NATIONAL ENERGY TECHNOLOGY LABORATORY

Recommended Project Finance Structures for the Economic Analysis of Fossil-Based Energy Projects

September 8, 2008

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NETL Contact:

John Wimer
Director, Systems Division
Office of Systems, Analyses and Planning

National Energy Technology Laboratory
www.netl.doe.gov

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Prepared by:
Research and Development Solutions LLC

Paul Worhach,
Nexant

John Haslbeck,
Parsons

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Section 1 Introduction

1.1 Project Scope

The Office of Systems, Analyses and Planning at the National Energy Technology Laboratory is preparing technical and economic analyses of coal-to-power, coal-to-liquids (CTL), coal-to-synthetic natural gas (CTG), natural gas to liquids (GTL) and natural gas to power technologies. As part of this effort, a set of market validated financial assumptions, including the required internal rate of return for the equity portion of the investment (IRROE), cost of debt, and the financing structure (debt/equity ratio) are needed to conduct comparative economic analyses of commercial and advanced coal-based power and fuel systems.

A set of financial assumptions were developed in 2006 for low and high risk power projects for projects developed and owned by Investor Owned Utilities (IOUs) and Independent Power Producers (IPPs.) Low risk systems were defined to be commercial technologies, such as Natural Gas Combined Cycle (NGCC), subcritical and supercritical Pulverized Coal (PC), or Circulating Fluidized Bed (CFB). High risk systems were defined to be advanced technologies such as Integrated Gasification Combined Cycle (IGCC), with generally fewer than 5 commercially operating plants. NETL would like to update these parameters.

Advanced technology fuel production systems, such as CTG and CTL, may have different technology and financial risk profiles as compared with advanced power systems. Power plants typically have guaranteed revenues via regulated power prices or long-term off take contracts, while fuels plants may have a greater exposure to market risk. As such, NETL recognizes that it may be necessary to develop a set of case-specific assumptions for fuel production systems.

Interviews with project developers/owners, financial organizations and law firms were conducted with the objective of developing a consensus set of financial assumptions for: 1) conventional technology power projects (e.g., NGCC, PC and CFB), 2) advanced technology power projects (e.g., IGCC), and 3) advanced fuel production systems (e.g., CTG and CTL). In addition, information was gathered on state-based incentives that Public Utility Commissions are proposing to offer IGCC or other clean advanced technology projects.

1.2 Objectives

Every power or fuel development project will have unique characteristics, depending on the reputations of the firms involved, the levels of government guarantees, subsidies, and incentives, the guarantees offered by EPC contractors, and the long and short term contracts available to hedge product price risk, among other factors. As such, it is difficult to develop a base case in which all of these factors are quantified, and in which a comparable set of financial parameters can be specified. The objective of this project is thus to characterize a reasonable range of financial assumptions for each of the technologies for market-financeable projects. In these cases, “market-financeable” may mean that a portion of the technology risk is mitigated by government participation in the projects in some manner.

Moreover, because of regulatory uncertainties for coal-based projects due to concerns about greenhouse gas emissions, and because carbon capture and sequestration (CCS) technologies are

still in an early stage of development and demonstration, project development and finance for coal-based projects seems to be currently on hold, and may be for some time to come. Two coal-based power projects in the U.S. that have recently received final permits may likely be the last such projects permitted for the foreseeable future. "Commercial" coal systems in the future may require CCS, increasing their technology risk.

Because of this current regulatory, market, and technology uncertainty, NETL may need to again revise their financial assumptions in the mid-term as these issues begin to be addressed and resolved.

1.3 NETL Power Systems Financial Model

The Power Systems Financial Model is a discounted cash flow based financial model developed by NETL that is used to evaluate long-term costs and investment criteria for advanced energy systems. The model incorporates detailed accounting of the financing structure, interest during construction, depreciation, senior and subordinated debt, debt payments, and escalation of feedstock , O&M, and product prices, among many other financial and engineering parameters. The model also computes a levelized cost of electricity (levelized COE) for power based projects. NETL has developed a standard set of default parameters for use in the model that are detailed in the Quality Guidelines for Energy System Studies. Model users can easily change all parameters to assess the sensitivity of project economics.

The three key parameters that are the focus of this study are debt equity ratio (D/E), internal rate of return on equity investment (IRROE), and cost of debt. In practice, debt structures for large capital projects will be complex, with multiple levels of debt, and a potential mix of federally guaranteed and non-guaranteed loans. The cost of debt as developed here is an average across all sources of debt financing.

