Implications of the February Weather Event for Energy Risk Management

Texas Public Power Association

Annual Meeting

July 26-28, 2021

San Antonio, Texas

nFRONT CONSULTING LLC

Power Industry Planners • Analysts • Advisors

Introduction

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35 Years consulting and industry experience

Client Service Focus
- Energy Risk Management
- Forecasting
- Power Supply Planning
- Rate Design and Pricing
- General Business Analytics
- Strategic Planning

Educational Background
- BS Nuclear Engineering
- MBA with honors
- The Wharton School

Introduction

- **nFront Consulting** provides consulting and advisory services to both support and optimize the assets, programs, systems, and business operations of our electric industry clients.
  - Planning and Optimization
  - Resource Integration, Implementation, and Management
  - Project Advisory Services
  - Environmental Services

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Overview

- Energy Risk Management History and Standards
- Challenges of Extreme Events
- Reconsidering Price Modeling and Hedging Approaches
- Additional Considerations for Energy Risk Control
- The Wild Card – Judicial and Legislative Action
- Implications for Long-Term Resource Planning
- Recommendations and Wrap-Up

Energy Risk Management – What is It?

Energy risk management is a collection of processes and systems to help protect a utility against the economic effects of adverse changes in:

- Wholesale power prices
- Fuel prices
- Load behavior
- Generation availability
- Transmission congestion

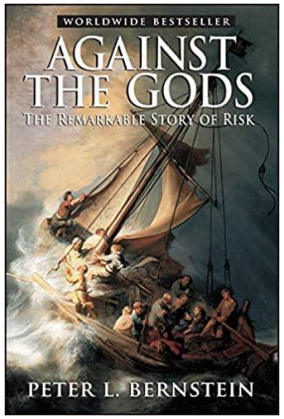
Energy Risk Management is inherently defensive in nature.

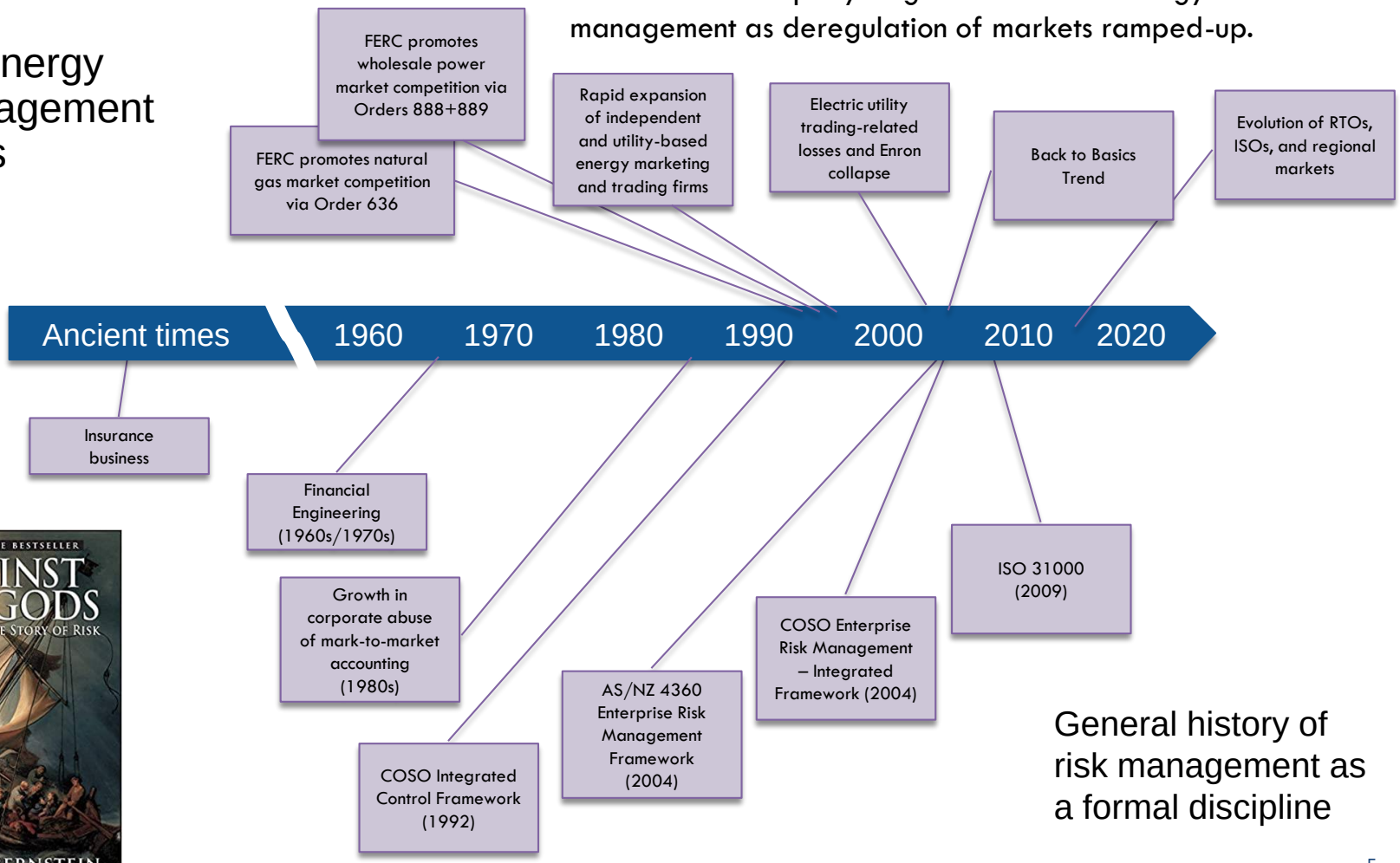
For most utilities, the value lies not in attempting to forecast specific prices, but rather, to understand price behavior, the drivers, and most importantly, the ***impact of potential adverse load and price changes on their energy portfolio and business economics.***

