needs to add approximately 625 new power plants to meet peak demand in 2010. Then assuming that each CCGT is constructed in a 2x1 configuration utilizing 2 F series combustion turbines, this number of new power plants would require almost 1,250 turbines for construction. This implies that the U.S. will consume roughly 43%-48% of the current global supply of F-series combustion turbines.

Utilizing our estimates of natural gas utilization for new combined-cycle plants (Figure #15), we assume that 20,000-26,000 MW of new CCGTs will burn approximately 1 Tcf of natural gas in a year based on different capacity factors and heat rates. This implies a potential incremental demand for natural gas from power generation of approximately 10-14 Tcf annually. We even assume that 50% of existing natural gas-fired generation is displaced, releasing roughly 1.8 Tcf of the existing 3.5 Tcf of natural gas burned in installed generation. This then implies that the natural gas market could grow to 32-36 Tcf annually from roughly 22 Tcf in 1999. If no additional reserve capacity is added over the forecast period, the reserve margin would decline to 8.0%.

Figure 37: **Domestic Natural Gas-Fired Combustion Turbine Demand '00-'10**

	Total Capacity MW	Economic Add 1.0%	Internet/IT Add 2.0%	Normal Retirements	Economic Displacement	Needed Reserve Margin	Total Add
Total Add	202,157	98,040	196,081	38,710	38,710	20,216	312,757
# 500 MW CCGTs	404	196	392	77	77	40	626
Comb. Turbine Demand (2x1 Configuration)	809	392	784	155	155	81	1,251
Global Comb. Turbine Supply							2,600-2,900
U.S. Share of Supply							43.1%-48.1%

Notes:
Assumes all incremental generation installed is natural gas-fired CCGTs. GE currently produces approximately 183 F Class combustion turbines and Siemens-Westinghouse produces 60 F Class Turbines which are generally the basis of most new central station CCGT's. Additional turbines may be supplied by other Japanese and European sources. Also assumes CCGT's are built in a 2x1 configuration that utilizes 2 combustion turbines and 1 steam turbine.

Sources: Calpine Corp., and DB Alex. Brown estimates

Figure 38: **Potential CCGT Incremental Natural Gas Demand '00-'10**

	Economic Add 1.0%	Internet/IT Add 2.0%	Total Capacity Additions MW	Normal Retirements	Economic Displacement	Existing Gas Burn Displaced	Total Incremental Build
Total Add	98,040	196,081	202,157	38,710	38,710		312,757
Tcf 85% Capacity	4.90	9.80	10.11	1.94	1.94	(1.75)	13.89
Tcf 65% Capacity	3.77	7.54	7.78	1.49	1.49	(1.75)	10.28

Notes:
Assumes all incremental generation installed is natural gas-fired CCGTs with heat rates of approximately 6,700 Btu/kWh, and 1 Mcf of natural gas equates to a heat content of 1 million Btu. Therefore, approximately 20,000 MW of new CCGT generation would burn 1 Tcf of natural gas at an 85% capacity factor, and approximately 26,000 MW at a 65% capacity factor. Also assumes 50% of existing gas-fired generation is retired.

Source: Deutsche Banc Alex. Brown estimates

Figure 39: **Potential Impact on Reserve Margins '00-'10**

	Total Utility Capacity MW	Current Peak Reserve Margin	Forward Peak Reserve Margin	Constant 10% Reserve Margin	Incremental Reserve Margin Needed
1999	**790,000**	79,000	10.00%		
2000	816,333	79,000	9.68%	81,633	2,633
2001	843,544	79,000	9.37%	84,354	2,721
2002	871,663	79,000	9.06%	87,166	2,812
2003	900,718	79,000	8.77%	90,072	2,906
2004	907,920	79,000	8.70%	90,792	720
2005	915,361	79,000	8.63%	91,536	744
2006	923,051	79,000	8.56%	92,305	769
2007	930,997	79,000	8.49%	93,100	795
2008	939,209	79,000	8.41%	93,921	821
2009	965,249	79,000	8.18%	96,525	2,604
2010	992,157	79,000	7.96%	99,216	2,691
Total Add	**202,157**	**0**		**20,216**	

Notes:
Analysis assumes 1.0% annual rate of general economic growth in electricity demand translates into an equivalent rate of new generation supply. Also assumes Internet and related IT technology growth adds 2.0% to annual electricity demand and hence generation supply.

Source DOE/EIA data, Deutsche Banc Alex Brown estimates

Implications of Scenario

We believe this scenario is a conservative representation of the potential future supply and demand for electricity over the next decade. Based on current turbine supplies, this scenario would represent a conservative U.S. share of consumption of the world supply and conservative relevant to recent experience. We believe this scenario begins to approach a realistic potential natural gas demand from electric generation. However, we believe alternative sources of generation would still need to be utilized to meet demand. Natural gas supplies might reasonably supply approximately two-thirds of the natural gas-fired generation this scenario projects.

SCENARIO #6

Analysis

Our sixth scenario takes our fifth scenario and reduces the additional generation released by higher capacity factors on existing generation and reduces the incremental addition of reserve margin. This scenario continues to assume a 1.0% annual rate of electricity demand growth related to general economic growth. We also assume that Internet and Information Technology-related demand growth will add 2.0% annually to electricity demand. *However, in this scenario, we introduce a new element to our analysis of general economic growth. We base the growth in capacity (MWs) needed on mWh growth and not on installed capacity. This method produces somewhat lower capacity requirements (about 100,000 MWs over 11 years) than simply growing installed capacity.*

Due to the current low level of reserve margins and due to the baseload nature of technology related electricity demand, we also assume that new generation demand requires the installation of new baseload generation to meet peak demand.

We maintain the levels of retirements and economic displacements of currently installed generation plants. We assume a 1.0% annual rate of existing generation capacity retirements (as of year-end 1999 levels) and a 1.0% annual rate of economic displacement due to the superior economic inefficiency of new installed generation. We then assume that the generation capacity displaced and retired is replaced by generation capacity equal to only 70% of the nominal retired and displaced capacity (MWs) as new generating units will operate at higher capacity factors and efficiency. We also assume that installed generation at beginning of year includes the addition of prior-year growth and new incremental reserve margin from the prior year required to maintain a minimum 8.0% reserve. This means that additional capacity is not added to meet reserve margin requirements until falling below 8%.

We then assume that capacity additions from increased capacity factors on existing installed generation of approximately 1.0% annually for 5 years beginning in 2004, down from 2.0% in the prior scenario. We exclude any further capacity additions for reliability measures. Nameplate additions may also underestimate the actual summer capacity required to meet peak summer demand. Reserve margins (in MW) could actually increase as plants get closer to actual demand areas, to provide for currently interruptible load, and to provide a margin of reliability. We utilize the same data sources, 1999 reserve margin assumption, and initial installed U.S. generation fleet for all of our scenarios.

Figure 40: **Potential Electric Baseload Generation Supply/Demand Growth '00-'10**

	Total Generating Capacity MW	Economic Add 1.0%	Internet/IT Add 2.0%	Normal Retirements 1.0%	Economic Retirements 1.0%	Increased Capacity Factor 1.0%	Needed Reserve Margin	Total Net Peak Add.	New Capacity Need
1999	**790,000**								
2000	807,123	5,708	11,416				0	17,123	2.17%
2001	824,760	5,879	11,758				0	17,637	2.19%
2002	842,926	6,055	12,111				0	18,166	2.20%
2003	861,637	6,237	12,474				0	18,711	2.22%
2004	868,270	6,424	12,848	5,530	5,530	(7,900)	0	22,432	2.60%
2005	875,480	6,617	13,234	5,530	5,530	(7,900)	0	23,011	2.65%
2006	883,287	6,815	13,631	5,530	5,530	(7,900)	0	23,606	2.70%
2007	891,706	7,020	14,040	5,530	5,530	(7,900)	0	24,219	2.74%
2008	900,757	7,230	14,461	5,530	5,530	(7,900)	0	24,851	2.79%
2009	918,359	7,447	14,895	5,530	5,530		0	33,402	3.71%
2010	936,632	7,671	15,342	5,530	5,530		0	34,072	3.71%
Total Add	**146,632**	**73,104**	**146,208**	**38,710**	**38,710**	**(39,500)**	**0**	**257,232**	**32.6%**
'00-'10									
Average		6,646	13,292	5,530	5,530	-7,900	0	23,385	
Median		6,617	13,234	5,530	5,530	-7,900	0	23,011	
CAGR	**1.6%**							**2.6%**	

Notes:

Analysis assumes 1.0% annual rate of electricity demand related to general economic growth translates into an equivalent rate of new baseload generation supply. Also assumes Internet and related IT technology growth adds 2.0% to annual electricity demand and hence baseload generation supply. We also assume a 1.0% annual rate of retirement for existing generation capacity (as of year end 1999) and a 1.0% rate of economic displacement due to economic inefficiency. We then assume that only 70% of retired and displaced MWs need to be replaced as new generating units will operate at higher capacity factors and efficiency. Our initial installed generation base includes IOU, municipal, independent, and co-op owned generation capacity less a portion of independently owned generation equal to approximately 40,000 MW that we assume will not grow materially. Installed generation at beginning of year includes addition of new incremental reserve margin from prior year to maintain a minimum 8% reserve.

Excludes increased capacity for reliability measures. Reserve margin (in MW) could actually increase as plants get closer to actual demand areas, to provide for interruptible load, and to provide a margin of reliability.

Sources. EEI & DOE data, DB Alex. Brown estimates

Figure 41: **Electricity Demand (MWHs & MWs) Estimates**

	MM MWH			INCREMENTAL MM MWH			INCREMENTAL MW		
	4.0%	3.0%	2.0%	4.0%	3.0%	2.0%	4.0%	3.0%	2.0%
2000E	3,900.00	3,862.50	3,825.00	150.00	112.50	75.00	22,831	17,123	11,416
2001E	4,056.00	3,978.38	3,901.50	156 00	115.88	76.50	23,744	17,637	11,644
2002E	4,218.24	4,097.73	3,979.53	162.24	119.35	78.03	24,694	18,166	11,877
2003E	4,386.97	4,220.66	4,059.12	168.73	122.93	79.59	25,682	18,711	12,114
2004E	4,562.45	4,347.28	4,140.30	175.48	126.62	81.18	26,709	19,272	12,357
2005E	4,744.95	4,477.70	4,223.11	182.50	130.42	82.81	27,777	19,851	12,604
2006E	4,934.74	4,612.03	4,307.57	189.80	134.33	84.46	28,889	20,446	12,856
2007E	5,132.13	4,750.39	4,393.72	197.39	138.36	86.15	30,044	21,059	13,113
2008E	5,337.42	4,892.90	4,481.60	205.29	142.51	87.87	31,246	21,691	13,375
2009E	5,550.92	5,039.69	4,571.23	213.50	146.79	89.63	32,496	22,342	13,643
2010E	5,772.95	5,190.88	4,662.65	222.04	151.19	91.42	33,796	23,012	13,915
	52,597	49,470	46,545	2,023	1,441	913	307,908	219,312	138,912

Source. Deutsche Banc Alex. Brown Estimates

Conclusions of Scenario

This scenario concludes that the U.S. needs approximately 147,000 new net MWs of peak generating capability, a 1.6% compound annual increase in capacity. This includes roughly 219,000 MW of new incremental demand growth and approximately 0 new MWs from incremental reserve margin, offset by a roughly 33,000 MW net reduction of capacity due to retirements and economic displacements and 40,000 MW from incremental capacity factors on existing generation. Total new power plant additions over the next decade are then roughly 257,000 MW, a 2.6% compound annual addition to capacity. This scenario involves adding an average of over 23,000 new megawatts of capacity each year from 2000 through 2010.