Section 2 Energy Project Finance

Large, complex fossil-based energy projects are capital-intensive, have multi-year construction periods, may face significant project and process contingencies for advanced technologies, and currently face an uncertain regulatory climate. The project finance community has emphasized that each project will have unique characteristics that will impact the project finance structure, including the track records and reputations of the project developers, the levels of government guarantees, subsidies, and incentives available, the guarantees offered by EPC contractors, the long and short term contracts available to hedge product price risk, among others. Furthermore, coal-based projects are facing greater uncertainty due to concerns about CO_2 emissions. As such, it is difficult to develop a base scenario in which the factors that impact the financing structure are quantified, and in which a comparable set of financial parameters can be specified.

In project finance generally, there is a fundamental tension between debt and equity sources of funding. Each source will prefer that its own share be as low as possible. Lenders will want debt financing to be low enough to assure at a minimum that they will be steadily repaid, and equity investors will want to leverage debt financing to increase the IRROE. Generally, the lending community has the upper hand – lenders will require that the debt service coverage ratio (DSCR) be between 1.75 and 2.25. (DSCR is the ratio of operating income to debt payments.) Moreover, lenders will want to understand the technologies and the various contingencies in operation that could affect the project's ability to repay the debt. The riskier the technology, the less debt funding will be available, and the more equity that will be required.

The finance structures considered here are for "project financing," i.e. non-recourse financing, as opposed to corporate financing. Non-recourse debt is secured by a pledge of collateral, which typically will be the real assets of the project. Liability is limited to the collateral of these assets. Project financing is technically defined as the financing of long-term infrastructure or industrial projects based on non-recourse financing, and where debt and equity are paid back from the cashflow generated by the project. Project financing is typically accounted for off the balance sheet, while corporate finance will be on balance sheet, and the corporation would hold a general liability for the amount of the loan.

Interviews generally confirmed that it is reasonable to use a generic set of factors representing low risk and high risk technologies, for lack of a better approach that would try to quantify the many specific characteristics of these projects. For the D/E ratio, 80/20 or 70/30 for low-risk commercial projects (with 70/30 becoming the standard), and a range of 60/40 or 50/50 for high risk projects was considered reasonable. However, high-risk projects, particularly coal-based projects, might not be currently financeable in the market. For high risk first-of-a-kind projects, requirements may include loan guarantees, guarantees from project owners, fixed price turnkey EPC contracts with performance guarantees, subsidies, direct federal funding or municipal or state sources of funding, along with product off take contracts or federal price guarantees.

One expert commented that some high risk fuels-based projects may require 100% equity financing.

Another significant factor is that carbon capture and sequestration (CCS) is a looming issue in project finance for all coal-based projects. Since CCS has not been demonstrated on a large scale, first-of-a-kind commercial coal technologies such as PC or CFB will become high-risk with the addition of CCS. Furthermore, banks are becoming very cautious in financing coal-based projects. Unless the technical risks of CCS are addressed, these risks may have significant implications for financing structure. These issues are discussed more in the next section.

IRROE and cost of debt are fairly standard for both low and high risk technologies. The equity market will require 20-25% for IRROE (calculated over the project life, typically 30 years), the cost of debt will be based upon the London Interbank Offered Rate (LIBOR) plus a premium, which ranges from 1-3% for low-risk projects, and up to 7% for high-risk projects. The industry standard for debt term is 15 years; 30 year terms may be available for IOUs and for projects with government loan guarantees.

Section 3 Current Market Finance for Coal Projects

Carbon capture and sequestration is recognized as a significant issue in the project finance community for any coal based project. Due to regulatory uncertainty, it is generally considered unlikely that any new coal project without CCS, conventional or advanced, will be developed in the near future. However, technological uncertainty for CCS and the early stage of CCS R&D and demonstration, on top of the technology risk of CTL or CTG or IGCC alone, makes quantifying financing assumptions difficult. First-of-a-kind projects may not be able to be financed by the market without significant government participation in some way.

In 2008 a group of leading international financial institutions adopted a set of guidelines for electric power project finance known as the Carbon Principles. Signatories to the principles now include Citigroup, Bank of America, Credit Suisse First Boston, JPMorganChase, Morgan Stanley, and Wells Fargo. Adopters of the principles commit to 1) encouraging clients to pursue low carbon alternatives to conventional generation and to consider the potential value of avoided CO_2 emissions, 2) evaluating the financial and operational risk to fossil generation financings due to the potential of domestic carbon regulations, and 3) educating clients, government, and other industry participants regarding the additional diligence required for fossil fuel generation financings.