Energy Risk Management History

Rise of energy risk management in utilities

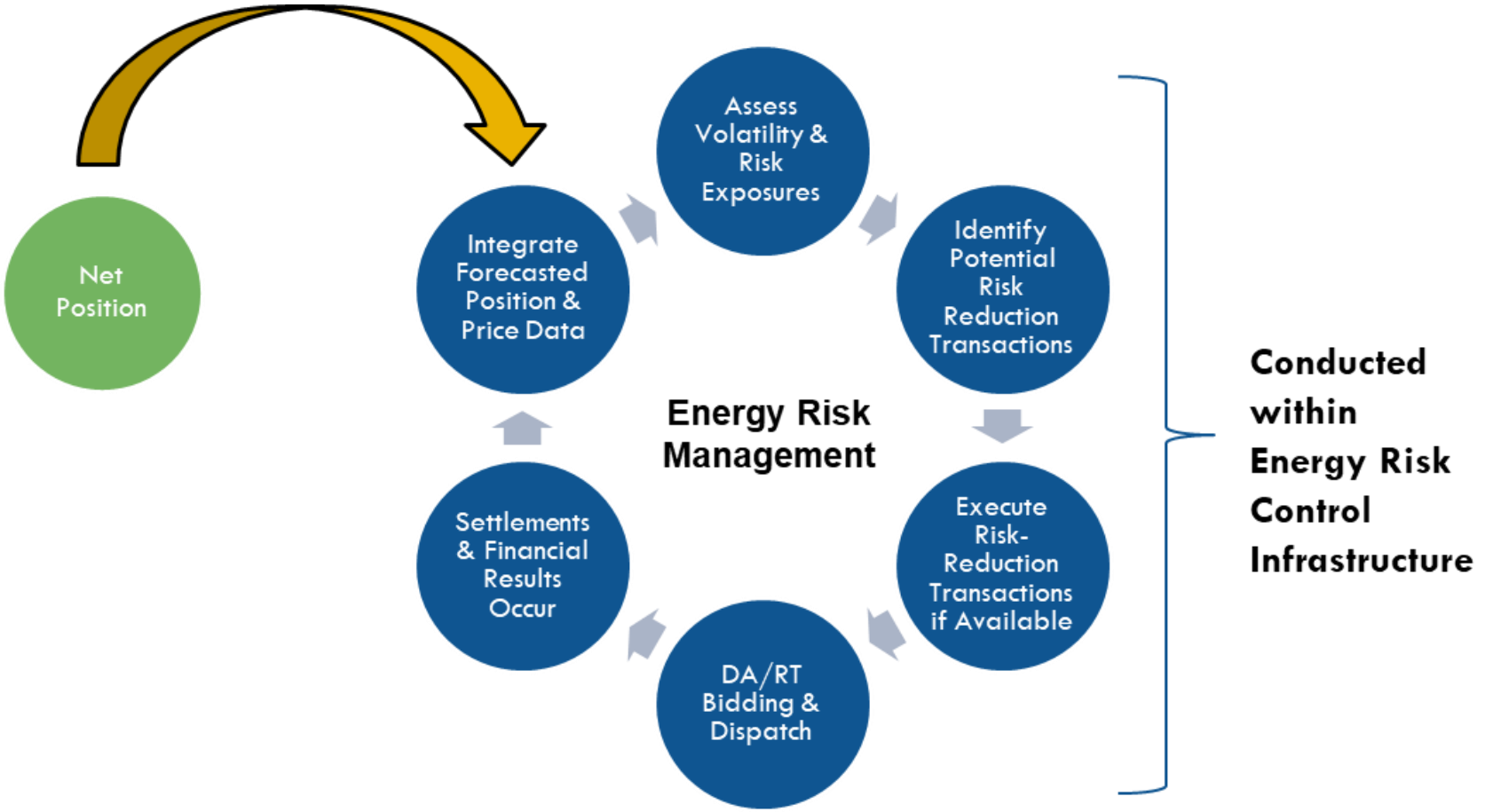
Electric utilities rapidly began to embrace energy risk management as deregulation of markets ramped-up.





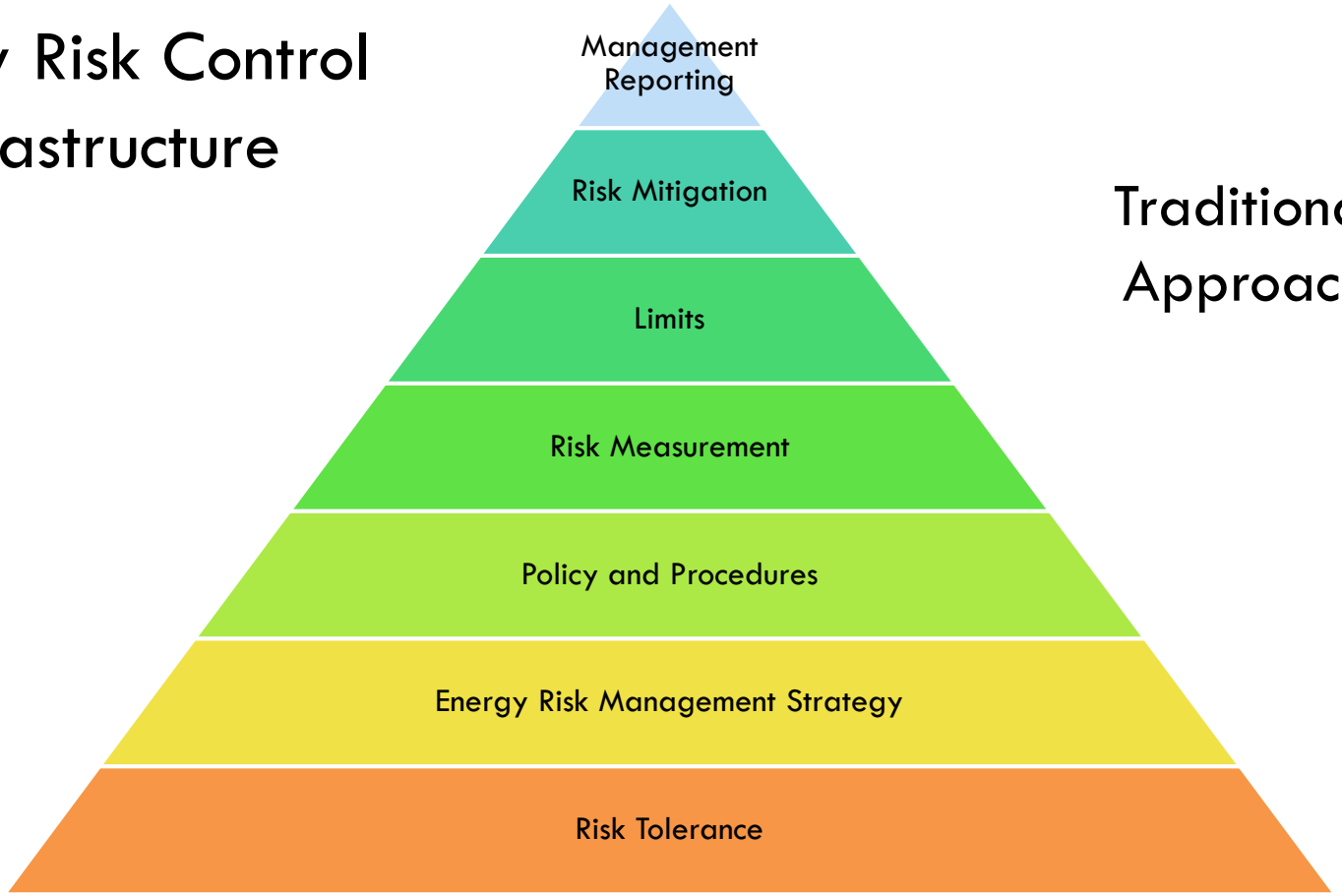
General history of risk management as a formal discipline