Assuming that all the additional capacity requirements are met with the construction of natural gas fired combined-cycle power facilities, we estimate that the U.S. needs to add approximately 515 new power plants to meet peak demand in 2010. Then assuming that each CCGT is constructed in a 2x1 configuration utilizing 2 F series combustion turbines, this number of new power plants would require over 1,050 turbines for construction. This implies that the U.S. will consume roughly 36%-40% of the current global supply of F-series combustion turbines.

Utilizing our estimates of natural gas utilization for new combined-cycle plants (Figure #15), we assume that 20,000-26,000 MW of new CCGTs will burn approximately 1 Tcf of natural gas in a year based on different capacity factors and heat rates. This implies a potential incremental demand for natural gas from power generation of approximately 8-11 Tcf annually. We even assume that 50% of existing natural gas-fired generation is displaced, releasing roughly 1.8 Tcf of the existing 3.5 Tcf of natural gas burned in installed generation. This then implies that the natural gas market could grow to 30-33 Tcf annually from roughly 22 Tcf in 1999. If no additional reserve capacity is added over the forecast period, the reserve margin would decline to 8.4%.

Figure 42: **Domestic Natural Gas-Fired Combustion Turbine Demand '00-'10**

	Total Capacity MW	Economic Add 1.5%	Internet/IT Add 2.0%	Normal Retirements	Economic Displacement	Total Add
Total Add	146,632	73,104	146,208	38,710	38,710	257,232
# 500 MW CCGTs	293	146	292	77	77	514
Comb. Turbine Demand (2x1 Configuration)	587	292	585	155	155	1,029
Global Comb. Turbine Supply						2,600-2,900
U.S. Share of Supply						35.5%-39.6%

Notes:
Assumes all incremental generation installed is natural gas-fired CCGTs. GE currently produces approximately 180 F Class combustion turbines and Siemens-Westinghouse produces 60 F Class Turbines which are generally the basis of most new central station CCGT's. Additional turbines may be supplied by other Japanese and European sources. Also assumes CCGT's are built in a 2x1 configuration that utilizes 2 combustion turbines and 1 steam turbine.

Sources: Calpine Corp., and DB Alex. Brown estimates

Figure 43: **Potential CCGT Incremental Natural Gas Demand '00-'10**

	Economic Add 1.5%	Internet/IT Add 2.0%	Total Capacity Additions MW	Normal Retirements	Economic Displacement	Existing Gas Burn Displaced	Total Incremental Build
Total Add	73,104	146,208	-	38,710	38,710		257,232
Tcf 85% Capacity	3.66	7.31	0.00	1.94	1.94	(1.75)	11.11
Tcf 65% Capacity	2.81	5.62	0.00	1.49	1.49	(1.75)	8.14

Notes:
Assumes all incremental generation installed is natural gas-fired CCGTs with heat rates of approximately 6,700 Btu/kWh, and 1 Mcf of natural gas equates to a heat content of 1 million Btu. Therefore, approximately 20,000 MW of new CCGT generation would burn 1 Tcf of natural gas at an 85% capacity factor, and approximately 26,000 MW at a 65% capacity factor. Also assumes 50% of existing gas-fired generation is retired.

Source: Deutsche Banc Alex. Brown estimates

Figure 44: Potential Impact on Reserve Margins '00-'10

	Total Utility Capacity MW	Current Peak Reserve Margin	Forward Peak Reserve Margin	Minimum 8% Reserve Margin
1999	**790,000**	79,000	10.00%	
2000	807,123	79,000	9.79%	76,500
2001	824,760	79,000	9.58%	76,500
2002	842,926	79,000	9.37%	76,500
2003	861,637	79,000	9.17%	76,500
2004	868,270	79,000	9.10%	76,500
2005	875,480	79,000	9.02%	76,500
2006	883,287	79,000	8.94%	76,500
2007	891,706	79,000	8.86%	76,500
2008	900,757	79,000	8.77%	76,500
2009	918,359	79,000	8.60%	76,500
2010	936,632	79,000	8.43%	76,500
Total Add	**146,632**	**0**		**0**

Notes:
Analysis assumes 1.0% annual rate of general economic growth in electricity demand translates into an equivalent rate of new generation supply. Also assumes Internet and related IT technology growth adds 2.0% to annual electricity demand and hence generation supply.

Source: DOE/EIA data, Deutsche Banc Alex. Brown estimates

Implications of Scenario

We believe this scenario is a very conservative representation of the potential future supply and demand for electricity over the next decade. Based on current turbine supplies, this scenario would represent a very conservative U.S. share of consumption of the world supply and conservative relevant to recent experience. We believe this scenario begins to approach a pretty realistic representation of the potential natural gas demand from electric generation. However, we believe alternative sources of generation would still be needed to meet demand. Natural gas supplies might reasonably supply approximately between three-quarters and seven-eighths of the natural gas-fired generation this scenario projects.

SCENARIO #7

Analysis

Our seventh scenario takes our sixth scenario and removes all elements of our analysis except for 3.0% demand growth from economic activity. This scenario continues to assume a 1.0% annual rate of electricity demand growth related to general economic growth. We also assume that Internet and Information Technology-related demand growth will add 2.0% annually to electricity demand.

In this scenario, we continue to utilize the mWh growth method of determining new capacity needs. Instead of growing installed generation, we growth mWh demand and convert the mWhs into new incremental generation utilizing a 75% load factor for new installed nameplate generation. This method generally leads to lower growth in generation by several thousand MWs in each year. Due to the current low level of reserve margins and due to the baseload nature of technology related electricity demand, we also assume that new generation demand requires the installation of new baseload generation to meet peak demand.

We assume no existing generation capacity retirements or economic displacements due to the superior economic inefficiency of new installed generation. We also assume no new incremental reserve margin additions and no capacity additions from increased capacity factors on existing installed generation. We exclude any other capacity additions for reliability measures. Nameplate additions may also underestimate the actual summer capacity required to meet peak summer demand. Reserve margins (in MW) could actually increase as plants get closer to actual demand areas, to provide for currently interruptible load, and to provide a margin of reliability. We utilize the same data sources, 1999 reserve margin assumption, and initial installed U.S. generation fleet for all of our scenarios.

Figure 45: **Potential Electric Baseload Generation Supply/Demand Growth '00-'10**

	Total Generating Capacity MW	Economic Add 1.0%	Internet/IT Add 2.0%	Normal Retirements 0.0%	Economic Retirements 0.0%	Increased Capacity Factor	Needed Reserve Margin	Total Net Peak Add.	New Capacity Need
1999	**790,000**								
2000	807,123	5,708	11,416	0	0	0	0	17,123	2.17%
2001	824,589	5,822	11,644	0	0	0	0	17,466	2.16%
2002	842,404	5,938	11,877	0	0	0	0	17,815	2.16%
2003	860,575	6,057	12,114	0	0	0	0	18,171	2.16%
2004	879,110	6,178	12,357	0	0	0	0	18,535	2.15%
2005	898,016	6,302	12,604	0	0	0	0	18,905	2.15%
2006	917,299	6,428	12,856	0	0	0	0	19,284	2.15%
2007	936,969	6,556	13,113	0	0	0	0	19,669	2.14%
2008	957,031	6,688	13,375	0	0	0	0	20,063	2.14%
2009	977,495	6,821	13,643	0	0	0	0	20,464	2.14%
2010	998,368	6,958	13,915	0	0	0	0	20,873	2.14%
Total Add	**208,368**	**69,456**	**138,912**	**0**	**0**	**0**	**0**	**208,368**	**26.4%**
'00-'10									
Average		6,314	12,628	0	0	0	0	18,943	
Median		6,302	12,604	0	0	0	0	18,905	
CAGR	**2.2%**							**2.2%**	

Notes:
Analysis assumes 1 0% annual rate of electricity demand related to general economic growth translates into an equivalent rate of new baseload generation supply Also assumes Internet and related IT technology growth adds 2.0% to annual electricity demand and hence baseload generation supply We assume no retirement for existing generation capacity or economic displacement due to economic inefficiency Our initial installed generation base includes IOU, municipal, independent, and co-op owned generation capacity less a portion of independently owned generation equal to approximately 40,000 MW that we assume will not grow materially Assumes no incremental addition of reserve margin

Excludes increased capacity for reliability measures. Reserve margin (in MW) could actually increase as plants get closer to actual demand areas, to provide for interruptible load, and to provide a margin of reliability.

Sources: EEI & DOE data, DB Alex Brown estimates

Conclusions of Scenario

This scenario concludes that the U.S. needs approximately 208,000 new net MWs of peak generating capability, a 2.2% compound annual increase in capacity. Total new power plant additions over the next decade are then also roughly 208,000 MW. This scenario involves adding an average of over 19,000 new megawatts of capacity each year from 2000 through 2010.

Assuming that all the additional capacity requirements are met with the construction of natural gas fired combined-cycle power facilities, we estimate that the U.S. needs to add approximately 417 new power plants to meet peak demand in 2010. Then assuming that each CCGT is constructed in a 2x1 configuration utilizing 2 F series combustion turbines, this number of new power plants would require almost 835 turbines for construction. This implies that the U.S. will consume roughly 29.32% of the current global supply of F-series combustion turbines.

Utilizing our estimates of natural gas utilization for new combined-cycle plants (Figure #15), we assume that 20,000-26,000 MW of new CCGTs will burn approximately 1 Tcf of natural gas in a year based on different capacity factors and heat rates. This implies a potential incremental demand for natural gas from power generation of approximately 8-10 Tcf annually. We assume no existing natural gas-fired generation is retired or displaced. This then implies that the natural gas market could grow to between 30-32 Tcf annually from roughly 22 Tcf in 1999. If no additional reserve capacity is added over the forecast period, the reserve margin would decline to 7.9%.

