

Energy Insurance Risk

This book examines key risks that the Nations critical energy infrastructure is confronting and the ways in which the insurance industry can help manage these risks, including how it identifies, assesses, and manages them and their potential impacts. Today, weather-related incidents account for the majority of economic losses in the insurance industry as well as in the critical infrastructure sectors. In addition to the traditionally-recognised natural hazards, critical energy infrastructure faces significant emerging threats, including cybersecurity and space weather risks. While the United States has a large, mature insurance market, developing insurance mechanisms for protecting critical infrastructure from these emerging risks remains a significant challenge. The lack of historical data on the frequency and severity of these events, the changing nature of technologies impacted by them, as well as the inherent uncertainties posed by these risks make it difficult to accurately assess these emerging risks and develop proper insurance products. Insurance instruments can be a useful risk mitigation tool for critical infrastructure by encouraging resilience-enhancing investments and acilitating recovery after a disaster. However, due to the increased interdependencies across various critical infrastructure systems and sectors as well as the growing dependence of todays society on the critical infrastructure functions and advanced technologies, the question of insurability of critical infrastructure against emerging risks faces new challenges.

Actuarial thinking is everywhere in contemporary America, an often unnoticed byproduct of the postwar insurance industry's political and economic influence. Calculations of risk permeate our institutions, influencing how we understand and manage crime, education, medicine, finance, and other social issues. Caley Horan's remarkable book charts the social and economic power of private insurers since 1945, arguing that these institutions' actuarial practices played a crucial and unexplored role in insinuating the social, political, and economic frameworks of neoliberalism into everyday life. Analyzing insurance marketing, consumption, investment, and regulation, Horan asserts that postwar America's obsession with safety and security fueled the exponential expansion of the insurance industry and the growing importance of risk management in other fields. Horan shows that the rise and dissemination of neoliberal values did not happen on its own: they were the result of a project to unsocialize risk, shrinking the state's commitment to providing support, and heaping burdens upon the people often least capable of bearing them. Insurance Era is a sharply researched and fiercely written account of how and why private insurance and its actuarial market logic came to be so deeply lodged in American visions of social welfare.

AN AUTHORITATIVE GUIDE THAT EXPLAINS THE EFFECTIVENESS AND IMPLEMENTATION OF BOW TIE ANALYSIS, A QUALITATIVE RISK ASSESSMENT AND BARRIER MANAGEMENT METHODOLOGY From a collaborative effort of the Center for Chemical Process Safety (CCPS) and the Energy Institute (EI) comes an invaluable book that puts the focus on a specific qualitative risk management methodology – bow tie barrier analysis. The book contains practical advice for conducting an effective bow tie analysis and offers guidance for creating bow tie diagrams for process safety and risk management. Bow Ties in Risk

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Management clearly shows how bow tie analysis and diagrams fit into an overall process safety and risk management framework. Implementing the methods outlined in this book will improve the quality of bow tie analysis and bow tie diagrams across an organization and the industry. This important guide: Explains the proven concept of bow tie barrier analysis for the preventing and mitigation of incident pathways, especially related to major accidents Shows how to avoid common pitfalls and is filled with real-world examples Explains the practical application of the bow tie method throughout an organization Reveals how to treat human and organizational factors in a sound and practical manner Includes additional material available online Although this book is written primarily for anyone involved with or responsible for managing process safety risks, this book is applicable to anyone using bow tie risk management practices in other safety and environmental or Enterprise Risk Management applications. It is designed for a wide audience, from beginners with little to no background in barrier management, to experienced professionals who may already be familiar with bow ties, their elements, the methodology, and their relation to risk management. The missions of both the CCPS and EI include developing and disseminating knowledge, skills, and good practices to protect people, property and the environment by bringing the best knowledge and practices to industry, academia, governments and the public around the world through collective wisdom, tools, training and expertise. The CCPS has been at the forefront of documenting and sharing important process safety risk assessment methodologies for more than 30 years. The EI's Technical Work Program addresses the depth and breadth of the energy sector, from fuels and fuels distribution to health and safety, sustainability and the environment. The EI program provides cost-effective, value-adding knowledge on key current and future international issues affecting those in the energy sector.