Energy Risk Management Cycle



Energy Risk Management History & Standards

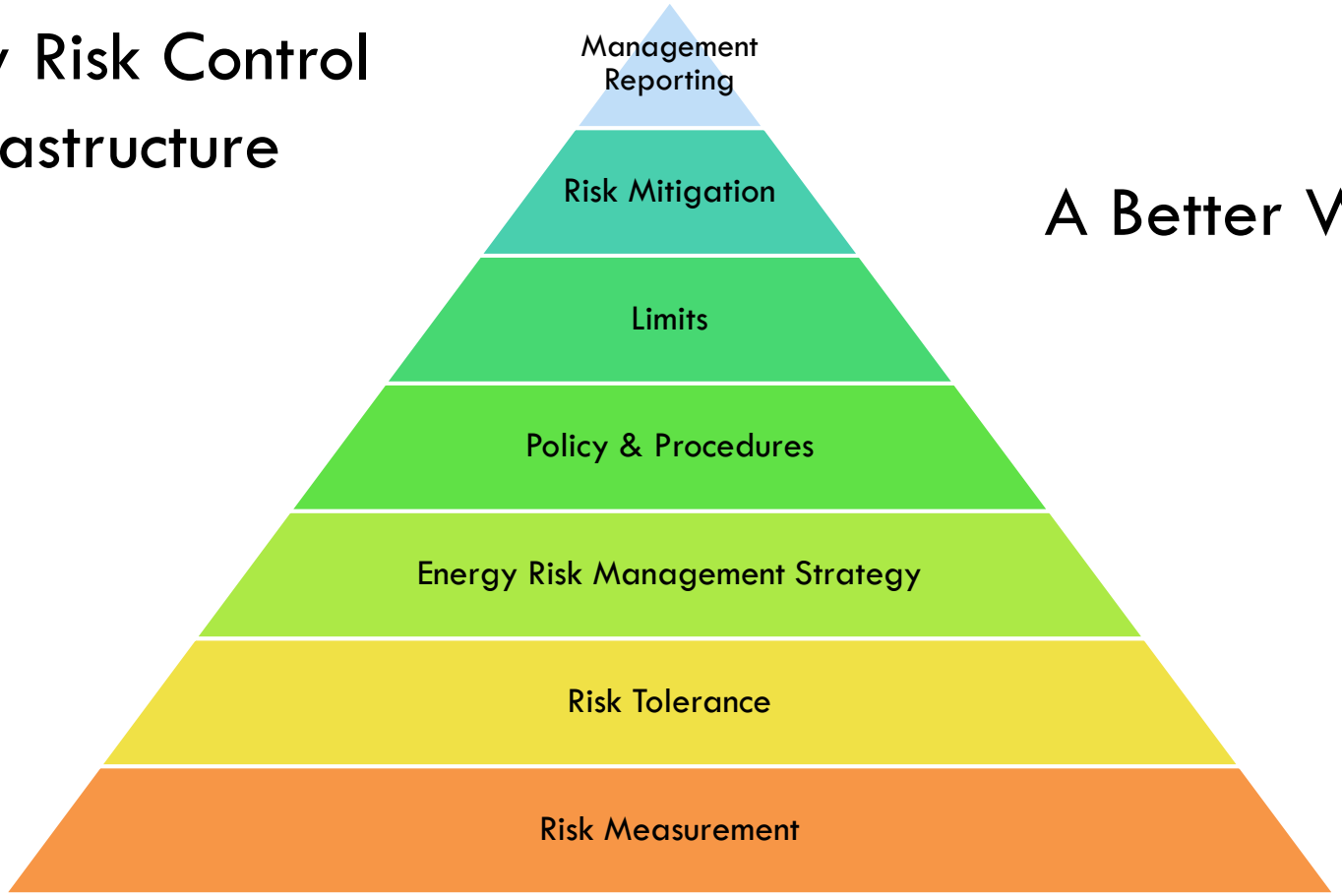
Energy Risk Control Infrastructure



Traditional Approach

Energy Risk Management History & Standards

Energy Risk Control Infrastructure

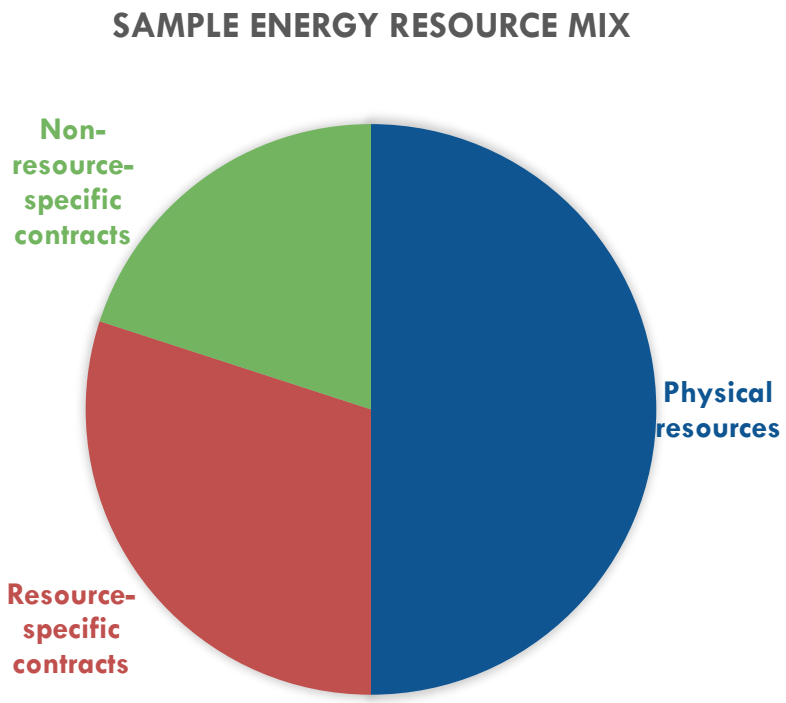


A Better Way

Energy Risk Management History & Standards

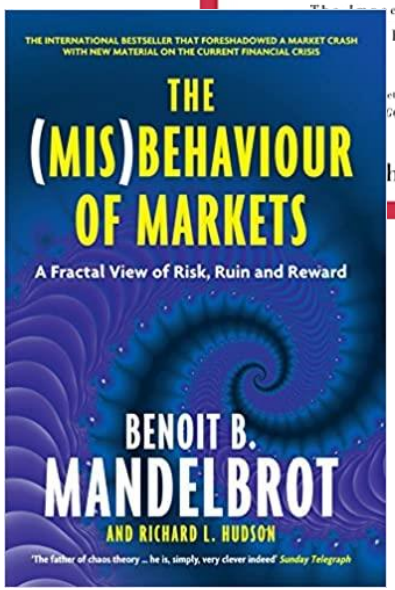
- Assets and contracts are typically mixed and matched to create a reliable, economic, and resilient energy portfolio.
  - Physical Resources
  - Resource-specific contracts
  - Non-resource specific contracts
    - Index-based supply contracts
    - Forwards
      - Physical
      - Financial
    - Options
      - Physical
      - Financial
    - Futures
      - Financial
    - Swaps
      - Financial

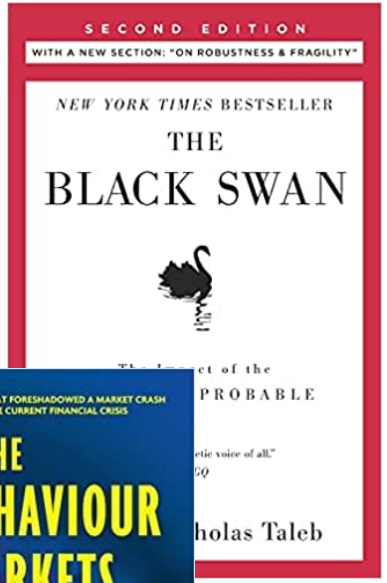
Energy Hedging



Challenges of Extreme Events

- They occur more often than then “should”, especially when near misses are considered.
- Because we think they could never realistically happen, we’re typically not very prepared.
- Risk measurement can be particularly difficult.