Figure 46: **Domestic Natural Gas-Fired Combustion Turbine Demand '00-'10**

	Total Capacity MW	Economic Add 1.0%	Internet/IT Add 2.0%	Normal Retirements	Economic Displacement	Total Add
Total Add	208,368	69,456	138,912	0	0	208,368
# 500 MW CCGTs	417	139	278	0	0	417
Comb. Turbine Demand (2x1 Configuration)	833	278	556	0	0	833
Global Comb. Turbine Supply						2,600-2,900
U.S. Share of Supply						28.7%-32.1%

Notes:
Assumes all incremental generation installed is natural gas-fired CCGTs. GE currently produces approximately 180 F Class combustion turbines and Siemens-Westinghouse produces 60 F Class Turbines which are generally the basis of most new central station CCGT's. Additional turbines may be supplied by other Japanese and European sources. Also assumes CCGT's are built in a 2x1 configuration that utilizes 2 combustion turbines and 1 steam turbine.

Sources: Calpine Corp., and DB Alex. Brown estimates

Figure 47: Potential CCGT Incremental Natural Gas Demand '00-'10

	Economic Add 1.0%	Internet/IT Add 2.0%	Total Capacity Additions MW	Normal Retirements	Economic Displacement	Existing Gas Burn Displaced	Total Incremental Build
Total Add	69,456	138,912	-	-	-		208,368
Tcf 85% Capacity	3.47	6.95	0.00	0.00	0.00	0.00	10.42
Tcf 65% Capacity	2.67	5.34	0.00	0.00	0.00	0.00	8.01

Notes:
Assumes all incremental generation installed is natural gas-fired CCGTs with heat rates of approximately 6,700 Btu/kWh, and 1 Mcf of natural gas equates to a heat content of 1 million Btu. Therefore, approximately 20,000 MW of new CCGT generation would burn 1 Tcf of natural gas at an 85% capacity factor, and approximately 26,000 MW at a 65% capacity factor. Also assumes 50% of existing gas-fired generation is retired.

Source: Deutsche Banc Alex Brown estimates

Figure 48: Potential Impact on Reserve Margins '00-'10

	Total Utility Capacity MW	Current Peak Reserve Margin	Forward Peak Reserve Margin
1999	**790,000**	79,000	10.00%
2000	807,123	79,000	9.79%
2001	824,589	79,000	9.58%
2002	842,404	79,000	9.38%
2003	860,575	79,000	9.18%
2004	879,110	79,000	8.99%
2005	898,016	79,000	8.80%
2006	917,299	79,000	8.61%
2007	936,969	79,000	8.43%
2008	957,031	79,000	8.25%
2009	977,495	79,000	8.08%
2010	998,368	79,000	7.91%
Total Add	**208,368**	**0**	

Notes:
Analysis assumes 1.0% annual rate of general economic growth in electricity demand and translates into an equivalent rate of new generation supply. Also assumes Internet and related IT technology growth adds 2.0% to annual electricity demand and hence generation supply.

Source: DOE/EIA data, Deutsche Banc Alex. Brown estimates

Implications of Scenario

We believe this scenario is a very conservative representation of the potential future supply and demand for electricity over the next decade but still exceeds most industry forecasts we have seen. Based on current turbine supplies, this scenario would represent a very conservative U.S. share of consumption of the world supply and conservative relevant to recent experience. We believe this scenario represents a realistic representation of the potential natural gas demand from electric generation. We do not believe this scenario suggests that material alternative sources of generation would be needed to meet demand.

SCENARIO #8

Analysis

Our eighth scenario continues to assume a 1.5% annual rate of electricity demand growth related to general economic growth. We also assume that Internet and Information Technology-related demand growth will add an additional 2.0% annually to electricity demand. We also show the proportion of electricity demand that would be consumed by IT related equipment if the growth in this segment merely grows at the 2.0% rate.

In this scenario, we continue to utilize the mWh growth method of determining new capacity needs. We also illustrate how the Internet/IT share of electricity demand will grow over the next decade by merely adding 2.0% to annual demand. Due to the current low level of reserve margins and due to the baseload nature of technology related electricity demand, we also assume that new generation demand requires the installation of new baseload generation to meet peak demand.

We also assume a 1.0% annual rate of existing generation capacity retirements (as of year end 1999 levels) and a 1.0% annual rate of economic displacement due to the superior economic inefficiency of new installed generation. We then assume that the generation capacity displaced and retired is replaced by generation capacity equal to only 70% of the nominal retired and displaced capacity (MWs) as new generating units will operate at higher capacity factors and efficiency. We also assume that installed generation at beginning of year includes the addition of prior year growth and new incremental reserve margin from the prior year required to maintain a minimum 10.0% reserve.

We then assume that capacity additions from increased capacity factors on existing installed generation of approximately 1.0% annually for 5 years beginning in 2004. We exclude any further capacity additions for reliability measures. Nameplate additions may also underestimate the actual summer capacity required to meet peak summer demand. Reserve margins (in MW) could actually increase as plants get closer to actual demand areas, to provide for currently interruptible load, and to provide a margin of reliability.

Figure 49: Potential Electric Baseload Generation Supply/Demand Growth '00-'10

	Total Generating Capacity MW	Economic Add 1.5%	Internet/IT Add 2.0%	Internet/IT Capacity	Internet/IT Share	Normal Retirements 1.0%	Economic Retirements 1.0%	Increased Capacity Factor 1.0%	Needed Reserve Margin	Total Net Peak Add.	New Capacity Need
1999	790,000			102,700	13.00%						
2000	812,197	8,562	11,416	114,116	14.05%				2,220	22,197	2.81%
2001	834,933	8,818	11,644	125,759	15.06%				2,274	22,736	2.80%
2002	858,221	9,083	11,877	137,636	16.04%				2,329	23,289	2.79%
2003	882,077	9,356	12,114	149,750	16.98%				2,386	23,855	2.78%
2004	892,469	9,636	12,357	162,107	18.16%	5,530	5,530	(7,900)	1,039	26,192	2.97%
2005	903,456	9,925	12,604	174,711	19.34%	5,530	5,530	(7,900)	1,099	26,788	3.00%
2006	915,055	10,223	12,856	187,566	20.50%	5,530	5,530	(7,900)	1,160	27,399	3.03%
2007	927,280	10,530	13,113	200,679	21.64%	5,530	5,530	(7,900)	1,223	28,025	3.06%
2008	940,148	10,846	13,375	214,054	22.77%	5,530	5,530	(7,900)	1,287	28,667	3 09%
2009	962,452	11,171	13,643	227,697	23.66%	5,530	5,530		2,230	38,104	4.05%
2010	985,431	11,506	13,915	241,612	24.52%	5,530	5,530		2,298	38,780	4.03%
Total Add	195,431	109,656	138,912			38,710	38,710	(39,500)	19,543	306,031	38.7%
'00-'10											
Average		9,969	12,628			5,530	5,530	-7,900	1,777	27,821	
Median		9,925	12,604			5,530	5,530	-7,900	2,220	26,788	
CAGR	2.0%									3.0%	

Notes:
Analysis assumes 1.5% annual rate of electricity demand related to general economic growth translates into an equivalent rate of new baseload generation supply Also assumes Internet and related IT technology growth adds 2.0% to annual electricity demand and hence baseload generation supply We also assume a 1 0% annual rate of retirement for existing generation capacity (as of year end 1999) and a 1 0% rate of economic displacement due to economic inefficiency. We then assume that only 70% of retired and displaced MWs need to be replaced as new generating units will operate at higher capacity factors and efficiency Our initial installed generation base includes IOU, municipal, independent, and co-op owned generation capacity less a portion of independently owned generation equal to approximately 40,000 MW that we assume will not grow materially Installed generation at beginning of year includes addition of new incremental reserve margin from prior year to maintain a minimum 10% reserve

Excludes increased capacity for reliability measures Reserve margin (in MW) could actually increase as plants get closer to actual demand areas, to provide for interruptible load, and to provide a margin of reliability.

Sources: EEI & DOE data, Mills-McCarthy & Associates estimates, and DB Alex. Brown estimates

Conclusions of Scenario

This scenario concludes that the U.S. needs approximately 195,000 new net MWs of peak generating capability, a 2.0% compound annual increase in capacity. This includes roughly 248,000 MW of new incremental demand growth and approximately 20,000 new MWs from incremental reserve margin, offset by a roughly 33,000 MW net reduction of capacity due to retirements and economic displacements and 40,000 MW from incremental capacity factors on existing generation. Total new power plant additions over the next decade are then roughly 306,000 MW, a 3.0% compound annual addition to capacity. This scenario involves adding an average of over 28,000 new megawatts of capacity each year from 2000 through 2010.

Assuming that all the additional capacity requirements are met with the construction of natural gas fired combined-cycle power facilities, we estimate that the U.S. needs to add approximately 612 new power plants to meet peak demand in 2010. Then assuming that each CCGT is constructed in a 2x1 configuration utilizing 2 F series combustion turbines, this number of new power plants would require almost 1,225 turbines for construction. This implies that the U.S. will consume roughly 42%-47% of the current global supply of F-series combustion turbines.

Utilizing our estimates of natural gas utilization for new combined-cycle plants (Figure #15), we assume that 20,000-26,000 MW of new CCGTs will burn approximately 1 Tcf of natural gas in a year based on different capacity factors and heat rates. This implies a potential incremental demand for natural gas from power generation of approximately 10-14 Tcf annually. We even assume that 50% of existing natural gas-fired generation is displaced, releasing roughly 1.8 Tcf of the existing 3.5 Tcf of natural gas burned in installed generation. This then implies that the natural gas market could grow to 32-36 Tcf annually from roughly 22 Tcf in 1999. If no additional reserve capacity is added over the forecast period, the reserve margin would decline to 8.0%.

Figure 50: **Domestic Natural Gas-Fired Combustion Turbine Demand '00-'10**

	Total Capacity MW	Economic Add 1.5%	Internet/IT Add 2.0%	Normal Retirements	Economic Displacement	Needed Reserve Margin	Total Add
Total Add	195,431	109,656	138,912	38,710	38,710	19,543	306,031
# 500 MW CCGTs	391	219	278	77	77	39	612
Comb. Turbine Demand (2x1 Configuration)	782	439	556	155	155	78	1,224
Global Comb. Turbine Supply							2,600-2,900
U.S. Share of Supply							42.2%-47.1%

Notes:
Assumes all incremental generation installed is natural gas-fired CCGTs. GE currently produces approximately 180 F Class combustion turbines and Siemens-Westinghouse produces 60 F Class Turbines which are generally the basis of most new central station CCGT's. Additional turbines may be supplied by other Japanese and European sources. Also assumes CCGT's are built in a 2x1 configuration that utilizes 2 combustion turbines and 1 steam turbine.