GARP's Fundamentals of Energy Risk Management introduces investors to the basic components and some of the basic terminology used in the energy industry. It covers the commodity cycle, energy use and sources, and various risk types, various energy products and the markets where energy is traded. It also introduces certain risk management fundamentals and real option thinking. The book is GARP's required text used by risk professionals looking to obtain their Certificate in Energy Risk Management.

Commodities represent today the fastest growing markets worldwide. Historically misunderstood, generally under- studied and under- valued, certainly under- represented in the literature, commodities are suddenly receiving the attention they deserve. Bringing together some of the best authors in the field, this book focuses on the risk management issues associated with both soft and hard commodities: energy, weather, agriculturals, metals and shipping. Taking the reader through every part of the commodities markets, the authors discuss the intricacies of modelling spot and forward prices, as well as the design of new Futures markets. The book also looks at the use of options and other derivative contract forms for hedging purposes, as well as supply management in commodity markets. It looks at the implications for climate policy and climate research and analyzes the various freight derivatives markets and products used to manage shipping and freight risk in a global commodity world. It is required reading for energy and mining companies, utilities' practitioners, commodity and cash derivatives traders in investment

banks, CTA's and hedge funds

The business of reinsurance developed at the fringe of financial services and, for most of its existence, went largely unnoticed outside the expert community. More recently, both public and professional sensitivity towards managing risks has increased and reinsurers have emerged as authorities on global threats such as climate change and natural catastrophes. This is the first book to provide a comprehensive historical description of this industry. It traces the global development of reinsurance from the early 19th century until today. As such it gives a detailed account of how the nature of risk itself changed over the last 200 years. It highlights all aspects relevant in shaping the industry from the development of risk, risk engineering and risk management, actuarial science, the financial and monetary environment, market conditions, impacts of politics, the effects of regulatory changes, to large risks and natural catastrophes. A comprehensive introduction by the editors highlights the different challenges and approaches to managing risk from a reinsurance perspective such as mathematical, financial, legal, and contractual developments, as well as the changing business models adopted. All of these are dealt with in further detail by ten contributing authors.

Among the books on the world energy crisis, on technological possibilities for self-sufficiency, and on various energy sources, this is one of a very few to address the practicalities of government regulatory responsibilities versus the pursuit of profit in the private sector and to look at the processes, logistics, and complex interactions among private energy companies, financial sectors, and national governments. The authors provide answers to such questions as: How do oil company operations influence government policies? What kinds of energy projects can be financed by existing financial institutions? How does the availability of insurance affect innovations in energy? They also examine how major investors and governments make decisions about the management of the volatile mix of political, economic, and technological risks that buffet the energy sector; critique the conventional wisdom concerning the major fuels; and project the likely evolution of the world energy market over the next decade.

This book offers an in-depth and up-to-date review of different statistical tools that can be used to analyze and forecast the dynamics of two crucial for every energy company processes—electricity prices and loads. It provides coverage of seasonal decomposition, mean reversion, heavy-tailed distributions, exponential smoothing, spike preprocessing, autoregressive time series including models with exogenous variables and heteroskedastic (GARCH) components, regime-switching models, interval forecasts, jump-diffusion models, derivatives pricing and the market price of risk. *Modeling and Forecasting Electricity Loads and Prices* is packaged with a CD containing both the data and detailed examples of implementation of different techniques in Matlab, with additional examples in SAS. A reader can retrace all the intermediate steps of a practical implementation of a model and test his understanding of the method and correctness of the computer code using the same input data. The book will be of particular interest to the quants employed by the utilities, independent power generators and marketers, energy trading desks of the hedge funds and financial institutions, and the executives attending courses designed to help them to brush up on their technical skills. The text will be also of use to graduate students in electrical engineering, econometrics and finance wanting to get a grip on advanced statistical tools applied in this hot area. In fact, there are sixteen Case Studies in the book making it a self-contained tutorial to electricity load and price modeling and forecasting.

