Finance Energy Institute

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FINANCIAL ANALYSIS
OF STORAGE AND RENEWABLE ENERGY

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FINANCIAL ANALYSIS
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INTRODUCTION:

The course will address a variety of contract and loan structuring issues associated with wind and solar energy projects as well as battery storage. The course is designed to investigate how various project finance techniques and contract structures can be used to achieve a competitive power prices while maintaining a satisfactory equity return. The course will begin by discussing distinctive project finance features of facilities that depend on wind, hydro or solar resources. Subsequent sessions will address the theory underlying liquidated damages for delay, and performance as well as design of other incentives that is inherent in different contract structures. Nuanced project finance issues associated with structuring debt for renewable projects will be discussed including under what conditions the DSCR drives debt capacity and when the debt to capital ratio is instrumental.
The course will be taught with a combination of theoretical discussions, term sheet review and focused financial models.

KEY BENEFITS:

- ✓ Understand the theoretical issues with computing LCOE and the importance of cost of capital for renewable and storage projects;
- ✓ Understand differences in contract structures for renewable projects and dispatchable projects and how a single price structure can distort incentives for efficient construction and operation;
- ✓ Understand storage and cost characteristics of alternative batteries and how different structures work in alternative markets.
- ✓ Understand components of financing that influence the bid price required to meet a required rate of return on equity and can result in relatively low prices with reasonable returns.
- ✓ Understand the importance of debt sizing constraints and what strategies are relevant when the debt to capital constraint applies relative to when the debt service coverage ratio drives the debt size;
- ✓ Understand how to compute P50, P90 and P99 for different projects driven by resource risk;
- ✓ Understand the difference between mean reverting resource variation and estimation mistakes that do not correct as the basis for 1-year P90 and 10-year P90.
- ✓ Understand under what conditions debt sculpting can affect returns and how synthetic sculpting can be used to increase returns when the DSCR constraint applies.
- ✓ Understand the theory of credit spreads, variable rate debt and interest rates in different currencies and compute the implied probability of default that in inherent in credit spreads.
- ✓ Understand how to evaluate the costs to equity investors and the benefits to lenders for various credit enhancements including DSRA accounts, cash flow sweeps and covenants.

A Unique approach to financial modeling to improve analysis and reduce project risks.

MODULE 1

REVIEW OF WIND, SOLAR AND BATTERY COST TRENDS THROUGH LCOE ANALYSIS

- ✓ Capital intensity of Solar, Wind and Hydro compared to other technologies and the importance of cost of capital for capital intensive projects.
- ✓ Understanding of levelized cost of energy mathematics and why discount rates and energy levels must be considered in the calculation and why real LCOE is a more appropriate measure than nominal LCOE.
- ✓ Benchmarking fixed and variable O&M costs for solar, wind and hydro projects compared to conventional power plants with fuel expense.
- ✓ The theory of carrying costs applied to convert one- time costs to time-period costs and relation to LCOE and the importance of adjusting carrying charges for inflation and taxes.
- ✓ Review of solar cost trends through analysis of capital costs, feed-in tariffs and Finance theory in the context of project finance relative to corporate finance and the notion of mitigating risks through paying premium prices for construction and operation contracts.
- ✓ Illustration of project finance features in relation to the LCOE of wind, solar and hydro projects compared to conventional projects and how project finance
- ✓ features can affect the cost of wind, solar and hydro facilities

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MODULE 2

ANALYSIS OF BATTERY COSTS AND CONFIGURATIONS THROUGH ISLAND AND MERCHANT PRICE ANALYSIS

- ✓ Cost analysis of solar versus diesel in an island scenario and using variable cost of diesel relative to total cost of solar.
- ✓ Compute the optimal sizing of solar capacity in the island scenario with different load profiles and daily solar patterns.
- ✓ Measurement of the value of solar and wind energy in different merchant markets around the world.
- ✓ Review and analyze the trade-offs between storage time per cycle, capital costs, operating life, future capital expenditures, efficiency and operating costs. Work though which configuration of batteries makes most sense in alternative situations.
- ✓ Assess the economics of different battery configurations in merchant electricity markets.
- ✓ Evaluate the economics of batteries together with different daily load and solar patterns and compute the optimal amount of solar capacity as well as battery capacity.