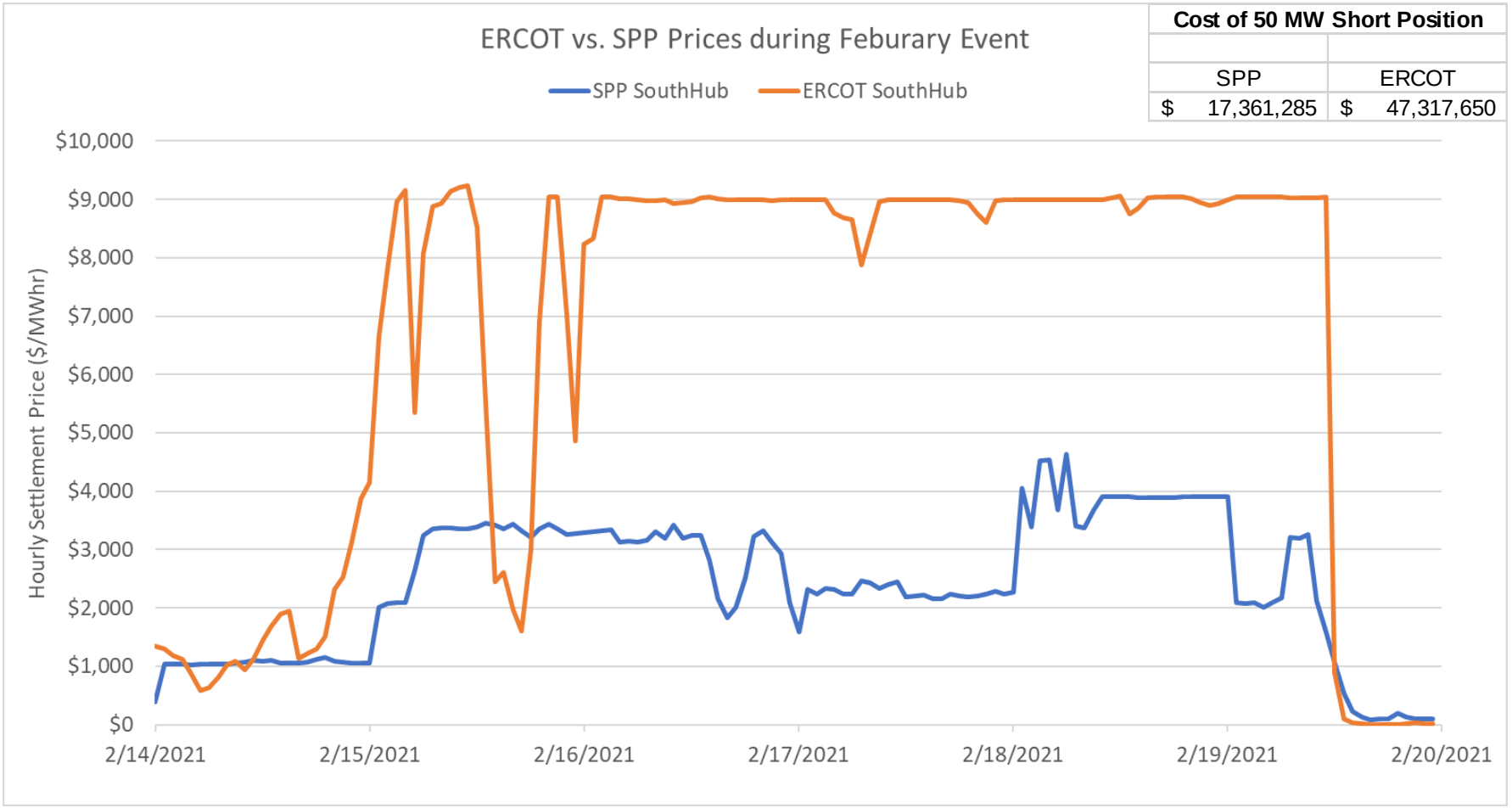


Challenges of Extreme Events

- Winter Storm Uri
  - Not one but three severe winter storms overlapped during Feb 10 through Feb 20, 2021
  - Similar but worse than the "Groundhog Day Blizzard" of 2011
  - Due in part to inadequately winterized generation and natural gas systems, the storms resulted in widespread electricity generation failures and rolling blackouts across ERCOT
    - ERCOT's isolation from the surrounding grid was a contributing factor
  - More than 4.5 million homes and businesses were left without power, many in freezing temperatures and some for over a week
  - Damages have been estimated at over $195 billion, surpassing Hurricane Harvey as the costliest disaster in Texas history
  - Some energy firms made billions in profits, while others went bankrupt

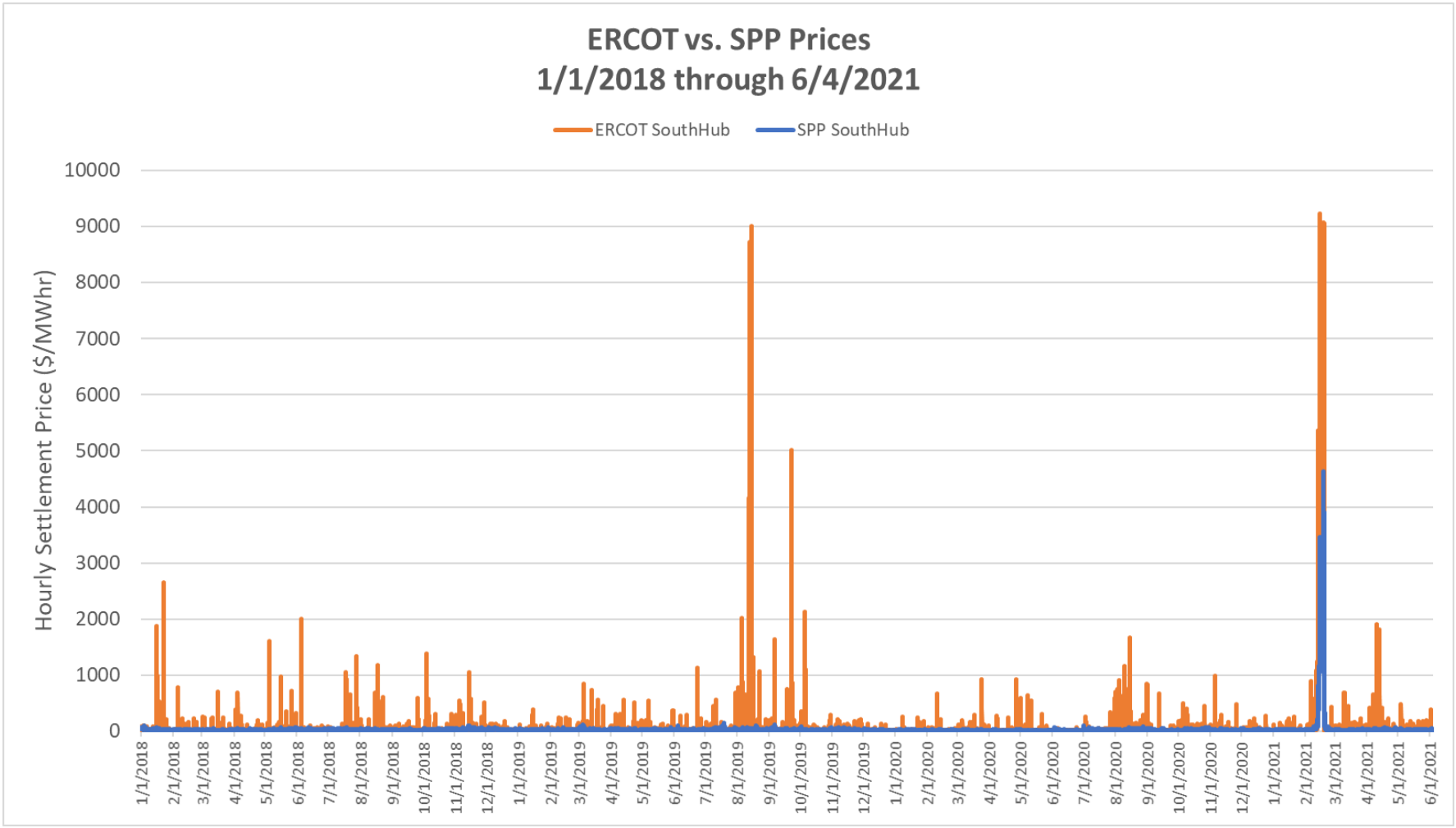
Source: Wikipedia, "2021 Texas Power Crisis"