The April 2010 Deepwater Horizon oil spill disaster in the Gulf of Mexico was the largest spill to have occurred in U.S. waters. The scale of clean-up costs and third-party damages has prompted congressional review of clean-up and damage compensation mechanisms, as well as

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of ways to facilitate future oil spill prevention, response, and recovery. A key element is the role of insurance in ensuring that costs of spills can be financed. Contents of this report: (1) Intro.; (2) The Deepwater Horizon Oil Spill Incident; (3) The Offshore Energy Exploration and Production Business: Risk Management and the Demand for Insurance; (4) Offshore Energy Insurance Market; (5) Compensating Oil Pollution Victims; (6) Policy Issues. Illus.

A comprehensive overview of trading and risk management in the energy markets Energy Trading and Risk Management provides a comprehensive overview of global energy markets from one of the foremost authorities on energy derivatives and quantitative finance. With an approachable writing style, Iris Mack breaks down the three primary applications for energy derivatives markets – Risk Management, Speculation, and Investment Portfolio Diversification – in a way that hedge fund traders, consultants, and energy market participants can apply in their day to day trading activities. Moving from the fundamentals of energy markets through simple and complex derivatives trading, hedging strategies, and industry-specific case studies, Dr. Mack walks readers through energy trading and risk management concepts at an instructive pace, supporting her explanations with real-world examples, illustrations, charts, and precise definitions of important and often-misunderstood terms. From stochastic pricing models for exotic derivatives, to modern portfolio theory (MPT), energy portfolio management (EPM), to case studies dealing specifically with risk management challenges unique to wind and hydro-electric power, the book guides readers through the complex world of energy trading and risk management to help investors, executives, and energy professionals ensure profitability and optimal risk mitigation in every market climate. Energy Trading and Risk Management is a great resource to help grapple with the very interesting but oftentimes complex issues that arise in energy trading and risk management.

What would you do if a law that enabled your investment to operate successfully abroad suddenly changed, and your business could no longer operate profitably there? Imagine exporting goods to a government buyer only to discover after the fact that your home country, or the United Nations, has just imposed an embargo on that country. Managing Countr

This Intergovernmental Panel on Climate Change Special Report (IPCC-SREX) explores the challenge of understanding and managing the risks of climate extremes to advance climate change adaptation. Extreme weather and climate events, interacting with exposed and vulnerable human and natural systems, can lead to disasters. Changes in the frequency and severity of the physical events affect disaster risk, but so do the spatially diverse and temporally dynamic patterns of exposure and vulnerability. Some types of extreme weather and climate events have increased in frequency or magnitude, but populations and assets at risk have also increased, with consequences for disaster risk. Opportunities for managing risks of weather- and climate-related disasters exist or can be developed at any scale, local to international. Prepared following strict IPCC procedures, SREX is an invaluable assessment for anyone interested in climate extremes, environmental disasters and adaptation to climate change, including policymakers, the private sector and academic researchers.

This is the final report for the DOE-NETL grant entitled 'Creating New Incentives for Risk Identification & Insurance Processes for the Electric Utility Industry' and later, 'Energy & Risk Transfer Assessment'. It reflects work done on projects from 15 August 2004 to 29 February 2008. Projects were on a variety of topics, including commercial insurance for electrical utilities, the Electrical Reliability Organization, cost recovery by Gulf State electrical utilities after major hurricanes, and review of state energy emergency plans. This Final Technical Report documents and summarizes all work performed during the award period, which in this case is from 15 August 2004 (date of notification of original award) through 29 February 2008. This report presents this information in a comprehensive, integrated fashion that clearly shows a logical and synergistic research trajectory, and is augmented with findings and conclusions drawn from the research as a whole. Four major research