MODULE 3

STRUCTURING PROJECT CONTRACTS FOR SOLAR AND WIND

- ✓ Fundamental difference between classic PPA contracts with availability payments for dispatch able plants and single price structures for resource based projects where output is not directly controlled.
- ✓ Risk allocation matrices and use of the DSCR, LLCR and PLCR to determine acceptable resource risks [using the formula: break-even cash flow reduction = (DSCR-1)/DSCR or Required DSCR = 1/ (1-Cash Flow Reduction)].
- ✓ Problem of liquidated damage incentives for delay when the single price in a renewable energy EPC contract and PPA contract when the marginal cost of energy is below the single price in the PPA.
- ✓ Problem of setting incentives for performance ratio in Solar project when PPA price is above short-run marginal cost for periods when capacity is constrained.

MODULE 4

DEBT SIZING AND DEVELOPMENT COST ANALYSIS FOR RENEWABLE ENERGY

- ✓ The difference in sizing debt because of the debt-to-capital ratio relative to the DSCR involves the notion of whether forward looking cash flow can be relied upon or alternatively whether the amount of "skin in the game" measured by accounting costs is more reliable.
- ✓ How development fees, owner costs, development costs, contingencies and other items that can increase the cost of a project affect returns primarily when the debt to capital constraint applies and have less or no importance when the DSCR drives debt capacity.
- ✓ Theory of development fees and how development fees can be computed as a function of development costs, probability of success and IRR required after the development period.
- ✓ How differences in one-year and ten-year P50, P90 and P99 can affect the debt capacity when the DSCR constraint applies using wind farm example.
- ✓ Items such as project IRR, debt tenure, tax rate and interest rates that influence whether the debt to capital constraint or the debt to capital constraint applies.

MODULE 5

UNDERSTANDING RESOURCE ANALYSIS FOR WIND, HYDRO AND SOLAR PROJECTS

- ✓ Analysis of resource data that varies over time for irradiation, wind speeds and hydro volumes and computation of P99, P95, P90 etc. for different resources.
- ✓ Understanding the difference in variation due directly to resource variation as compared to other sources related to performance ratio, wake effect, turbulence, correlations and other factors that do not exhibit mean reversion.
- ✓ Using case study to evaluate P50, P90 and P99 on one-year basis and long-term basis for series of wind farms and working through implied standard deviations of permanent effects compared to wind variation effects.
- ✓ How differences in one-year and ten-year P50, P90 and P99 can affect the debt capacity when the DSCR constraint applies using wind farm example.

MODULE 6

STRUCTURING OF WIND, SOLAR AND HYDRO REPAYMENTS

- ✓ Importance of the debt tenure relative to other debt parameters and problems when the debt tenure does not equal the life of the project.
- ✓ Use of geometry to maximize debt is explained in the context of patterns of cash flow available for debt service.
- ✓ Theory of sculpting and constant risk over the life of a project.
- ✓ Detailed sculpting formulas including effects of letter of credit fees, changes in the DSRA, LLCR on debt to capital and interest income.
- ✓ Evaluation of cases with synthetic sculpting where cash flow is adjusted to fit to the debt service through step-down capacity charges or through adjustments to O&M expenses.

MODULE 7

CREDIT SPREADS AND EQUITY RETURNS FOR SUSTAINABLE ENERGY IN DIFFERENT COUNTRIES

- ✓ Theory of credit spreads, debt IRR and all-in interest cost and relation to both probability of default and loss given default.
- ✓ Computation of the implied default probability with different credit spreads, debt tenors and loss given default parameters.
- ✓ Reasons for step-up credit spreads with no prepayment penalties and constant credit spreads with prepayment penalties.
- ✓ Comparison of country risk estimates with required credit spreads.
- ✓ Evaluation of different currencies and interest rates and hedging variable rates relative to fixed rates.
- ✓ Alternative ways of measuring the required return on equity using Yieldco market statistics, stock prices and probability of defaults on contracts.
- ✓ Alternative structures that incorporate some interest rate risk with caps and floors and the types of transactions that have some natural hedging against varying interest rates will also be addressed.