Sources: Calpine Corp. estimates and Deutsche Banc Alex Brown estimates

Figure 51: **Potential CCGT Incremental Natural Gas Demand '00-'10**

	Economic Add 1.5%	Internet/IT Add 2.0%	Total Capacity Additions MW	Normal Retirements	Economic Displacement	Existing Gas Burn Displaced	Needed Reserve Margin	Total Incremental Build
Total Add	109,656	138,912	195,431	38,710	38,710		19,543	306,031
Tcf 85% Capacity	5.48	6.95	9.77	1.94	1.94	(1.75)	0.98	13.55
Tcf 65% Capacity	4.22	5.34	7.52	1.49	1.49	(1.75)	0.75	10.02

Notes:
Assumes all incremental generation installed is natural gas-fired CCGTs with heat rates of approximately 6,700 Btu/kWh, and 1 Mcf of natural gas equates to a heat content of 1 million Btu. Therefore, approximately 20,000 MW of new CCGT generation would burn 1 Tcf of natural gas at an 85% capacity factor, and approximately 26,000 MW at a 65% capacity factor. Also assumes 50% of existing gas-fired generation is retired.

Sources: Calpine Corp estimates and Deutsche Banc Alex. Brown estimates

Figure 52: **Potential Impact on Reserve Margins '00-'10**

	Total Utility Capacity MW	Current Peak Reserve Margin	Forward Peak Reserve Margin	Constant 10% Reserve Margin	Incremental Reserve Margin Needed
1999	**790,000**	79,000	10.00%		
2000	812,197	79,000	9.73%	81,220	2,220
2001	834,933	79,000	9.46%	83,493	2,274
2002	858,221	79,000	9.21%	85,822	2,329
2003	882,077	79,000	8.96%	88,208	2,386
2004	892,469	79,000	8.85%	89,247	1,039
2005	903,456	79,000	8.74%	90,346	1,099
2006	915,055	79,000	8.63%	91,506	1,160
2007	927,280	79,000	8.52%	92,728	1,223
2008	940,148	79,000	8.40%	94,015	1,287
2009	962,452	79,000	8.21%	96,245	2,230
2010	985,431	79,000	8.02%	98,543	2,298
Total Add	**195,431**	**0**		**19,543**	

Notes:
Analysis assumes 1.5% annual rate of general economic growth in electricity demand translates into an equivalent rate of new generation supply. Also assumes Internet and related IT technology growth adds 2.0% to annual electricity demand and hence generation supply.

Sources: DOE/EIA data, Deutsche Banc Alex. Brown estimates

Implications of Scenario

This scenario suggests that Internet/IT demand will consume close to 25% of U.S. electricity supplies by 2010. We believe this scenario is a very conservative representation of the potential future supply and demand for electricity over the next decade but still exceeds most industry forecasts we have seen. Based on current turbine supplies, this scenario would represent a very conservative U.S. share of consumption of the world supply and conservative relevant to recent experience. We believe this scenario represents a realistic representation of the potential natural gas demand from electric generation. We believe this scenario suggests that alternative sources of generation would be needed to meet at least one-third of new electricity demand.

SCENARIO #9 – The High Technology Growth Scenario

Analysis

This is perhaps the most interesting scenario. It suggests that the growth in technology based electricity demand could be so profound as to require a radical reconstruction of the electric utility industry. This scenario depicts a high growth rate in IT related electricity demand. The demand for highly reliable baseload generation and backup power related to the amount and source of the growth suggests the need for not only significant new generation supplies but also a new delivery infrastructure to meet the new demand and the quality requirements of that demand.

Our ninth scenario continues to assume a 1.5% annual rate of electricity demand growth related to general economic growth. We also assume that share of Internet and Information Technology-related demand will grow 15% annually. Given the magnitudes of growth expected in computer equipment and the Internet, we believe 15% electricity growth from this sector is reasonable. We also illustrate how the Internet/IT share of electricity demand will grow over the next decade. *In this scenario, we continue to utilize the mWh growth method of determining new capacity needs.* Due to the current low level of reserve margins and due to the baseload nature of technology related electricity demand, we also assume that new generation demand requires the installation of new baseload generation to meet peak demand.

We assume no existing generation capacity retirements or economic displacements due to the superior economic inefficiency of new installed generation. We also assume that installed generation at beginning of year includes the addition of prior year growth and new incremental reserve margin from the prior year required to maintain a minimum 10.0% reserve.

We then assume that capacity additions from increased capacity factors on existing installed generation of approximately 1.0% annually for 5 years beginning in 2004. We exclude any further capacity additions for reliability measures. Nameplate additions may also underestimate the actual summer capacity required to meet peak summer demand. Reserve margins (in MW) could actually increase as plants get closer to actual demand areas, to provide for currently interruptible load, and to provide a margin of reliability.

Figure 53: Potential Electric Baseload Generation Supply/Demand Growth '00-'10

	Total Generating Capacity MW	Economic Add 1.5%	Internet/IT Add	Internet/IT Capacity 15.0%	Internet/IT Share	Normal Retirements 0.0%	Economic Retirements 0.0%	Increased Capacity Factor	Needed Reserve Margin	Total Net Peak Add.	New Capacity Need
1999	790,000			102,700	13.00%						
2000	816,630	8,562	15,405	118,105	14.46%	0	0	0	2,663	26,630	3.37%
2001	846,112	8,818	17,716	135,821	16.05%	0	0	0	2,948	29,482	3.61%
2002	878,841	9,083	20,373	156,194	17.77%	0	0	0	3,273	32,729	3.87%
2003	915,269	9,356	23,429	179,623	19.63%	0	0	0	3,643	36,427	4.14%
2004	947,135	9,636	26,943	206,566	21.81%	0	0	(7,900)	3,187	31,866	3.48%
2005	983,813	9,925	30,985	237,551	24.15%	0	0	(7,900)	3,668	36,678	3.87%
2006	1,025,986	10,223	35,633	273,184	26.63%	0	0	(7,900)	4,217	42,173	4.29%
2007	1,074,439	10,530	40,978	314,162	29.24%	0	0	(7,900)	4,845	48,453	4.72%
2008	1,130,072	10,846	47,124	361,286	31.97%	0	0	(7,900)	5,563	55,633	5.18%
2009	1,202,698	11,171	54,193	415,479	34.55%	0	0	0	7,263	72,627	6.43%
2010	1,284,729	11,506	62,322	477,801	37.19%	0	0	0	8,203	82,031	6.82%
Total Add	**494,729**	**109,656**	**375,101**			**0**	**0**	**(39,500)**	**49,473**	**494,729**	**62.6%**
'00-'10											
Average		9,969	34,100			0	0	-3,591	4,498	44,975	
Median		9,925	30,985			0	0	0	3,668	36,678	
CAGR	**4.5%**									**4.5%**	

Notes:
Analysis assumes 1.5% annual rate of electricity demand related to general economic growth translates into an equivalent rate of new baseload generation supply. Also assumes Internet and related IT technology related demand grows 15 0% annually, adding to annual electricity demand and hence baseload generation supply We also assume a 1 0% annual rate of retirement for existing generation capacity (as of year end 1999) and a 1 0% rate of economic displacement due to economic inefficiency. We then assume that only 70% of retired and displaced MWs need to be replaced as new generating units will operate at higher capacity factors and efficiency Our initial installed generation base includes IOU, municipal, independent, and co-op owned generation capacity less a portion of independently owned generation equal to approximately 40,000 MW that we assume will not grow materially Installed generation at beginning of year includes addition of new incremental reserve margin from prior year to maintain a minimum 10% reserve.

Excludes increased capacity for reliability measures. Reserve margin (in MW) could actually increase as plants get closer to actual demand areas, to provide for interruptible load, and to provide a margin of reliability

Sources: EEI & DOE data, Mills-McCarthy & Associates estiamtes, and DB Alex Brown estimates

Conclusions of Scenario

This scenario concludes that the U.S. needs approximately 495,000 new net MWs of peak generating capability, a 4.5% compound annual increase in capacity. This includes roughly 485,000 MW of new incremental demand growth and approximately 49,000 new MWs from incremental reserve margin, offset by roughly 40,000 MW from incremental capacity factors on existing generation. This scenario involves adding an average of almost 45,000 new megawatts of capacity each year from 2000 through 2010.

Assuming that all the additional capacity requirements are met with the construction of natural gas fired combined-cycle power facilities, we estimate that the U.S. needs to add approximately 1,000 new power plants to meet peak demand in 2010. Then assuming that each CCGT is constructed in a 2x1 configuration utilizing 2 F series combustion turbines, this number of new power plants would require almost 2,000 turbines for construction. This implies that the U.S. will consume roughly 68-76% of the current global supply of F-series combustion turbines.

Utilizing our estimates of natural gas utilization for new combined-cycle plants (Figure #15), we assume that 20,000-26,000 MW of new CCGTs will burn approximately 1 Tcf of natural gas in a year based on different capacity factors and heat rates. This implies a potential incremental demand for natural gas from power generation of approximately 19-25 Tcf annually. We even assume that 50% of existing natural gas-fired generation is displaced, releasing roughly 1.8 Tcf of the existing 3.5 Tcf of natural gas burned in installed generation. This then implies that the natural gas market could grow to 41-47 Tcf annually from roughly 22 Tcf in 1999. If no additional reserve capacity is added over the forecast period, the reserve margin would decline to 6.2%.

The two charts that follow in Exhibits 57 & 58 represent the net MW of capacity installed at the end of each year of our scenario and the number of plants we estimate would be required to meet the capacity scenario.

Figure 54: **Domestic Natural Gas-Fired Combustion Turbine Demand '00-'10**

	Total Capacity MW	Economic Add 1.5%	Internet/IT Add 2.0%	Normal Retirements	Economic Displacement	Needed Reserve Margin	Total Add
Total Add	494,729	109,656	375,101	0	0	49,473	494,729
# 500 MW CCGTs	989	219	750	0	0	99	989
Comb. Turbine Demand (2x1 Configuration)	1,979	439	1,500	0	0	198	1,979
Global Comb. Turbine Supply							2,600-2,900
U.S. Share of Supply							68.2%-76.1%

Assumes: GE produces approximately 180 F Class combustion turbines and Siemens-Westinghouse produces 60 F Class Turbines which are generally the basis of most new central station CCGT's. Additional turbines may be supplied by other Japanese and European sources. Also assumes CCGT's are built in a 2x1 configuration that utilizes 2 combustion turbines.

Sources. Calpine Corp estimates and Deutsche Banc Alex Brown estimates

Figure 55: **Potential CCGT Incremental Natural Gas Demand '00-'10**

	Economic Add 1%	Internet/IT Add 2%	Total Capacity Additions MW	Normal Retirements	Economic Displacement	Existing Gas Burn Displaced	Needed Reserve Margin	Total Incremental Build
Total Add	109,656	375,101	494,729	0.00	0.00		49,473	494,729
Tcf 85% Capacity	5.48	18.76	24.74	0.00	0.00	0.00	2.47	24.74
Tcf 65% Capacity	4.22	14.43	19.03	0.00	0.00	0.00	1.90	19.03

Assumes: Natural gas-fired CCGTs are incremental generation installed with heat rates of 6,700 Btu/kWh and 85% capacity rates, and 1 Mcf equates to a heat content of 1 million Btu. Therefore, approximately 20,000 MW of new CCGT generation would burn 1 Tcf of natural gas at an 85% capacity factor, and approximately 26,000 MW at a 65% capacity factor. Also assumes 50% of existing gas-fired generation is retired.