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projects were undertaken and completed during the 42 month period of activities conducted and funded by the award; these are: (1) Creating New Incentives for Risk Identification and Insurance Process for the Electric Utility Industry (also referred to as the 'commercial insurance' research). Three major deliverables were produced: a pre-conference white paper, a two-day facilitated stakeholders workshop conducted at George Mason University, and a post-workshop report with findings and recommendations. All deliverables from this work are published on the CIP website at <http://cipp.gmu.edu/projects/DoE-NETL-2005.php>. (2) The New Electric Reliability Organization (ERO): an examination of critical issues associated with governance, standards development and implementation, and jurisdiction (also referred to as the 'ERO study'). Four major deliverables were produced: a series of preliminary memoranda for the staff of the Office of Electricity Delivery and Energy Reliability ('OE'), an ERO interview protocol and stakeholder/experts interviews, a formal research paper, and a data quality and availability study of North American Electric Reliability Corporation/ERO's disturbances and outages working group ('DAWG') databases. (3) Critical Electric Power Infrastructure Recovery and Reconstruction: Issues & New Policy Initiatives in Four Gulf Coast States After 2005's Catastrophic Hurricanes (also referred to as the 'Gulf Coast cost recovery study'). Four deliverables were produced: the original research paper providing preliminary findings and recommendations (29 September 2006), a formal presentation of that report to officials, staff and invited guests at OE's Washington, DC headquarters, a series of update memoranda and quarterly activity updates (1 November 2006 through Q3-2007), and a final cumulative update of the original research report (February 2008). Documentation and information on these research activities can be found on the CIP website at <http://cipp.gmu.edu/projects/DoE-NETL-2006.php>. (4) Evaluation of State Energy Emergency Response Plans (also referred to as the 'SEERP project'). Two major deliverables were produced: an evaluation of 47 SEERPs with findings, statistical analyses, geospatial renderings (mappings of the States whose plans were evaluated with statistical analysis underpinnings) and recommendations (17 September 2007), and a major revision to the original deliverable to include one additional plan (Missouri), with fully updated findings, statistical analyses, geospatial renderings, and recommendations (Revision 1, 29 February 2008). This report provides an overview of the financial impact of cyber incidents, the coverage of cyber risk available in the insurance market, the challenges to market development and initiatives to address those challenges.

Climate change affects virtually every aspect of the U.S. energy system. As climatic effects such as rising seas and extreme weather continue to appear across many geographies, U.S. energy infrastructure is increasingly at risk. The U.S. Gulf Coast--which is home to 44 percent of total U.S. oil refining capacity and several major ports--is highly vulnerable to flooding events and dangerous ocean surges during severe storms and hurricanes. The link between water availability and energy and electricity production creates another layer of risk to U.S. energy security. Climate risk could manifest not only in physical damages, but also in financial market failures. Climate change-related challenges could impede energy firms' access to capital markets or private insurance markets. Already, climate-related risks have created severe financial problems at a handful of U.S. energy firms, forcing them to interrupt their sales of energy to consumers in particular locations. Over time, climatic disruptions to domestic energy supply could entail huge economic losses and potentially require sizable domestic military mobilizations. The United States is ill prepared for this national security challenge, and public debate about emergency preparedness is virtually nonexistent. To explore the challenges of climate risk to the U.S. energy system and national security, the Council on Foreign Relations organized a two-day workshop in New York, on March 18 and 19, 2019. The gathering of fifty participants included current and former state and federal government officials and regulators, entrepreneurs, scientists, investors, financial- and corporate-sector leaders, credit agencies, insurers, nongovernmental organizations, and energy policy experts. During their deliberations, workshop participants

explored how climate-related risks to U.S. energy infrastructure, financial markets, and national security could be measured, managed, and mitigated. *Impact of Climate Risk on the Energy System* summarizes the insights from this workshop and includes contributions from seven expert authors delving into related topics.

Appropriate risk management tools can help remove some of the barriers to financing Renewable Energy Technology (RET) projects, particularly in developing countries where risk and risk perceptions are highest. That is why UNEP is working on a comprehensive overview of currently available and potential financial risk management instruments for Renewable Energy Technology (RET) projects. This study will pave the way for an upcoming GEF project that will promote the use of financial risk management instruments that favor the development of RETs.