MODULE 8

CREDIT ENHANCEMENTS FOR DIFFERENT TYPES OF RENEWABLE PROJECTS

- ✓ Review of various added provisions that are included in loan agreements to provide additional protection to lenders that cannot make a bad project into a good project.
- ✓ Demonstration that covenants and cash sweeps can only either limit dividends or reduce the amount of effective net debt associated with a project.
- ✓ Measurement of the negative effects on the equity IRR of a project and methods to consider the risk benefits to the bank versus the costs to sponsors.
- ✓ Mechanics of cash sweep with different triggers and theory of what kinds of transactions would be relevant for cash sweep (e.g. hydro but not solar because of volatility).
- ✓ In describing credit enhancements, the difference between analysis with the DSCR, LLCR and PLCR are discussed.
- ✓ Economics of Maintenance Reserve Accounts for inverters and other equipment. Cost of maintaining maintenance reserve account for items such as inverter replacement relative to including costs in maintenance contracts. Effects of major maintenance on tax expense and DSCR.

UNIQUE RESOURCES FOR FURTHER LEARNING AND RETAINING KNOWLEDGE

An essential part of the course is the provision of vast materials that can be used to re-enforce the concepts discussed during the workshops and to allow participants to engage in further studies. Materials include:

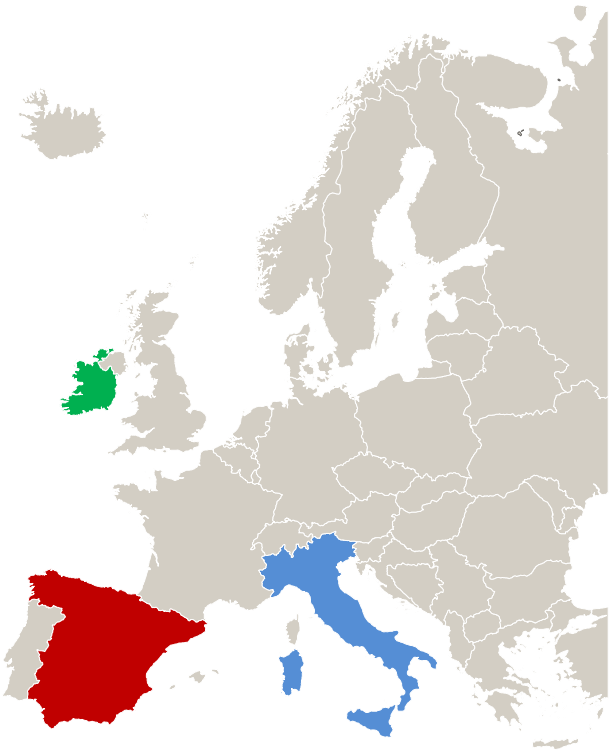
- ✓ Many featured models in electric power that fully resolve circular reference, rigorous structuring, customized scenario analysis and other features.
- ✓ Hundreds of focused exercises that highlight a variety of advanced financial issues.
- ✓ Framework of unique presentation of data and risk analysis including Monte Carlo simulations.
- ✓ Methods for extracting crucial data for financial and energy analysis with transparent macros that automatically update information.
- ✓ Unique tools to convert PDF files, format spreadsheet and enhance efficiency,
- ✓ Collection of comprehensive case studies, financial articles, contracts and models.

OPTIONAL EXCEL SESSION

The objective of this session is to assure that all participants, including people who do not routinely work with Excel, become familiar with the tools in Excel and work comfortably on the class exercises. The optional Excel session will cover short-cut keys, effective presentations, use of forms, one-way and two-way data tables, and look-up functions for scenario analysis.

LOCATIONS

Locations can vary depending on requests.



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