The early adopters have laid out an additional set of guidelines for "Enhanced Diligence", which require clients to carry out enhanced environmental due diligence, develop carbon mitigation plans, conduct an independent assessment of the project and of the mitigation plans, consult with affected constituencies and publically disclose relevant information about the project. The enhanced diligence process applies to new coal projects of over 200 MW or expansion of capacity of over 200 MW.

The Carbon Principles and this enhanced due diligence are the beginning of what likely will be an extended process of establishing new criteria for energy project financing.

The current state of coal-based project development has also been widely reported in the energy trade press. An article in the January 2008 issue of *Power*, entitled "Industry Prognosis for 2008: Carbon Paralysis," confirms that regulatory uncertainty is affecting new generation decisions, and concludes that it is unclear when, if and how this uncertainty will be resolved.

Given this current situation, a generic set of factors for low-risk projects (conventional technologies without CCS, recently financed projects) and high-risk projects (advanced technologies with or without CCS, conventional technologies with CCS) will be developed.

The technologies under the high risk categories will not be differentiated. Interviews have indicated that there is a threshold, largely dictated by the debt service coverage ratio, that projects need to meet in order to obtain a minimum level of debt financing. If that threshold is achieved at least at a minimum level, then sufficient debt could be available, perhaps at a D/E ratio of 50/50, and which could also meet equity investors IRROE targets at a minimum level. If debt financing is not available, 100% equity financing could be assumed, but that is likely not realistic and would probably not meet minimum equity IRROE targets. An exception would be

100% equity financing by an Investor Owned Utility for a power project, with an IRROE base rate guarantee.

Section 4 Overview and Summary of Interviews

4.1 Developers and owners

Nexant interviewed Headwaters, Inc., WMPI, Tenaska, Erora/MDL Holdings, and an anonymous EPC contractor.

The project developers interviewed agree that the IRROE required for power projects has not changed in the last several years. IRROE requirements of high-teens to mid-twenties remain standard for investment decision-making. However, the risk related to coal power projects in the U.S. is currently regarded as "almost insurmountable." One developer said that the days of a "typical" bank financing deal for a coal power plant is a thing of the past, and that any financial closure would be project specific and be non-typical.

Even with these risks, one developer holds the view that coal related project risks will be rewarded because long-term electricity rates will increase significantly. However, conventional banks are very risk averse right now, and projects may have to go to project-unique financing scenarios.

Developers said that the conventional wisdom is that any new coal plant is "dead on arrival," even with proposed CCS, since there is no proven commercial CCS technology available, monitoring has not been demonstrated, and the legal liability framework for carbon leakage has not been developed. The developers believe it will be 10 to 15 years before these issues will be resolved.

The developers emphasized that there is a fundamental conflict between equity and debt financing. Both the debt and equity participants will seek to keep their own financing share under a certain level, given project risks and potential returns. Debt financiers want to assure that debt will be repaid steadily – the debt service coverage ratio will determine the amount of debt available. Debt service coverage ratios of 1.75-2.25 are standard. Debt financiers will want to understand technology and process integration and assure reliability of revenues to support the coverage ratio. This may be a significant barrier for the financing of early high-risk technology coal and CCS projects.

The developers agreed that 35-45% equity is standard for commercial projects. 70% debt or less is becoming the standard for low risk technologies. IRROE rates in high teens to the low/mid 20s also continue to be industry standard. At the pre-feasibility stage of project development, equity investors will want to see higher rates of return, of 30% or more.

For high-risk projects, with significant project contingencies and rising costs, developers will need access to more equity – contingencies will not find funding from debt sources. D/E ratios will be pushed to 50/50 or below, if these projects are even market financeable without significant government involvement. Large capital requirements, with high-risk technologies, make project financing very difficult. An alternative may be public financing through municipal bonds and public-private partnerships with state and/or federal participation.

An EPC firm indicated that the current trend with coal projects is that they mostly utility owned. However, it is now the case that no banks will lend to coal projects, and the source of financing is 100% equity secured by rate based cost recovery by the IOUs. In one case, the regulator has agreed to 18% increase of the tariff starting from 2008 to support the project.