Among the key barriers to investment in energy efficiency improvements are uncertainties about attaining projected energy savings and apprehension about potential disputes over these savings. The fields of energy management and risk management are thus intertwined. While many technical methods have emerged to manage performance risks (e.g. building commissioning), financial risk transfer techniques are less developed in the energy management arena than in other more mature segments of the economy. Energy Savings Insurance (ESI) - formal insurance of predicted energy savings - is one method of transferring financial risks away from the facility owner or energy services contractor. ESI offers a number of significant advantages over other forms of financial risk transfer, e.g. savings guarantees or performance bonds. ESI providers manage risk via pre-construction design review as well as post-construction commissioning and measurement and verification of savings. We found that the two most common criticisms of ESI - excessive pricing and onerous exclusions - are not born out in practice. In fact, if properly applied, ESI can potentially reduce the net cost of energy savings projects by reducing the interest rates charged by lenders, and by increasing the level of savings through quality control. Debt service can also be ensured by matching loan payments to projected energy savings while designing the insurance mechanism so that payments are made by the insurer in the event of a savings shortfall. We estimate the U.S. ESI market potential of \$875 million/year in premium income. From an energy-policy perspective, ESI offers a number of potential benefits: ESI transfers performance risk from the balance sheet of the entity implementing the energy savings project, thereby freeing up capital otherwise needed to "self-insure" the savings. ESI reduces barriers to market entry of smaller energy services firms who do not have sufficiently strong balance sheets to self-insure the savings. ESI encourages those implementing energy saving projects to go beyond standard, tried-and-true measures and thereby achieve more significant levels of energy savings; and ESI providers stand to be proponents of improved savings measurement and verification techniques, as well as maintenance, thereby contributing to national energy savings objectives and perhaps elevating the quality of information available for program evaluation. Governmental agencies have been pioneers in the use of ESI and could continue to play a role in developing this innovative risk-transfer mechanism. There is particular potential for linkages between ESI and the ENERGY STAR (registered trademark) Buildings Program. It is likely that ENERGY STAR (registered trademark)-labeled commercial buildings (which have lower performance risk thanks to commissioning) would be attractive to providers of energy savings insurance. Conversely, the award of energy savings insurance to an ENERGY STAR (registered trade mark)-labeled building would raise the perceived credibility of the Label and energy savings attributed to the Program.

This study examined the risks and risk management issues involved with the implementation by electric power utilities of compressed air energy storage and underground pumped hydro storage systems. The results are listed in terms of relative risks for the construction and operation of these systems in different geologic deposits, with varying amounts of pressurization, with natural or man-made disasters in the

vicinity of the storage equipment, and with different modes of operating the facilities. (LCL).

A One Day Conference on Offshore & Onshore Energy Insurance: a Risk Management Perspective Wednesday 21 February 1996, The Merchant Centre, London EC4
Financial Risk Management Instruments for Renewable Energy Projects Summary Document UNEP/Earthprint
A practical approach to ART-an alternative method by which companies take on various types of risk This comprehensive book shows readers what ART is, how it can be used to mitigate risk, and how certain instruments/structures associated with ART should be implemented. Through numerous examples and case studies, readers will learn what actually works and what doesn't when using this technique. Erik Banks (CT) joined XL Capital's weather/energy risk management subsidiary, Element Re, as a Partner and Chief Risk Officer in 2001.

"This book serves as a technical yet practical risk management manual for professionals working with water and wastewater organizations. It provides readers with a functional comprehension of water and wastewater operations as well as a broad understanding of industry derivations and various stakeholder interconnectivity. This knowledge is imperative, as most administrative professionals are proficient in their respective areas of expertise but sometimes lack fluency on the broader technical aspects of their organization's purpose, operations, and externalities. It also examines risk management best-practices and provides an actionable review of doing the right thing, the right way, every time through a combination of core risk management principles. These include enterprise, strategic, operational, and reputational risk management, as well as risk assessments, risk/frequency matrixes, checklists, rules, and decision-making processes. Finally, the book addresses the importance of risk transfer through insurance policies and provides best practices for the prudent selection of these policies across different scenarios. Features: Provides an understanding of water & wastewater technical operations to properly implement sound risk management and insurance programs. Emphasizes the importance of building well-designed, resilient systems, such as policies, processes, procedures, protocol, rules, and checklists, that are up-to-date and fully implemented across a business. Offers a detailed look into insurance policy terms and conditions and includes practical checklists to assist readers in structuring and negotiating their own policies. Handbook of Risk and Insurance Strategies for Certified Public Risk Officers and other Water Professionals combines practical knowledge of technical water/wastewater operations along with the core subjects of risk management and insurance for practicing and aspiring professionals charged with handling these vital tasks for their organizations. Readers will also gain invaluable perspective and knowledge on best-in-class risk management and insurance practices in the water and wastewater industries"--