Challenges of Extreme Events



Cost of 50 MW Short Position	
SPP	ERCOT
$ 17,361,285	$ 47,317,650

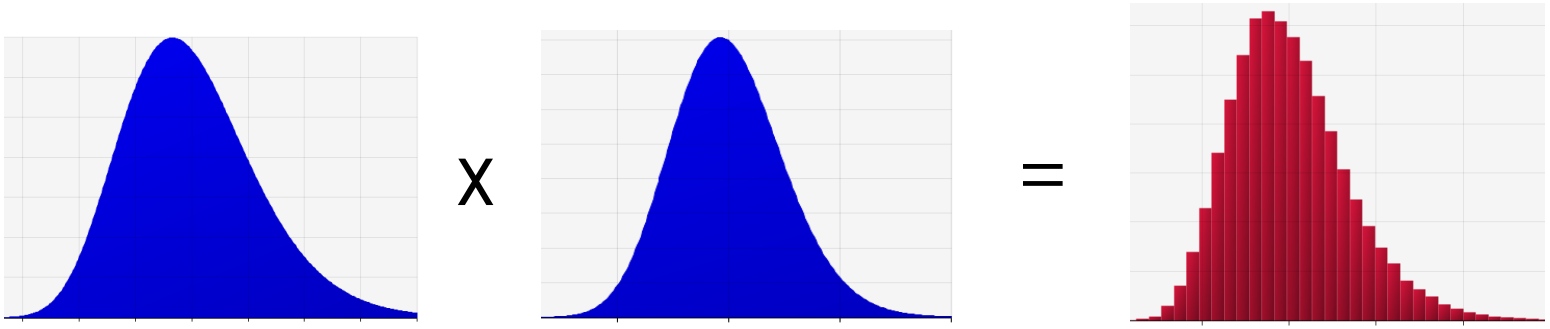
Challenges of Extreme Events



Reconsidering Price Modeling & Hedging Approaches

- Value and Importance of Monte Carlo simulation
  - What?
    - Simulation approach that allows for rapid data-driven examination of portfolio behavior across thousands (typically) of combinations of potential load, generation, and market conditions

For more info:
https://www.palisade.com/risk/monte_carlo_simulation



Reconsidering Price Modeling & Hedging Approaches

- Simple Live Example

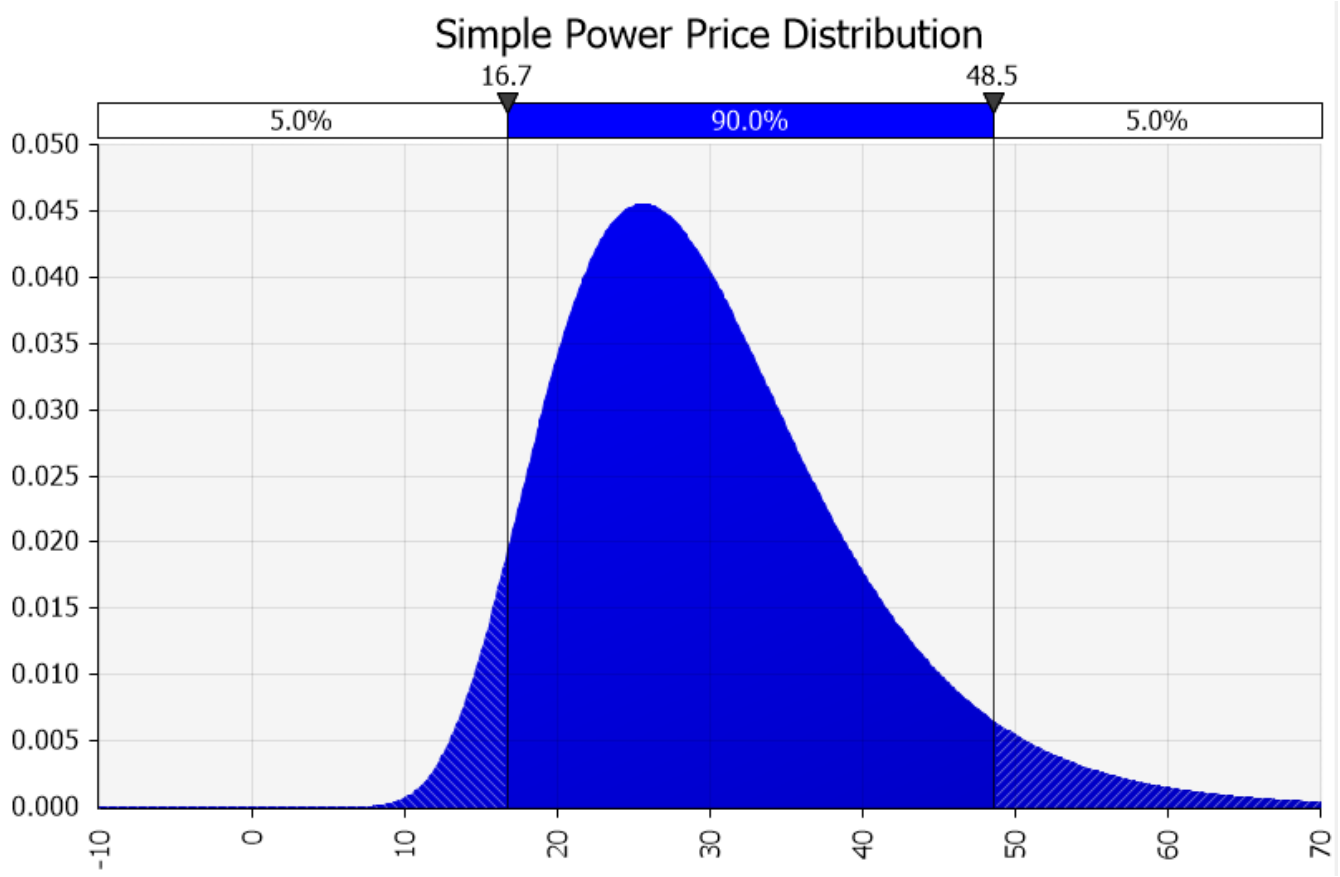
	A	B	C	E
1	**Simple Monte Carlo Simulation Example**			
2				
3		Expected Value	Uncertainty (Standard Deviation)	
4	Price	$ 30	20%	
5	Volume	$ 1,000	10%	
6	Total Cost	$ 30,000	?	
7				
8		What is the range of Total Cost at various levels of probability?		
9		What is the average Total Cost?		
10		What is the most likely Total Cost?		
11				