4.2 Petrochemicals Project Financing Expert

An interview with Michael Kratochwill, Vice President of Nexant, Inc. in the Strategy, Project Finance, and M&A Support practice of Nexant's Petroleum and Chemicals Division indicated that a D/E ratio of 80/20 requires a very high degree of certainty, even for commercial power technologies. For conventional fuel-based projects, with the addition of commodity-based risk, a D/E ratio of 70/30 is the practical maximum. Including technical risk, 60/40 or 50/50 will be more characteristic. However, it may be the case that in some high risk fuel technologies a 100% equity investment may be required.

Fuel projects will require firm product off take agreements to mitigate risk, and the debt service coverage ratio is key, with a minimum ratio of 2:1 required. Since debt financiers will require firm off take agreements such that the minimum debt service coverage ratio is met, the upside potential for equity investors will be negatively impacted. Chemical and fuels equity investors typically require an IRROE of 20% or greater.

4.3 Financiers

Nexant interviewed Taylor-DeJongh, a leading international energy and infrastructure project finance advisory firm.

Taylor-DeJongh indicated that the specific questions about D/E ratios, IRROE, and cost of debt for power projects cannot be answered due to the fact that most recent power projects are predominantly privately financed by either utilities or generation companies off their balance sheets, rather than using project finance. The firm was able to identify and analyze the few projects that were financed in the market in the last three-and-half years. Table 4-1 shows the statistics for these projects.

There were five market financed deals identified for coal-fired greenfield plants: three in the U.S., one in Germany and one in Australia, all of which were IPP projects, and all of which were low-risk commercial plants (five plants used various pulverized coal processes, and one plant used CFB process.) All U.S. projects had private-equity companies participating in these deals.

Table 4-1 Recent Financing Closures for Conventional Coal Projects

Project Name	Owner Type/ Country	Type/ Sponsors	Off take	Capacity (MW)	Project Cost ($MM)	D/E Ratio	LIBOR/ Project Interest Rate	Financial Close Date
Bluewaters Power Station 2	IPP Australia	PC Subcritical Devereaux Holdings Griffin Coal Mining Co Pty Ltd	Not Disclosed	208	1,120	80/20	4.718/6.168	24-Dec-07
Sandy Creek Power Plant	IPP/ United States	PC Supercritical Dynegy Inc LS Power LLC	150MW PPA	900	1,647	61/39	5.463/7.963	30-Aug-07
Longview Power Plant	IPP/ United States	PC Supercritical First Reserve Corp GenPower LLC	5-year PPA	695	2,030	54/46	5.330/7.6	28-Feb-07
Walsum 10 IPP Scheme	IPP/ Germany	CFB Steag AG EVN AG	10-year take-or-pay	750	1,083	75/25	5.3306.055	28-Feb-07
Plum Point Energy Project	IPP/ United States	PC Subcritical Plum Point Energy Associates/ LS Power Public Ownership	90 MW PPA	665	1048 Fixed Price EPC Includes $300 MM in public bonds	80/20		1-Jan--07

Source: Taylor-DejJongh

IOU projects, as well as 'high technology risk' projects, were financed off companies' balance sheets, presumably to reduce delays and costs associated with project finance. It is impossible to determine the D/E ratios, interest rates and IRROE for these projects without access to private corporate data.

The financing terms for an average 'low technology risk' project were as follows:

Table 4-2 Average Financial Parameters for Recent Conventional Coal Projects

D/E Ratio	Concurrent LIBOR Rate	Interest Rate
66/34	5.182	7.289

There were also a number of acquisition and refinancing ("A&R") deals during these years which, when compared to greenfield projects, can provide a rough estimate of overall risk minus the risk associated with construction and start-up. Table 4-3 shows the statistics for these acquisitions.