Source: Deutsche Banc Alex Brown estimates

Figure 56: **Potential Impact on Reserve Margins '00-'10**

	Total Utility Capacity MW	Current Peak Reserve Margin	Forward Peak Reserve Margin	Constant 10% Reserve Margin	Incremental Reserve Margin Needed
1999	**790,000**	79,000	10.00%		
2000	816,630	79,000	9.67%	81,663	2,663
2001	846,112	79,000	9.34%	84,611	2,948
2002	878,841	79,000	8.99%	87,884	3,273
2003	915,269	79,000	8.63%	91,527	3,643
2004	947,135	79,000	8.34%	94,713	3,187
2005	983,813	79,000	8.03%	98,381	3,668
2006	1,025,986	79,000	7.70%	102,599	4,217
2007	1,074,439	79,000	7.35%	107,444	4,845
2008	1,130,072	79,000	6.99%	113,007	5,563
2009	1,202,698	79,000	6.57%	120,270	7,263
2010	1,284,729	79,000	6.15%	128,473	8,203
Total Add	**494,729**	**0**		**49,473**	

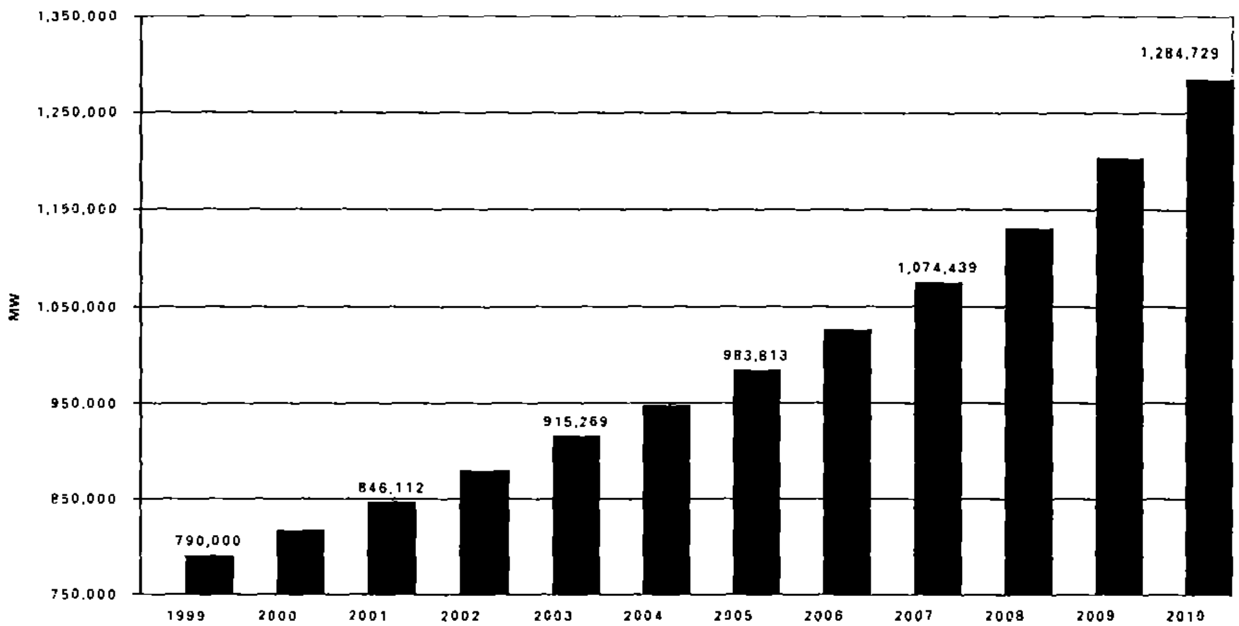
Notes: Analysis assumes 1.5% annual rate of general economic growth in electricity demand translates into an equivalent rate of new generation supply. Also assumes Internet and related IT technology growth adds 2% to annual electricity demand and hence generation supply.

Sources. DOE/EIA data, Deutsche Banc Alex Brown estimates

Implications of Scenario

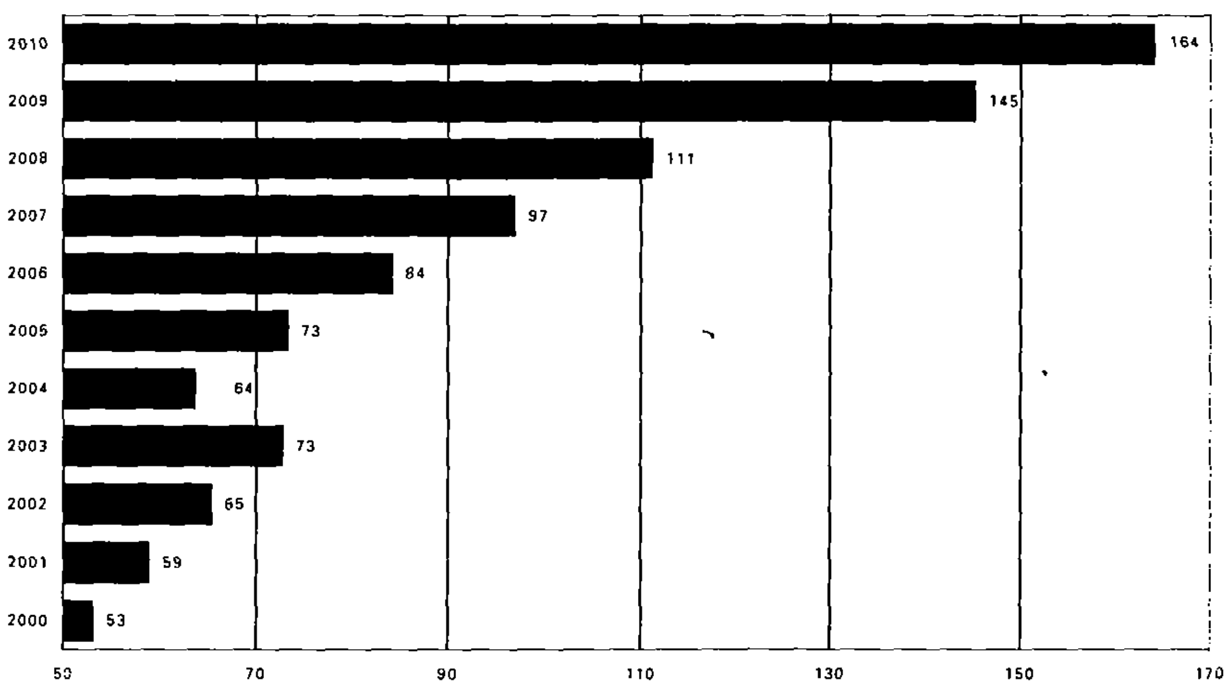
This scenario suggests that Internet/IT demand will consume close to 37% of U.S. electricity supplies by 2010. If the initial proportion of existing technology demand is correct and the demand related to the sector grows at a 15% compound annual rate, IT related demand growth would require over 375 gigawatts of new generating capacity alone. We believe this scenario is a reasonable representation of the potential future supply and demand for electricity over the next decade. If the Internet and the indirect effects of its growth continue to expand at the fantastic rates expected, a 15% annual growth in electricity demand from this sector could prove conservative. Based on current turbine supplies, this scenario would represent a moderate U.S. share of consumption of the world supply and would be somewhat conservative relative to recent experience. This scenario represents an optimistic representation of the potential natural gas demand from electric generation. We believe this scenario would require up to 300 gigawatts of alternative sources of generation to meet demand.

Figure 57: **Electric Utility Generation Capacity Growth '00-'10 - High Technology Growth Scenario**



Source: DOE/EIA data, Deutsche Banc Alex. Brown estimates

Figure 58: **Potential Power Plant Build - High Technology Growth Scenario**



Source: Deutsche Banc Alex. Brown estimates

IMPLICATIONS OF OUR INVESTIGATION

We derive a number of conclusions from our analysis that some observers may consider radical. Utilizing even conservative assumptions that we thought met many conventional expectations for electricity growth, we come to some startlingly huge expectations. Our scenarios generally point to the need for 400-500 gigawatts of new electric generating capacity by 2010. Using even modest historical assumptions for demand growth in the current decade, we believe the U.S. will need enough new electricity supplies to build incremental capacity that exceeds the current combined installed electric capacities of the U.K. and France. This conclusion exceeds most 'reputable' forecasts by a significant margin. However, we believe most of the *'reputable' forecasts ignore the very core issue that will drive electricity* demand in the future.

Figure 59: Potential Electric Baseload Generation Supply/Demand Growth '00-'10

	Total Generating Capacity MW	Net Addition MW	Economic Add	Internet/IT	Normal Retirements	Economic Retirements	Increased Capacity Factor	Needed Reserve Margin	Total Net Peak Add	# Plants	# Turbines	Tcf 85%	Tcf 65%
WOW Scenario 1	1,170,758	380,758	157,390	262,317	91,245	88,480	0	38,076	637,508	1,275	2,550	32	25
Scenario 2	1,178,731	389,731	158,217	263,694	38,710	38,710	0	0	499,331	999	1,997	25	19
Scenario 3	1,216,169	426,169	159,813	266,355	0	0	0	0	426,169	852	1,705	21	16
Baseline Scenario 4	1,173,490	383,490	158,075	210,766	27,650	27,650	0	38,349	462,490	925	1,850	23	18
Scenario 5	992,157	202,157	98,040	196,081	38,710	38,710	(79,000)	20,216	312,757	626	1,251	16	12
Scenario 6	936,632	146,632	73,104	146,208	38,710	38,710	(39,500)	0	257,232	514	1,029	13	10
Scenario 7	998,368	208,368	69,456	138,912	0	0	0	0	208,368	417	833	10	8
Scenario 8	985,431	195,431	109,656	138,912	38,710	38,710	(39,500)	19,543	306,031	612	1,224	15	12
Tech Growth Scenario 9	1,284,729	494,729	109,656	375,101	0	0	(39,500)	49,473	494,729	989	1,979	25	19
'00-'10													
Average	1,095,713	305,713	117,002	217,004	22,811	22,811	-24,688	15,948	370,888	742	1,484	19	14
Median	1,085,929	295,929	109,656	203,423	33,180	33,180	-19,750	9,772	369,463	739	1,478	18	14

Source: EEI & DOE data, Mills-McCarthy & Associates, Calpine Corp., and DB Alex. Brown Estimates

Technology

Technology is having a profound direct and indirect impact on energy consumption in the global economy, particularly in the U.S. and Canada. The Internet Age will have a dramatic direct impact on electricity, natural gas, and possibly even coal consumption to fuel the geometric growth in broadband capacity volumes and microprocessor related electricity use. We also believe that this transformative economic trend will produce indirect benefits. The wealth effect of higher sustained economic growth also has a positive impact on energy consumption. The more Palm Pilots, cell phones, and Sega machines we can afford as a nation, the more electricity is consumed through both the production of the products and the ultimate consumer use of the products. The Internet age is also indirectly causing an increase in business travel, parcel deliveries, etc. related to the enhanced economic growth resulting from E-Commerce and its development. The impact of this economic event is likely to be surprisingly large and more far reaching than currently expected by even the optimists and certainly more than the forecasts that ignore the trend.