Reconsidering Price Modeling & Hedging Approaches

- Value and Importance of Monte Carlo simulation
  - Why?
    - Greater insight
    - Stronger decisions
  - How?
    - Data-driven
    - Statistically defensible
    - Designed to readily incorporate correlations
    - Supports risk-informed optimization
    - Can be mixed and matched with scenario analysis to create powerful analyses

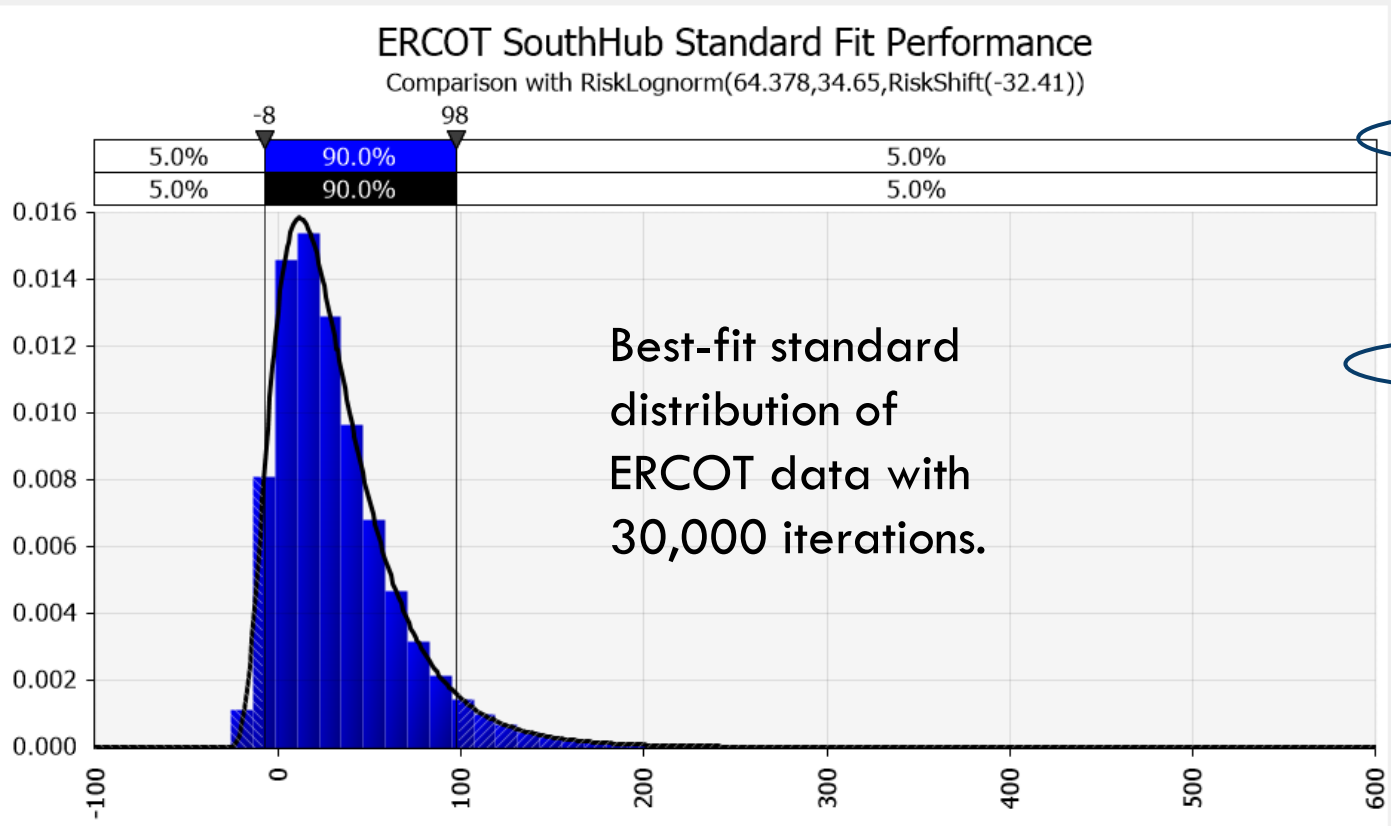
Reconsidering Price Modeling & Hedging Approaches

- Historically, simple price distribution forms have been considered sufficient to model energy markets.



Reconsidering Price Modeling & Hedging Approaches

- However, this type of data fit is poor for ERCOT and can lead to misleading results.



Statistics	ERCOT Sou...	RiskLognor...
Cell	F38	F38
Minimum	-25.93	-32.41
Maximum	504.60	+∞
Mean	31.97	31.97
90% CI	± 0.329	
Mode	12.68	11.55
Median	24.28	24.28
Std Dev	34.67	34.65
Skewness	1.7888	1.7706
Kurtosis	9.3662	9.0467
Values	30000	
Errors	0	
Filtered	0	
Left X	-8	-8
Left P	5.0%	5.0%
Right X	98	98
Right P	95.0%	95.0%
Dif. X	105.23	105.23
Dif. P	90.0%	90.0%
1%	-14.88	-14.87
2.5%	-11.32	-11.32
5%	-7.69	-7.68
10%	-2.71	-2.71
20%	4.67	4.67
25%	7.93	7.93
30%	11.10	11.10
35%	14.26	14.27

Reconsidering Price Modeling & Hedging Approaches

- The severity and duration of extreme events (Scarcity Events) in some markets makes alternative approaches necessary.
- One such approach we have found very useful is a ***bi-modal*** model, where:

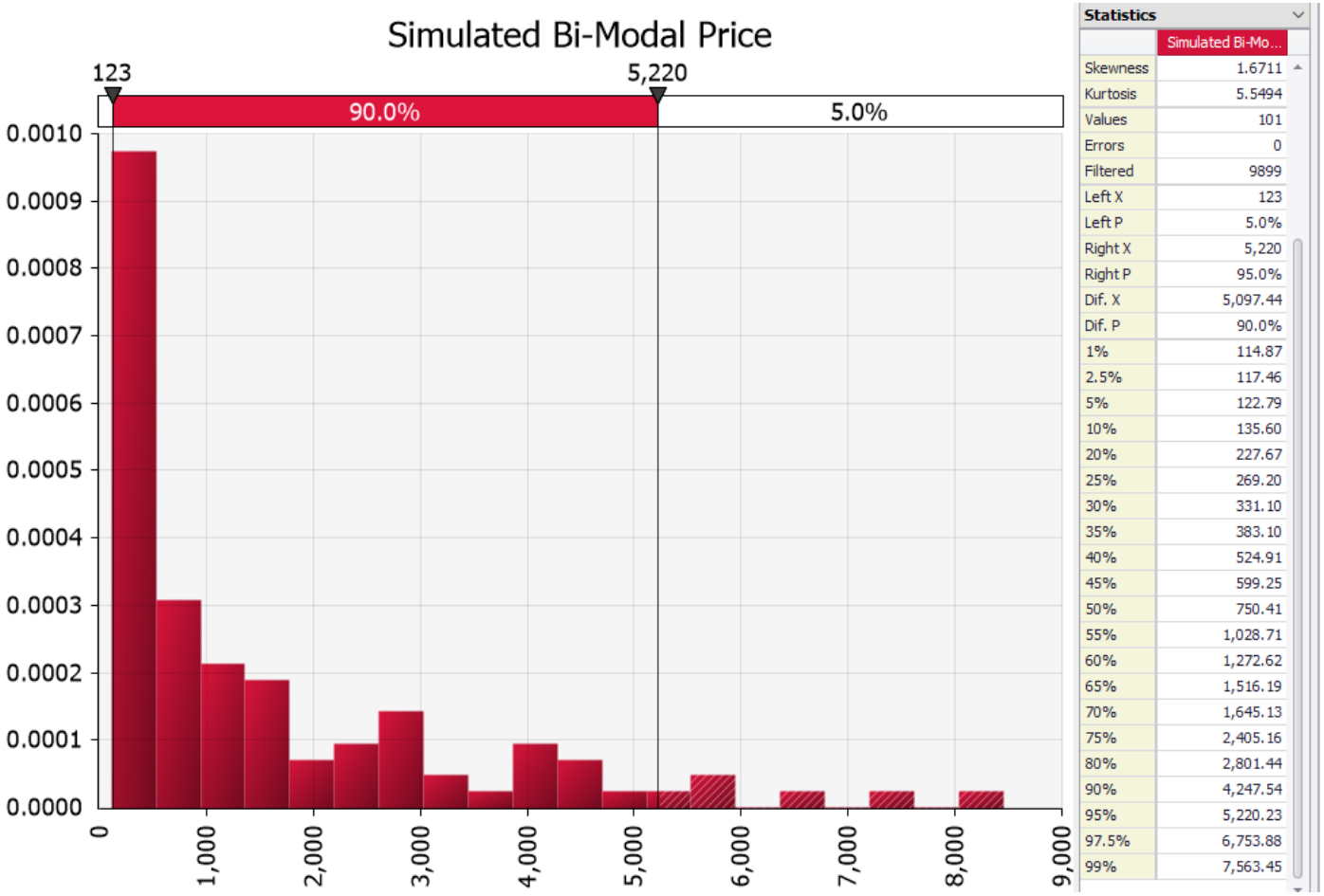
Mean Simulated Price = Forward Price =

Mean Normal Price

+

[Scarcity Probability] X [Mean Scarcity Adder]

Reconsidering Price Modeling & Hedging Approaches



Statistics	Simulated Bi-Mo...
Skewness	1.6711
Kurtosis	5.5494
Values	101
Errors	0
Filtered	9899
Left X	123
Left P	5.0%
Right X	5,220
Right P	95.0%
Dif. X	5,097.44
Dif. P	90.0%
1%	114.87
2.5%	117.46
5%	122.79
10%	135.60
20%	227.67
25%	269.20
30%	331.10
35%	383.10
40%	524.91
45%	599.25
50%	750.41
55%	1,028.71
60%	1,272.62
65%	1,516.19
70%	1,645.13
75%	2,405.16
80%	2,801.44
90%	4,247.54
95%	5,220.23
97.5%	6,753.88
99%	7,563.45

Highest 1% of results

Reconsidering Price Modeling & Hedging Approaches

- Why does this matter?
  - More accurately reflects potential cost under low probability, extreme events
  - Provides better signal (and justification) for beneficial hedging

Reconsidering Price Modeling & Hedging Approaches

Hedge Analysis Results using Lognormal Model

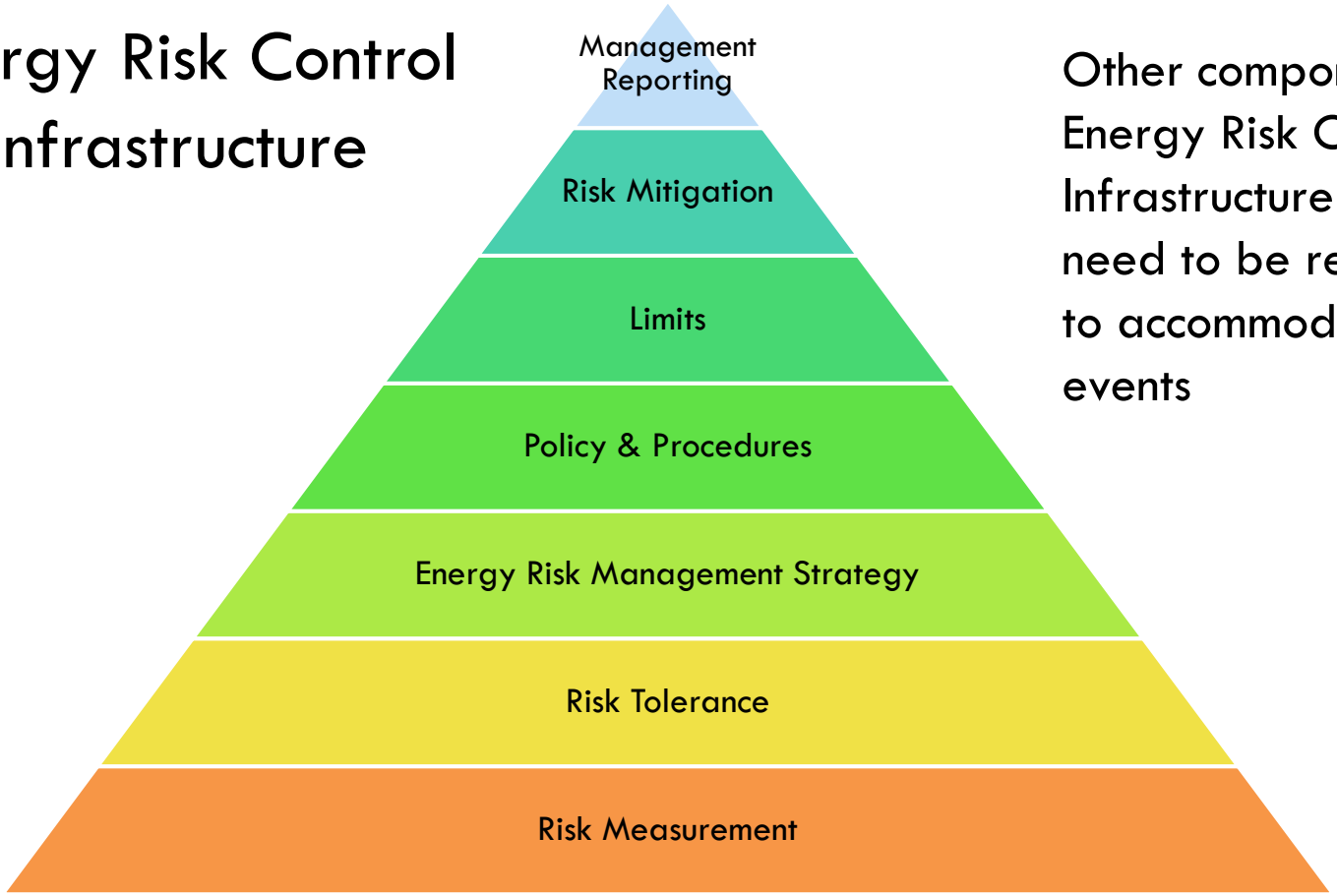
Without Hedge		With Hedge	
Ave Cost	$15M	Ave Cost	$16M
Max Cost	$20M	Max Cost	$19M