Table 4-3 Financial Parameters for Energy Project Acquisition and Refinancing

Project Name	Owner Type/ Country	Type/ Sponsors	Project Cost ($MM)	D/E Ratio	LIBOR/ Project Interest Rate	Financial Close Date
Birchwood Power Acquisition	United States	J-Power USA Development	148	61/39	2.820//4.820	8-May-08
Millmerran Power Station Refinancing 2	Australia	Marubeni Corp Energy Investors Funds Group LLC InterGen Energy Inc Tohoku Electric Power Co Inc	66	100/0	5.431/6.531	23-Aug-07
Centennial Power and CEM Portfolio Acquisition	United States	Beowulf Energy	760	76/24		10-Jul-07
Callide C Power Project Refinancing	Australia	CS Energy Ltd InterGen Energy Inc IG Power Holdings Ltd	251	100/0	5.408/6.408	15-Jun-07
Plum Point Refinancing	United States	LS Power Development	819	100/0		29-Mar-07
Energy Capital Partners Portfolio Acquisition	United States	Energy Capital Partners	1,325	65/35	5.354/8.354	2-Nov-06
Coleto Creek Power Plant Acquisition	United States	American National Power Inc	1,453	80/20	5.4258.385	13-Sep-06
Wygen IPP Power Plant Portfolio Refinancing	United States	Black Hills Corp	128	100/0	5.310/5.940	24-May-06
Drax Power Additional Financing	United Kingdom	Drax Power Ltd	188	100/0	5.310/6.210	24-May-06
Millmerran Power Project Refinancing	Australia	Marubeni Corp China Huaneng Group Tohoku Electric Power Co Inc InterGen Energy Inc	792	100/0	5.274/6.874	15-May-06
Loy Yang B Purchase Refinancing	Australia	Mitsui & Co Ltd IPM Eagle LLP	455	100/0	5.069/5.769	22-Mar-06
Windsor Coal-fired Electric Plant Portfolio Refinancing	United States	Cogentrix Energy Inc	320	84/16	/5.881	14-Feb-06

Project Name	Owner Type/ Country	Type/ Sponsors	Project Cost ($MM)	D/E Ratio	LIBOR/ Project Interest Rate	Financial Close Date
Coleto Creek Refinancing	United States	Carlyle Group Inc Sempra Energy	991	50/50	3.520/5.960	2-Jun-05
Eggborough Power Plant Restructuring	United Kingdom	British Energy plc	710	45/55	/7.000	15-Jan-05
Project Averages				77/23	4.892/6.511	

Source: Taylor-DeJongh

Taylor-DeJongh indicates that coal-fired power projects in developed markets require IRROEs of around 15%.

Taylor-DeJongh also noted that the average interest rate for IPPs was 7.289%, as shown in Table 4-2, which is lower than the 8-12% reported in the 2006 study for NETL on financing parameters. This is due to lower current LIBOR rates.

4.4 Law Firms

Nexant interviewed Hogan & Hartson LLP, a leading law firm with practices in both project finance and power plant permitting.

The interview confirmed that carbon capture and sequestration is recognized as significant issue in the project finance community for any coal based project. Given current regulatory uncertainty, the fact that EPC firms will not offer fixed-price contracts with guarantees for performance, and the technological risk of both the core processes for clean coal and the added risk of CCS, means that marked-based finance will not be available. Furthermore, they believe that public utility commissions will not pass on these additional project costs to rate-payers. Potential liability for CO_2 transportation and storage are also significant issues that must be resolved.

With the assumption that these issues can be addressed through government policy making, but still given the inherent high technology risk, it is unlikely that more than 50% debt financing could be secured for the high risk projects. The cost of debt would be in the range of 4-6% over LIBOR, and IRROE would be in the mid to high teens.

Hogan & Hartson indicate that there is an important role for policy makers to play in order to increase private sector involvement in clean coal project development. This includes:

- Establishing a clear, long-term regulatory environment at the state and federal levels on which investors can rely.
- Increasing the availability of Investment Tax Credits to help subsidize first-of-its-kind technologies.
- Providing federal loan guarantees and insurance for first-of-its-kind technologies.
- Continuing federal support for regional sequestration partnerships and other programs to mitigate CCS risk
- Developing public-private partnerships to support injection and storage, and providing risk insurance and low-cost debt.

Section 5 Literature References

This section includes references to recent literature in which some pertinent data points and facts were found.

"Back to the Future with SNG," Syngas Refiner, March 1, 2008, Todd Alexander and Mark Perrin, Chadbourne & Parke LLP

This article reports that there are four primary obstacles to CTG: 1) CCS, 2) rising construction costs 3) difficulty in hedging SNG price due to lack of correlation with coal feedstock, making the debt service coverage ratio difficult to satisfy, and 4) the limited availability of debt for high-technology/risk projects.

Given the size and complexity of these projects, multiple sources of debt financing will be required, and the authors report that they have observed requirements 700 basis points (7%) over LIBOR on debt financing for recent projects.