Environment

We are extremely skeptical of all the bluster about the Kyoto Protocol and the hollow election year political promises to close all the dirty coal plants. This bluster is based on wrongheaded environmental policy based on 1970s views and not on 2000s economic reality. Do not get us wrong, we are in favor of cleaning up the environment. However, coal is not inherently bad. Old, inefficient coal plants are a blight but they can be replaced by more efficient technology. The only realistic replacement for our coal plants are new coal plants or new nuclear installations. We are guessing that coal will generally beat nuclear in a popularity contest and in terms of economics.

One of the benefits of the Digital Revolution is likely to be the massive installation of more fuel efficient, smaller, cleaner, greener power generation. However, net fossil fuel combustion <u>will</u> increase significantly. Fortunately, new pollution control systems are on the cusp of commercial development that reduce nearly all the emissions of fossil fuel combustion at lower costs than current technologies allow. Acceptance of these technologies could prove a boon to the speed at which new power plants are approved and could slow the retirement of some older plants.

The environment versus energy debate is essentially a combat between two diametrically opposed objectives: clean the atmosphere or grow the economy. Therefore, the only way politicians and environmentalists can hope to achieve their admirable, but lofty goals is to virtually eliminate economic growth in the developed countries (again, particularly the U.S. and Canada) and arrest the development of the Internet. The Internet is growing several hundred percent per annum and requires fuel for growth. That fuel is electricity, which is in turn generated using fossil fuels. Vice President Al Gore should realize that the Internet will require trillions of additional kWhs to grow, he says he invented the thing. Reductions in fossil fueled electric generation would simply impede economic growth. We do not believe the Information Age juggernaut can or will be slowed by environmental radicals, it is too powerful a trend.

Generation

Clearly, much of the new electric generation assets will be natural gas-fired combined-cycle technology, for a time. However, it would be a modern day miracle if the U.S. and Canada could produce a 50% increase in deliverable natural gas by 2010 to approximately 33 Tcf (including LNG imports). We estimate that 20,000 MWs of new state of the art combined-cycle generation will burn approximately 1 Tcf of natural gas annually (see figure #15). That implies that approximately 200,000-220,000 MWs of new CCGTs can be installed by the end of 2010 if the natural gas industry produces the deliverability miracle. New natural gas peakers, fuel cells, and microtubines that are installed will further reduce that amount due to lower efficiency rates.

Based on the implications of our base scenario, and several of the moderate to optimistic scenarios, the capacity evident in the announced new merchant power plants will not be sufficient to meet new demand over the next five years. Our baseline scenario implies at least 165,000 MW of principally baseload generation are needed within five years. That is approximately the amount of announced merchant development. However, a significant portion of that generation will never be installed. A lack of financing (for the small, weak developers), turbines, fuel, and construction/engineering capacity will constrain a significant amount of that planned construction. Some developers will recognize that their plants are in the wrong locations and others will never have their sites and permits approved.

Based on the queue of current merchant plant development, it is fair to assume that nearly all will be natural gas-fired CCGTs. Most of this capacity will be added in the first half of the decade until they run up against natural gas supply shortages. If all the natural gas-fired CCGTs currently being developed were constructed, the U.S. would attain a 30-32 Tcf natural gas market by 2005. That level of net natural gas production has never been achieved nor has that rate of production growth been even near recent experience. We simply doubt that the gas will be delivered.

If all the recently announced plant development were constructed by 2005, we believe the U.S. might be capable of nearly treading water relative to current system reliability. This assumes each of these projects received the required financing, equipment, siting, natural gas, etc. needed to complete construction. As we do not believe this is a legitimate scenario, we expect the U.S. to run a capacity shortage, or at least a reliability scare, going into each peak season for the next five years at least. Approximately 20,000 MWs of new capacity is expected to enter commercial service by the peak season this year. This represents just over the minimum required to meet demand growth that we expect in even our most modest scenario (Scenario #7). This scenario allows for no plant retirements of any kind and does not allow for maintaining reserve margins. Therefore, system reliability continues to decline despite all of the touted merchant supply in the pipeline. Only 30-35 gigawatts in total are currently under construction nationwide.

Despite all the industry attention lavished on the national merchant generation capacity planned for the next 5 years, we believe it will be insufficient to meet demand in the aggregate. Regional discrepancies are a certainty. As no merchant developer has yet to utter a single word about developing coal plants, and since coal plants will require over 5 years to plan, site, permit, finance and construct, we believe the capacity shortfall is unlikely to be closed soon. Then, in our view, once developers come to the conclusion that fuels other than natural gas will be needed to meet demand, incremental generation will have a chance to catch up with demand, maybe. Coal is more than plentiful enough to meet the incremental supply needs not met by natural gas and the price of delivered coal continues to fall.

If electricity demand growth is just 3.0% (just slightly higher than the five-year average growth), we are likely to exceed 200,000 MWs of incremental electricity demand growth over the next decade. That does not allow for maintaining a stable reserve margin, or retiring, or displacing old plants. This implies that the U.S. will need to consider fuel sources other than natural gas to meet incremental electricity demand.

In our opinion, electricity demand is likely to continue to accelerate and grow 3%-4% annually. Assuming a 3.5% annual rate of growth in demand through

2010, the U.S. will need almost 340,000 new net MWs of capacity and will need to construct over 450,000 MWs of new and replacement capacity. The difference is the replacement of existing generating capacity and the maintenance of a stable reserve margin. This scenario implies that the U.S. will require the construction of about 150,000 MWs of new incremental coal-fired generating capacity and up to 250,000 MW of new coal plants overall (depending on what fuel types are retired and displaced).

This is a radical departure from the conventional view we know, but one that is supported by our assumptions. Environmentalists will be thrilled to hear this! However, this suggests the installation of technologically superior circulating fluidized bed boiler coal plants that are considerably cleaner than most existing coal plants. It also implies the incremental clean-up of a significant amount of older, dirtier coal-fired and oil-fired technology. Our various scenarios are based on nameplate generation. Line losses, lower summer capabilities, and on-site consumption could provide further need for incremental construction that we do not account for.

Distributed Generation

While a substantial market for distributed generation exists and is developing rapidly, we believe it will remain a niche portion of the overall electricity supply in the U.S. and Canada. We do not believe that the laws of physics and thermodynamics will ever allow distributed generation to match the efficiencies of central station electricity generation. Economies of scale generally persist in commodity manufacturing businesses and physical limitations will be hard to overcome. The large initial capital costs and/or financing costs of distributed generation could also limit widespread use of distributed generation in residential applications.

However, we expect hundreds of thousands of DG units to be sold worldwide in the intermediate-term for niche uses, wealthy consumers, and for the improved reliability applications at which DG will excel. The use of DG to significantly offset the impending electricity supply needs of the U.S. is impractical, in our opinion. We simply need to install too much low cost electricity as quickly as possible to meet demand. This implies the installation of the largest, cheapest units possible. Beyond the debatable economic issues of the distributed generation units themselves, the sheer volume of units that would be needed to be installed over the next decade to make even a modest dent in our expected electricity demand growth is staggering.

It would require the installation of approximately 33,000 30 kW microturbine units (less the relevant line losses associated with central generation) to replace a single 1,000 MW central station CCGT. Likewise, it would require the installation of over 142,000 7 kW residential fuel cells to replace the same CCGT (also less the corresponding CCGT transmission line losses). Capstone is currently producing 7-8 units per day, or less than 2,000 units in 2000. A near-term increase in production of microturbines and/or fuel cells beyond current expectations on the order of magnitude required to be really useful as an alternative to CCGTs is hard to imagine. The successful installation of those units is even harder to contemplate.

To achieve a 10% market share of the incremental electricity supply construction we expect, the U.S. would have to install at least 40,000 MW of distributed generation units over the next decade. This represents over 5.7 million 7 kW residential fuel cells or over 1.3 million 30 kW microturbines in less than 10 years. The Gas Research Institute has estimated that 20,000 MW of DG could be installed by 2015. We hope DG is more successful than that, but if GRI is correct, DG is unlikely to prove a major threat to central station power in the foreseeable future under ours or any other forecast.

Figure 60: **Microturbine Distributed Generation Natural Gas Consumption**

	DISTRIBUTED GENERATION					
Plant Capacity (KW)	10	10	10	10	10	10
Capacity Factor	95.00%	90.00%	85.00%	95.00%	90.00%	85.00%
KWHs Produced	83,220	78,840	74,460	83,220	78,840	74,460
Unit Heat Rate	12,000	12,000	12,000	12,500	12,500	12,500
Fuel Consumption						
MMBtu	999	946	894	1,040	986	931
Bcf	0.0010	0.0009	0.0009	0.0010	0.0010	0.0009
10 kW Units/ 1 Tcf Gas Burn	1,001,362	1,056,993	1,119,169	961,307	1,014,713	1,074,402

Source: Deutsche Banc Alex. Brown estimates

Peaking Generation

We believe numerous peaking units will be constructed over the next decade. Our analysis suggests that price volatility could continue to increase over our study period. In such an environment, peaking generation will be extremely valuable. These units can earn as much in less than a week of peak summer demand and prices as a large baseload plant does in a year. Peaking generation will have to compete for combustion turbines with the international markets and CCGTs. They will also have to compete with CCGTs and other industries for fuel under our base assumptions.

However, most of the incremental electricity demand growth we expect is baseload generation by definition. Internet servers and PC manufacturers are baseload customers. Therefore, we believe peakers will play a relatively minor role over the next decade relative to the need for baseload generation.

Backup Power

Given our outlook for electricity supplies, the need for backup power supplies appear more critical than ever. We expect merchant energy generators, utilities, and energy services providers to be the major players in this area. We expect this market to provide incremental opportunities to the baseload and peaking generation capacity needed. The high margins related to backup generation make this a lucrative market for participants.

Reliability/T&D

We believe that significant incremental investments in electric and natural gas transmission and distribution networks will be necessary to support electricity demand growth. While few material additions are currently pending, utilities have little choice but to build as electricity demand grows and the new generation is installed. Power plants are useless without wires. If transmission and distribution assets are not added, capacity shortages could be worse than our scenarios suggest. Signals from regulators and public opinion may be needed to stimulate T&D investment. The approval of "for profit" independent Transcos might also encourage transmission expansions.