Prices of contracts with risky aspects are typically linked to specific uncertainties and probabilities of adverse scenarios. Insurance companies carry the risk of losses in exchange for a premium, which depends on the loss distribution. Another example where risk is exchanged for a fixed price is swap contracts. Electricity futures can be seen as swaps where the

floating component are spot prices and the fixed component is a constant price for delivering electricity over a longer period. The primary goal of this thesis is the incorporation of model ambiguity for pricing these contracts. Moreover, we contemplate the complex structure of energy markets. For this reason, we also explore pricing a real option under model ambiguity. First of all, we study the theoretical properties of the distortion principle for insurance pricing. We find closed-form solutions for the optimal distortion premium under model ambiguity using Wasserstein distances. In various cases, we also find the distributions that reach the optimal prices. For the distortion principle, we can conclude that the price to pay for ambiguity only depends on the ambiguity radius and the distortion function, but not on the initial distribution. Additionally, we characterize the unboundedness of the robust distortion premium. Besides, we investigate the identification of distortion functions from observed prices. We propose a method to recover them from simulated prices in two cases: the average value-at-risk and power distortion principle. In the second part of this thesis, we bring together insurance pricing rules and electricity futures pricing rules. Due to the non-storability of electricity, many authors study different rules and empirical results to explain futures prices and the risk premia in this market. We extend the present literature and propose to explain the price formation of these contracts with three different quantities: the distortion premium, a correction factor and an ambiguity premium. [option]. The ambiguity premium is significant and increases with time-to-delivery for base futures. For these calculations, we specify a new regime-switching model for spot prices. [option1] These three factors capture a general mechanism of futures prices. We conclude the magnitude of futures increases with time-to-delivery. In addition, we recover a seasonal pattern of the risk premia and explain the changes in risk aversion depending on time-to-delivery. [option2] These three factors capture main characteristics of futures prices and the risk premia. Among them, we recover a seasonal pattern of the risk premia and explain the changes in risk aversion depending on time-to-delivery. The last part of this thesis studies an appropriate evaluation of a thermal power plant by incorporating model ambiguity. The different uncertainties that affect the expected profits of this real option are electricity prices, fuel prices and CO2 allowances. The power plant takes weekly decisions fixing the production for an entire week, while the uncertainties may affect the profit within weeks. Firstly, we discretize and quantize the uncertainties in a lattice process. To simulate different prices within weeks, we introduce an interpolation process called bridge process. Secondly, we propose a distance between lattice processes, which is tractable for solving dynamic problems backwards in time. This distance is a Wasserstein distance type with an underlying metric dependent on the state of the power plant. Our empirical results show that the larger the ambiguity radius is, the more conservative the production, and the less the achieved profit is. Although we solve a specific problem, our results can be applied to different multistage decision problems.

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This book examines key risks that the Nation's critical energy infrastructure is confronting and the ways in which the insurance industry can help manage these risks, including how it identifies, assesses, and manages them and their potential impacts. Today, weather-related incidents account for the majority of economic losses in the insurance industry as well as in the critical infrastructure sectors. In addition to the traditionally-recognized natural hazards, critical energy infrastructure faces significant emerging threats, including cybersecurity and space weather risks. While the United. For the future, significant progress could be made through interdisciplinary collaborative applied research (i.e., integrating the actuarial sciences with the "physical" or "engineering" sciences). This collaboration could be sponsored jointly by the U.S. Department of Energy and the insurance and risk management communities (as well as working through the insurance regulatory and rate-making processes).

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