"Renewable & Alternative Fuels Industry, An Overview to Israel's Ministry of Energy Staff," June 18, 2007 Tel Aviv, Israel, Mark J. Riedy, Andrews Kurth, LLP

In this presentation on the alternative fuels market, financial statistics are provided for CTL, gas-to-liquids, and biomass-to-liquids markets.

For CTL, a required IRROE of 14%-20% in near term is reported. Oil prices must remain in a U.S. $50/BBL - U.S. $60/BBL range to attract lenders and be able to achieve this IRROE. Debt/Equity Ratio will require equity at percentages of 50% and above.

For cases in which monetizable credit streams are available, such as through tax and production incentives, both the IRROE and debt service coverage ratios would increase. Demonstrations of technologies that reduce project costs are also needed.

"Lowering the Effective Cost of Capital for Generation Projects, Private Equity and power Project Financing: Renewables and Fuels Projects," June 27, 2006, John Buehler, Energy Investors Funds.

For power projects, project-focused funds generally target IRROE of 15% - 25%, depending on stage of investment and the development stage of the project.

For fuels projects, the volatility of oil prices will impact the risk and return of CTL and other alternative fuels projects. Banks will insist that commodity, technology, and project completion risks are allocated. The cost of futures and commodity contracts, and the cost of debt, may render the IRROE too low for equity investors.

Also the availability of fixed-price, turnkey EPC contract for fuel projects may be a debt financing requirement, but EPC guarantees may not be available for project developers.

“Project Financing for IGCC and Other Coal Gasification Projects,” Wyoming Coal Gasification Conference, February 28, 2007, Eric Redman, Heller Ehrman LLP and Summit Power Group.

This presentation makes the central point about project finance that lenders want risk free deals, with assured revenue streams, a large equity share, as many guarantees as possible, and long term contracts for products revenue, inputs, and long term arrangements for O&M cost control. Given these aspects of debt financing, the author suggests that first-of-a-kind projects may have to be smaller scale and 100% equity financed, since developers cannot provide guarantees on debt service until the technologies are proven.

Section 6 State Incentives for Clean Coal Projects

The Coal Utilization Research Council has prepared a comprehensive guide to state incentives for clean coal projects, "Overview of State Initiatives Relating to Advanced Coal Technology," Summer 2007. The report is summarized in Table 6-1, along with updated results from supplemental research. These incentives are not explicitly factored into the project finance assumptions developed in the report. However, as indicated in this report, incentives such as these may be required for successful market finance of high-risk technology power and fuel projects.

Table 6-1 State-Based Incentives for Clean Coal

State	Incentives	State	Incentives
Alabama	Early legislative proposals to promote coal gasification and liquefaction	New Mexico	Equipment tax credit, construction tax credit, sequestration research funding
Alaska	Bond financing	New York	Tax credits for facilities with CCS, PPAs for power, offer of minority shareholding in projects, bond financing
Arizona	Legislative task force formed	North Dakota	Demonstration project funding, tax incentives
California	CPUC study on siting IGCC	Ohio	R&D funding, tax and permit incentives
Colorado	Rate base incentives for IGCC demonstration	Oklahoma	Tax incentives
Florida	Rate base cost recovery for IGCC	Pennsylvania	IGCC included in portfolio standard, public benefit charge funding, tax credits,
Idaho	Formed CCS advisory committee	Rhode Island	Siting priority
Illinois	Bond financing, tax credits, property tax abatement, expedited licensing, operating tax credit	Texas	Project funding, tax credits, tax abatement
Indiana	Bond financing, investment tax credit, accelerated depreciation, cost recovery, 3% additional IRROE allowed in rate base,	Utah	Proposal for tax incentives, cost recovery
Kansas	Bond financing, legal framework for sequestration	Virginia	Expedited permitting, IRROE incentives, tax credits
Kentucky	Tax credits, grants, low interest loans	West Virginia	Rate making allowances
Minnesota	Project-based funding grants, research grants	Wyoming	Equipment sales tax exemption, fuel tax exemption,
Montana	Property tax abatement, research funding		

Section 7 Conclusions and Recommendations

The tables in this section show the recommended generic factors for use in NETL economic and financial analysis, based upon project interviews and recent project finance literature.