The implications of very high demand growth (double digits) from IT related industries even suggests the need to redesign or add significant redundancy and new power quality technologies to the existing power grid. If over one-third of the nation's most critical electricity demand will consume power requiring vastly different qualities, this issue will need to be addressed.

If T&D investments are not made, the trend towards self-generation and distributed generation will accelerate. However, the customers that are growing the fastest and also require these structural changes in the power grid will demand the attention of utilities, regulators, and legislators to address their needs. We suspect their market influence will inspire sufficient action to achieve the desired result.

Capacity Factors

When we began our what-if analysis of the electricity market, we assumed that utilities might be able to increase the capacity factors on legacy generation assets to increase generation from installed capacity. We believed that utilities would release significant capacity when generating assets became deregulated and a financial incentive was presented to the utilities.

Recent evidence suggests that this has not been a major contributor to new generation capacity. Despite incentives to add reserve margin and system reliability, and reduce dependence on purchased electricity, utilities appear to have added little as a result of increasing capacity factors. As reserve margins have declined, the inefficiencies of legacy plants may have already been significantly exhausted. We believe the fact that many plants are simply old and inefficient, makes it difficult to add much incremental capacity. The older units also tend to break down more frequently as they are pushed for capacity. Therefore, we do not expect significant capacity additions as the result of increasing utility utilization of installed assets. If it were easy, utilities would not be experiencing some of the system difficulties experienced in recent years and days.

Reserve Margins

Reserve margins could decline precipitously over the next decade if generation additions do not exceed marginal demand. Current utility calculations of reserve margin include interruptible load. Interrupting industrial and large commercial customers is no longer a viable economic reality. We believe incremental generation will need to be installed to cover that load. We also believe that maintaining a reasonable reserve margin is essential for maintaining a reliable electric system.

We believe that a reserve margin of about 10% will be required to maintain system reliability with a margin of safety. We expect the current grid will maintain less than a 10% reserve margin in 2000. This implies that reserve margins will need to be added each year to maintain system integrity. We believe any realistic scenario should include this assumption.

Retirements/Displacements

We began our analysis with the assumption that there would be numerous power plant retirements and economic displacements. We believe that our scenarios demonstrate that existing installed plant retirements and displacements will be less than conventional wisdom anticipates. The demand for electricity will require that assets continue to be productive until adequate new supply can be installed. Based on our growth assumptions, this supply will take longer than previously anticipated. The outlook for potential kWh prices may also allow for extended utilization of facilities previously thought uneconomic for longer than previously expected.

Capital

We believe capital will naturally be easily attracted to fund the expansion of the natural gas, electric generation, and utility industries. The growth we predict, the earnings characteristics of electricity and natural gas, and the vital nature of these industries should assure adequate capital to complete the necessary infrastructure to provide adequate supplies of energy for the economy. The Internet trend is too important.

The capital requirements of this new infrastructure construction are staggering. The potential capital costs of constructing over 200 gigawatts of natural gas-fired combined-cycle generating capacity are at least $100 billion. The cost of adding another 30 gigawatts of peaking capacity could add another $11 billion to the bill. Assuming the remaining needed generation capacity we forecast in our base scenario is coal-fired, the cost of over 200 gigawatts of CFB coal capacity could easily be over $500 billion. Therefore, the total capital cost of just the electric generation portion of our energy infrastructure upgrade could exceed $600 billion.

We have seen estimates of the replacement cost of the U.S. T&D network of about $1 trillion. Assuming this figure is correct and an addition to capacity of at least 10-20% over the pending infrastructure boom, T&D expenditures will certainly require several hundred billion dollars. This figure does not include state of the art technologies for power quality and conditioning equipment surely to be required.

We will leave a full accounting for the entire infrastructure build we expect to be required for a later report. However, the incremental CAPEX required for all the incremental natural gas wells, interstate and gathering pipelines, natural gas storage, LNG terminals, ships, storage, gas processing plants, etc. will surely require another several hundred billion dollars. Thus, the net capital requirement of a trend that has not yet been fully identified by the industry could be on the order of a $1 trillion challenge.

Natural Gas

We believe our analysis has enormous implications for the natural gas industry in general. Most of the natural gas industry is forecasting growth to meet a 30-35 Tcf market by 2010-2015. Just meeting this demand growth will represent a major challenge for the industry. GRI assumes that incremental natural gas demand from new electric generation will add about 5 Tcf to the market by 2010. We believe even this forecast underestimates potential natural gas demand but at least they attempt to address the issue.

Our base scenario implies an annual potential natural gas market of 28-32 Tcf by the 2004-2005 period. This is also the approximate amount of natural gas implied by the amount of new merchant power plant development to be constructed by 2005 that has been announced over the last few years. This level of construction implies an average annual increase in demand of between 1.3-1.7 Tcf per year over that period. Our base scenario implies a potential 40-45 Tcf annual market by 2010. This assumes Vice President Al Gore's buddies are successful in requiring all new generation to be gas-fired.

A gas market of this size implies that natural gas consumption from electric generation could rival winter heating demand as the largest market for natural gas. This would dramatically alter the nature of the industry itself. We doubt that this outcome is likely, we just cannot envision that much growth. We merely suggest that if all the necessary generation constructed was natural gas-fired CCGTs, that is how much natural gas would be required. The demand is there, but the ability of the natural gas industry to deliver that quantity of gas in ten years appears extremely unlikely. A 30-35 Tcf natural gas market does appear to be in the nation's immediate future. The only question is will this be a 2005, 2010, or 2015 event.

Natural Gas Infrastructure

Our analysis of the future natural gas market suggests that an enormous amount of new investment must be made in the industry to meet the quantity of natural gas demand we envision. Natural gas exploration and production companies need to locate, drill, develop, and produce from thousands of new wells in the U.S. and Canada. Much of that drilling activity will take place in difficult northern, Arctic, and offshore areas. The drilling support industries may require significant new additions of equipment and manpower. The natural gas pipelines will require significant amounts of new capacity to meet the incremental demand our analysis suggests.

In fact, as natural gas-fired generation loads increase and the seasonal nature of natural gas demand becomes more levelized, the seasonal pattern of summer storage fill and winter withdrawals could be altered dramatically. Natural gas pipelines could be required to add more pipeline capacity than the incremental gas demand we forecast to allow sufficient capacity to add to storage in the summer to allow withdrawals for the winter heating season. There just might not be enough capacity to simultaneously feed natural gas generation and add sufficiently to storage at the same time. Pipeline utilization over the summer months could actually exceed winter use under some conditions.

In each of our scenarios, the U.S. could also use a significant amount of new storage capacity. New types of peaking storage with faster withdrawal rates could also be useful. The need for new natural gas processing and gathering system capabilities would also be extensive. LNG storage, transportation, and terminaling is also an issue. One company has already initiated the reopening of an LNG terminal, another has recently been sold, and a third has experienced significant increases in import cargoes since being sold in 1999. We believe this LNG activity is a signal that our outlook for natural gas is on the right track.

All of these developments represent opportunities for the natural gas industry and investors alike, but the industry will need to begin to take steps to enhance deliverability before the opportunity passes. Infrastructure takes time to plan and construct. Therefore, we believe the time for planning is now, we can ill afford to delay further.

Equipment/Turbines

Our analysis suggests that natural gas combustion turbine supplies will be sufficient to meet demand over the next decade. Using our base scenario assumptions, and the current supply of turbines, combustion turbine supplies would be more than adequate to meet the entire potential demand for new electric generation facilities in the U.S. If natural gas supplies constrain CCGT generation construction, turbine supplies will clearly be sufficient over the ensuing decade. Only under our most optimistic assumptions for demand growth would turbine supplies be inadequate to meet demand.

Under our base scenario, the U.S. would consume approximately 65%-72% of world turbine supplies. This represents more than our fair share of new world generation equipment needed, but supply would be sufficient to meet U.S. demand. We also assume that there will not be enough natural gas to fire all the incremental electricity demand we expect in the U.S. We suggest that only about half of new generation can be successfully supplied by natural gas. Therefore, only half of the maximum potential turbine demand will require combustion turbines. Our analysis ignores the impact of significant new turbine manufacturing capacity planned by General Electric and Siemens. If this capacity is added early enough, in sufficient quantities, the supply of turbines will be reduced to a non-issue.

We have not yet examined the supply market for large steam turbines. However, given the demand we envision for new coal-fired generation, we expect to find supply issues for those as well. Virtually no one is expecting material new demand for coal plant equipment. The merchant generator that orders early, like Calpine, Dynegy, and Duke did with combustion turbines, may create a first mover advantage.

Plant Construction

However, given the magnitude of the tasks required to meet the demand we project, we have severe reservations about the U.S.' ability to construct dozens of power plants annually for over a decade. Our base scenario implies the construction of an average of 84 new power plants per year to *meet electricity demand. Power plants require about 12 months for a peaking* unit, 18-24 months for a combined-cycle plant, and **4-5 years** for a CFB coal plant. Each project requires hundreds of workers at various phases during construction.

If merchant power developers catch on to natural gas supply issues quickly, coal plants might realistically begin to help alleviate the capacity shortage in 2005-2006. If developers do not recognize the problem until 2001-2002, we will have a serious problem, in our opinion.

Volatility/Prices

Our analysis indicates that demand could outstrip our aggregate capability to install new supply over the intermediate term. This suggests that electricity price volatility could continue to increase, at least on a regional basis. The potential to maintain an aggregate short position could also present implications for kWh prices.

Current conventional wisdom maintains that electric industry deregulation and increasing competition will yield significant kWh unit price declines across the U.S. and Canada. We agree with this element of the analysis. Competition will tend to reduce prices. However, conventional thinking generally ignores the true potential for electricity demand growth. Shortages are likely to more than offset the impact of deregulation and competition, in our view.

A similar situation for natural gas exists. The potential for supply shortages is too serious to ignore. Our analysis of the demand for electricity suggests that the forward price curve for electricity could have an upward bias. More analysis is needed but when supply and demand are not in equilibrium, Economics 101 taught us that prices tend to rise. This applies to coal, natural gas, and electricity prices alike as each are linked to margin demand for electricity over the next decade.

As demand for baseload generation from IT equipment grows, the seasonal and hourly patterns of electricity supply and demand will also change significantly. Hourly demand and seasonal demand and pricing differences are likely to narrow. IT equipment tends to run at least close to 24x7. This implies that the slope of shoulder months and hours will flatten while increasing overall peak demand. This also has implications for the conventional wisdom regarding "off-peak" prices. They will get harder to find and off-peak prices might not be the $0.015-$0.020/kWh expected.

Energy Policy

We believe national energy policy is severely lacking. If our national electric grid is third world as some industry policy makers have recently suggested, some policy makers need to spend a month in Central America or Eastern Europe with the lights off for most of the day to recognize the difference. We have perhaps the finest electric system in the world. It has been sufficient to grow the world's largest and most powerful economy.