Hedge Analysis Results using Bi-Modal Model

Without Hedge		With Hedge	
Ave Cost	$15M	Ave Cost	$16M
Max Cost	$60M	Max Cost	$40M

Additional Considerations for Energy Risk Control Infrastructure

Energy Risk Control Infrastructure



Other components of your Energy Risk Control Infrastructure may also need to be reconsidered to accommodate extreme events

The Wild Card – Judicial and Legislative Action

- Lawsuits
  - Griddy Class Action
  - ERCOT and Centerpoint
  - ERCOT and Entergy Texas
  - American Electric Power & ERCOT
- Texas Legislative Actions
  - HB 2586
  - HB 16
  - SB 2
  - SB 3
  - SB 1580
  - SB 4492
  - SB 1520
  - SB 415
  - SB 2154
  - HB 2151

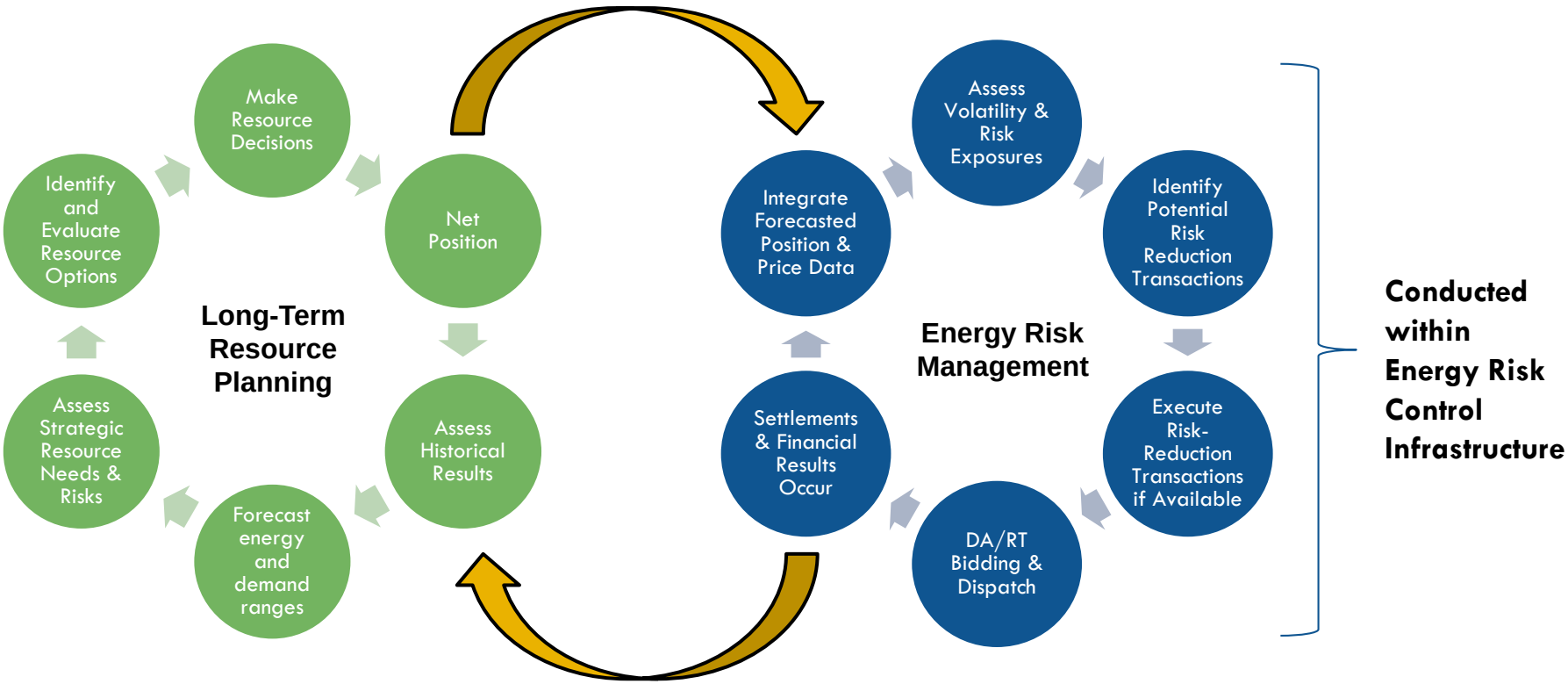
Texas Governor Signs Laws Requiring Power Companies To Weatherize After Winter Storm

Forbes

The "tug-of-war" between industry, customers, lawyers, legislators, regulators, and ERCOT is likely to contribute to market volatility for the foreseeable future in the ERCOT market.

Also, to what extent do you rely on lawsuits and legislative action to protect you?

Implications for Long-Term Resource Planning



Every 3-5 years and as needed

Seasonally/Monthly/Weekly/Daily

Implications for Long-Term Resource Planning

- Develop a clear policy on capacity reserves
  - How much and what types in which months?
- Carefully consider fuel source diversity in your portfolio
- Fuel flexibility is now more valuable
- Be careful about resource locations
- Don’t neglect to consider credit risk in all contracting activities

Recap and Recommendations

- Recap
  - Today, high quality risk measurement and communication is more important than ever.
  - Simulation modeling using Monte Carlo analysis is a powerful method that is very helpful in analyzing the risks of volatile markets such as ERCOT that are prone to severe events.
  - However, it is important to be careful when determining how best to model prices so that extreme outcomes are reflected in the simulation.
  - The continued (and potentially increasing) volatility in markets such as ERCOT makes hedging increasingly economical, even with large premiums.

Recap and Recommendations

- Recommendations for Consideration
  - Be sure of the quality of the risk measurement information you are producing and/or receiving.
  - If you haven't updated your energy risk management program recently, now might be a good time to do it.
  - If you use a 3rd party transaction agent, double-check that risk management roles and responsibilities are crystal clear.
  - Revisit your long-term resource plan more often.
    - Keep it fresh and don't just look at it on your shelf.

Thank you. Questions?

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