Nexant believes that because of current regulatory, market, and technology uncertainty, and because market finance for coal projects seems to be on-hold for the foreseeable future, NETL may need to again revise their financial assumptions in the mid-term as these issues begin to be addressed and resolved. It should be emphasized that the factors developed here assume that the regulatory and technology issues with CCS have been resolved. Otherwise, projects will not likely go forward at any financing structure.

All the "high risk" structures are based on the following assumptions: 1) plants are not first of a kind, 2) regulatory uncertainty has been resolved and 3) federal incentives are not required for successful market project finance. Although it is assumed that GHG regulatory uncertainty is resolved, projects with CCS still bear technical risk because CCS is an advanced technology.

Debt term is assumed to be 15 years, which is the industry standard. The IRROE is calculated over the project life, which will typically be 30 years.

These finance structures are for “project financing,” i.e. non-recourse financing, as opposed to corporate financing. Non-recourse debt is secured by a pledge of collateral, which typically will be the real assets of the project. Liability is limited to the collateral of these assets. Project financing is technically defined as the financing of long-term infrastructure or industrial projects based on non-recourse financing, and where debt and equity are paid back from the cashflow generated by the project. Project financing is typically accounted for off the balance sheet, while corporate finance will be on balance sheet, and the corporation would hold a general liability for the amount of the loan.

Tables 7-1 and 7-2 show the factors for Investor Owned Utility project finance. The low-risk projects assume conventional technologies without CCS and the high risk projects assume advanced technologies with or without CCS, or conventional technologies with CCS. The lower cost of debt and lower IRROE for IOU-based projects, as compared with IPP projects, reflect the greater certainty provided by rate-based electricity tariffs. The current LIBOR base rate (August 2008) is 3.5%. (The LIBOR one year ago, in August 2007, was 5.5%). There might be IRROE incentives available at the state level for higher risk clean coal projects, as indicated in Table 7-1, which would be reflected in higher electricity rates, but this is not included in the base case assumptions.

Table 7-1 Financial Structure for IOU Low-Risk Projects

Type of Security	% of Total	Current (Nominal) Dollar Cost	Weighted Current Cost of Capital
Debt	50	4.5% (LIBOR rate plus 1%)	2.25
Equity	50	12%	6
			8.25

Table 7-2 Financial Structure for IOU High-Risk Projects

Type of Security	% of Total	Current (Nominal) Dollar Cost	Weighted Current Cost of Capital
Debt	45	5.5% (LIBOR plus 2%)	2.475
Equity	55	12%	6.6
			9.075

Table 7-3 shows the financial parameters for IPP low-risk power projects using conventional technologies without carbon constraints. These factors are based on recently developed projects. Compared with the factors in Appendix A, the D/E ratio has been adjusted downward from 80/20 to 70/30, the LIBOR rate has been adjusted, and the IRROE has been increased to a standard of 20%.

Table 7-3 Financial Structure for IPP Low Risk Power Projects

Type of Security	% of Total	Current (Nominal) Dollar Cost	Weighted Current Cost of Capital
Debt	70	6.5% (LIBOR plus 3%)	4.55
Equity	30	20%	6
			10.55

Table 7-4 shows the financing assumptions for IPP projects using advanced technologies such as IGCC (with or without CCS) or conventional technologies with CCS. Although the IGCC system may be more technologically uncertain than conventional coal with CCS, both complete systems have considerable uncertainty, and the CCS component may be the most uncertain. The 60% debt share is a likely maximum, with a range of 50-60%. Sensitivity analysis should be

done on the D/E ratios for all cases. The 5% premium above LIBOR reflects the technology uncertainty for IGCC and CCS. However, regulatory and technology uncertainty will likely be barriers to project development in the near term for any financing structure.

Table 7-4 Financial Structure for IPP High Risk Power Projects

Type of Security	% of Total	Current (Nominal) Dollar Cost	Weighted Current Cost of Capital
Debt	60	8.5% (LIBOR plus 5%)	5.1
Equity	40	20%	8
			13.1

Table 7-5 shows the parameters for CTL and GTG projects. The lower D/E ratio and the higher cost of debt reflect the higher technology and commodity risk for the projects. The IRROE was chosen to be a market standard of 20%

Table 7-5 Financial Structure for High-Risk Fuels Projects

Type of Security	% of Total	Current (Nominal) Dollar Cost	Weighted Current Cost of Capital
Debt	50	9.5% (LIBOR plus 6%)	4.75
Equity	50	20%	10
			14.75

Section 8 References

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Appendix A 2006 Report on Financing Parameters

Financial Assumptions for Low and High Risk Technology Projects
Nexant, Inc.