We have not yet discovered any Commerce Department or Department of Energy studies that even mention the power requirements of the developing Information Age. They have not demonstrated an understanding of current market dynamics as far as we are concerned. The AGA and GRI have perhaps the best comprehension of the growing demand for natural gas from electric generation but they also significantly underestimate the situation.

We hope that the coming brownouts and blackouts will encourage Congress and the relevant agencies and regulators to look beyond their own forecasts to the *real* root of the problem...DEMAND. As the electric supply disruptions occur, the public, the politicians, and the regulators are all likely to blame deregulation, the utilities, and the wholesale energy traders.

However, we believe the current situation is an unfortunate confluence of events that include economic incentives, deregulation, the emerging technological revolution, poor regulatory and government oversight/vision, poor political leadership, and NIMBY. Some market participants are disincentivized to raise the issue. Deregulation has many utilities afraid to construct new power plants or transmission as their costs may not eventually be recovered in a deregulated market or approved by regulators. State and federal energy regulators were not much in a mood to approve new generation plants and transmission facilities. They also did not foresee the Internet Revolution as a risk that would warrant encouraging/ordering new construction. Politicians, environmentalists, and the general public sent market participants numerous signals that applications for new facilities were not likely to be welcome. Therefore, few permits were applied for. NIMBY was a very successful deterrent.

Now we are in a national jam and someone needs to coordinate our extrication. Unfortunately, that means regulators and politicians must first identify the real cause of the problem and coordinate with market participants to resolve the problem. That includes identifying the fact that they have created regulatory burdens and public opinion that is a major impediment to the solution. When that is accomplished, the solution will become evident to the market and corrective action will be swift, in our view.

Further Technological Disruptions

We are fairly certain that technological advances in energy production, transmission, generation, etc. will be commercialized over the next decade. These advances may be encouraged by the shortages of electric power that we envision. However, we believe these advances are some years off and may be too late in the decade to be commercially developed and installed in a scale significant enough to ease the burden on our system.

Promising technologies are being developed to provide off-peak power storage and superconducting transmission cables. New transmission technologies may allow for "coal by wire" from the clean, cheap western coal reserves in the Powder River Basin. Whatever the technological improvements are, we need them today and they are not yet ready for use.

We see technological advances as more of a risk than an opportunity to alleviate the problem. More people and capital are deployed in the endeavor to think up new ways to use electricity than are deployed in the conservation and efficiency game.

THE LOOMING CAPACITY EMERGENCY

NERC provided two stunning conclusions in its 1998-2007 reliability assessment that are worth noting. First, NERC's study concluded that electricity supplies could be inadequate to meet demand in the near-term. Second, NERC concluded that reserve margins are eroding to "dangerously low levels" (and have subsequently declined further). NERC concluded in its September 1998 report that existing generation and transmission capacity will be sufficient for approximately 3-5 years. However, we believe recent demand growth has already indicated that the 3- to 5-year forecast period will be exceeded by at least 1-2 years. This implies that 2000 is a bubble year. We might have sufficient capacity and we might not. Overall, NERC concluded that electric reliability in the U.S. was in jeopardy.

We tend to agree. We believe that the utilities, state and federal regulators, and energy policy makers alike are significantly underestimating the need for additional electricity resources to meet demand. If these industry participants fully recognized the magnitude of the need, they would be feverishly working on and talking about the problem. We would normally assume that our interpretation of the situation was optimistic but the track record of the relevant participants in forecasting demand growth in the latest 20 years has been to horribly underestimate growth.

We take comfort in being outside the consensus forecast, the track record of the energy forecasters has been woeful. Unless energy demand is less than 1.0% over the next decade, we believe we will land on the right side of the argument. If our interpretation of potential electricity demand is remotely accurate, the U.S. may need to add incremental supplies of electricity greater than the current installed generation base of the U.K. in less than 3 years.

Look, our conclusions are based on a forecast that we acknowledge is beyond the conventional norm. We could be wrong. But let us summarize the facts as we understand them that have led us to our "radical" outlook for energy consumption in the ensuing decade.

- Electricity kWh demand volume growth has historically averaged better than 2.5% and appears to be accelerating with the digital revolution in the second half of the latest decade.

- Electricity forecasts from the 'reputable' sources generally assume electricity demand growth of only 1.25%-2.0%, significantly less than the historical norm.

- The comparable natural gas and coal fuel forecasts are even more conservative.

- The reputable forecasts generally agree that electricity demand growth should track GDP growth at least over the next several years.
- U.S. GDP growth is also running above normal, presumably due to the Internet Revolution.
- The reputable forecasts of future energy consumption seem to ignore the economic transformation evident in the U.S. and global economy.
- The proportion of the U.S. service economy that relies on intensive use of electricity (and hence the fuels used to generate that power) is growing very rapidly.
- The sheer volume of installed generation in the U.S. means that a relatively small level of demand growth will require a significant level of new plant construction (at least > 10,000-20,000 MW/year).
- Future economic growth is nearly universally powered by electricity (electronics).
- A large proportion of future electricity demand growth is likely to be derived from Internet and electronic equipment.
- This trend is growing and it is likely to be sustainable over an extended period of time.
- This trend is also likely to produce indirect benefits for the economy and electricity demand growth, likely resulting in above average growth and consumer income.

Therefore, we conclude that the remarkable disruptive transformation of the U.S. economy resulting from a disruptive technological change (the Internet and telecommunications) is likely to have a sustained positive impact on electricity demand growth. We believe it is reasonable to assume that electricity demand growth is likely to run above trend and exceed 3.0% annually and could exceed 4.0%. This forecast compares well with economic growth forecasts and does not exceed recent empirical evidence.

We are not espousing major electric blackouts for the next 10 ½ years. There will be scattered brownouts and blackouts over the near term as we sort out the issues and better understand the changing industry dynamics. We are merely suggesting that it will be hard to construct enough generating capacity to meet demand for awhile. The market could catch up later in this decade as planning begins to calibrate to more realistic expectations for demand.

ENERGY SECTOR RENAISSANCE?

If our evaluation of a base scenario for electricity supply/demand growth is reasonably realistic, the energy sector will grow dramatically over the next decade. We envision the electric generation market growing by over 40% by 2010. The U.S. could build new electric generation facilities equal to more than 58% of the existing installed generation fleet. The potential market for natural gas could grow by 50% or more. The market for coal could actually grow significantly instead of contracting significantly. All of this incremental energy demand needs to also be transmitted, distributed, and transported. Significant new discoveries, development, and production of fuel for generation will also be necessary. Numerous industries support the growth inherent in each of these respective industries.

As the market begins to recognize the growth evident in the energy sector and the relevant importance of the sector to the growth of the digital economy, we believe the various energy industries could witness a renaissance of interest from investors. **Faster earnings growth and multiple expansion could result in a period of strong sector stock performance. We believe the relative valuation of the energy sector stocks provides investors with a secular opportunity that is rare in efficient markets. Few people currently recognize the trend but it could become widely recognized in the relatively near future.**

Stocks to Own

Based on the future electricity and natural gas markets depicted by conventional expectations for supply, demand, and price dynamics, we generally favor diversified, entrepreneurial energy companies with a strong comprehension of the wholesale energy markets, strong trading and marketing skills, excellent asset operating records, aggressive growth aspirations and a track record of meeting earnings growth and strategic business development targets. Selected diversified, electric and natural gas utilities and pipelines, wholesale energy marketers and traders, and merchant power generation developers meet this criteria. Generic electric and natural gas distribution utilities also present opportunities and special situations but competition generally will pose challenges that will require more precise stock selection.

Based on our more optimistic scenario for energy consumption, we believe that a rapidly rising tide will lift all boats significantly. All the new electricity, natural gas, and coal required to fuel the Internet growth will need to be produced, transported, transmitted, distributed, converted, etc. **All market participants will benefit significantly, in our view. We are excited by the prospects for the sector as a whole. However, the market participants that will benefit the most are generally the same names we prefer under less robust market conditions.** Many of these names straddle multiple elements of the energy value chain and would therefore benefit from more than one element of energy market growth. Some of these names will also be major participants in E-Commerce and telecommunications, benefiting directly from the Internet boom.

Clearly, power plant developers would sit at the top of our list. We believe the U.S. and Canada will require 900-1,000 new significantly sized power plants over the next decade. The power plant development game is dominated by a relatively modest number of significant players. Therefore, the power plant developers are probably best leveraged for very significant growth. Utilities have basically been out of the plant development business for 10-20 years. Currently, Calpine Corp (CPN, Strong Buy, $106), The AES Corporation (AES, Strong Buy, $78 1/4), Duke Energy (DUK, Market Perform, $60 27/32), Dynegy Corporation (DYN, Strong Buy, $73 3/4), FPL Corporation (FPL Group, Market Perform, $47 9/16), Northern States Power (NSP, Strong Buy, $22 7/16), Public Service Enterprise Group (PEG, Buy, $36), Reliant Energy (REI, Strong Buy, $27 1/16), Edison International (EIX, Buy, $19 3/4), PG&E Corp. (PCG, Market Perform, $26 1/8), and Southern Company (SO, Market Perform, $25 1/16) probably dominate this space.

The Wholesale traders and marketers would probably be the next to benefit most from our vision of the future markets. This group includes Constellation Energy Group (CEG, Buy, $34 3/16), Enron Corp. (ENE, Buy, $75 9/16), Duke, Dynegy, Reliant, PG&E, Southern Company, El Paso Energy (EPG, Buy, $48 1/6), and Williams Cos. (WMB, Strong Buy, $39 1/2). Diversified natural gas pipelines would also grow substantially, particularly due to the recent flurry of mergers that have concentrated that industry into a relatively small number of players. This group includes Duke Energy, Dominion Resources (D, Market Perform, $45 1/2), Williams Cos, and NiSource Inc. (NI, Market Perform, $18 3/16). These companies trade, transport, store, process, and market the relevant energy products that will be used to fire the generation that fuels the Internet (including some coal).

Our next report in the series will compare planned supply additions with our demand growth projections to better understand how short of capacity the U.S. could be over the next decade. We expect this report to be available in 6-8 weeks. We invite and look forward to a healthy Socratic discussion regarding our current report.

Additional information available upon request

An author of this report has a long position in the common shares of AES Corporation, Calpine Corporation, CMS Energy, Dynegy Inc., Enron Corporation, and Southern Company.

AES Corporation, American Water Works, Calpine Corporation, Cleco Corporation, CMS Energy, Constellation Energy Group, Edison International, El Paso Energy, Enron Corporation, Entergy, FirstEnergy, MDU Resources, Northern States Power, Philadelphia Suburban Corporation, Public Service Enterprise Group, Questar, Reliant Energy, Texas Utilities, Unicom Corporation, Western Resources, Dominion Resources, Duke Energy, FPL Group, Inc. NiSource, and Southern Company stocks are optionable.

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