The cost of capital associated with the financing of energy projects is primarily a function of the debt equity ratio, the cost of debt, the required IRROE for the project, and to a lesser extent of numerous other specific terms of the financial deal. In turn, the debt/equity ratio, the cost of debt and the IRROE are affected by the corporate structure of the project owner and the risk characteristics of the technology.

Independent Power Producers, who are exposed to the volatility of competitive energy markets, typically have a high sensitivity to technology risk, since the return on project investment is not guaranteed.

The energy project financing literature (Berg 2005, NCEP 2005, NETL 2006, Nexant 2000) and interviews with project financers (Confidential 2006, Nexant 2000) generally indicate that the required IRROE between 12 and 20%, and the cost of debt between 8 and 15%. For IPPs, the debt/equity ratio is typically between 80/20 and 70/30. More risky projects will tend to require more equity financing. See Table 1, which shows various financing structures quoted in the literature.

Investor Owned Utilities (IOUs) receive a guaranteed electricity tariff as established in the rate base by regulators. The cash flows for the project are guaranteed and the investors and creditors do not require an additional risk premium. As a consequence, projects financed by IOUs tend to be less sensitive to technology risk (Confidential 2006.) The financial structure for IOU projects tend to be more heavily weighted with equity, since the cost of equity is lower than for IPP projects (due to lower risk.)

A report from Standard and Poor's (Power Engineering 2006) quotes a 10% weighted cost of capital for both PC and IGCC, which seems to assume that there is no risk premium for IGCC. For an 80/20, debt/equity project, this could equate, for example, to an 8.5% cost of debt and a 16% IRROE.

The majority of projects are in the 12% to 20% IRR range with the IOU rate-based deals running closer to 12%. Projects with added risk elements and newer, less proven technologies might run up into the mid teens and even as high as 18-20%.

For the cost of debt, one general rule is to take the 5 year treasury as the base (currently at 5%) add risk premium as follows:

IOU add 4% for low risk and 6% for higher risk
IPP add 7% for low risk and 10% for higher risk (Confidential 2006.)

The difference in debt rates shown in Table 1 can be attributed to the change in the base treasury rates over time.

Table A-1: Financial Data from References

Study	IOU Debt/ Equity	IOU Debt Cost	IOU Equity	IOE Weighted Cost of Capital	IPP Debt/ Equity	IPP Debt Cost	IPP Equity Cost	IPP Weighted Cost of Capital
Nexant 2000					70/30 80/20	High 12% Low 8%	High 20% Low 12%	High 14.4% Low 8.8 %
NCEP 2006	47/53	6%	9%	7.59	70/30	8%	12%	9.2%
Berg 2005	45/55	6.5%	11.5%	9.25	70/30	8%	High 17% Mid 15%	11% 10%
NETL 2006					70/30	5.8%	16.5%	9%
Confidential 2006	50/50	High 12% Low 9%	12%	High 12% Low 11%	70/30	High15% Low 12%	High 20% Low 12%	High 16.5% Low 12%

Tables 2 to 5 show the financial parameters that are assumed for the low and high risk technology cases for IOUs and IPPs. The parameters are used to generate a set of Capital Charge factors for the NETL Quality Guidelines, and were chosen to reasonably represent the parameters from the industry literature and interviews.

Table A-2: Financial Structure for IOU Low-Risk Projects

Type of Security	% of Total	Current (Nominal) Dollar Cost	Weighted Current (Nominal) Cost
Debt	50	9%	4.5%
Equity	50	12%	6%
			11%

Table A-3: Financial Structure for IOU High-Risk Projects

Type of Security	% of Total	Current (Nominal) Dollar Cost	Weighted Current (Nominal) Cost
Debt	45	11%	4.95%
Equity	55	12%	6.6%
			11.55%

Table A-4: Financial Structure for IPP Low-Risk Projects

Type of Security	% of Total	Current (Nominal) Dollar Cost	Weighted Current (Nominal) Cost
Debt	80	12%	9.6%
Equity	20	16%	3.2%
			12.6%

Table A-5: Financial Structure for IPP High-Risk Projects

Type of Security	% of Total	Current (Nominal) Dollar Cost	Weighted Current (Nominal) Cost
Debt	70	15%	10.5%
Equity	30	20%	6%
			16.5%

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