Risk Management Opportunities with Biomass Co-Firing

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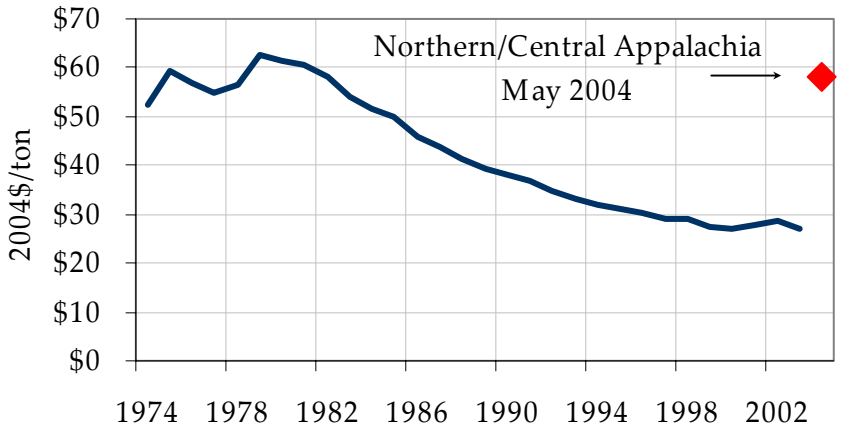
A New Look at Renewables

- A convergence of factors has brought new attention to renewable power generation
- Traditional Factors
  - Environmental benefits
  - Tax benefits
  - Economic benefits†
- A New "Latent" Factor?
  - Risk management/synergistic benefits

† *not always present*

Traditional Limitations

- The #1 reason behind the limited penetration of biomass power generation is simple: very limited *pure* economic justification
- Historically, coal prices have been cheap and stable (and declining in real dollar terms)
- Little incentive to devote resources to overcoming the technological and operational barriers



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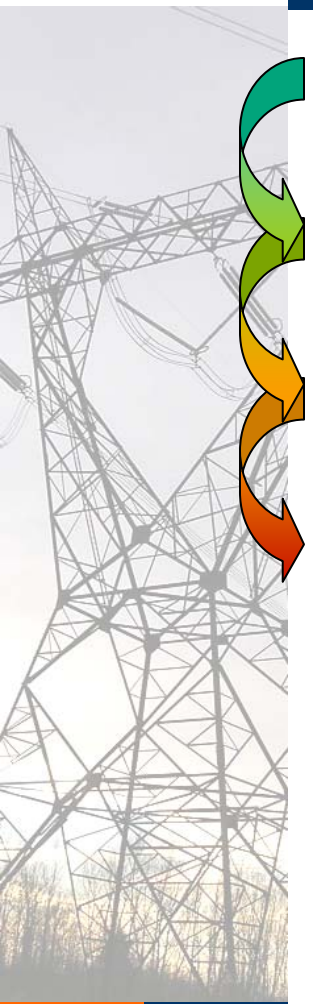
Substitution and Competitiveness



- Years of aggressive development activity have significantly increased gas-fired generation
- Increasing demand for gas has pushed up natural gas prices
- Higher natural gas prices have encouraged substitution of cleaner coal-fired generation
- Increasing demand for coal has taxed the coal infrastructure, pushing up spot prices

- As a result, greater pure economic margins are available to renewable generators – such as biomass – that were previously less viable

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Traditional Benefits

- Major Federal Tax Credits
  - Section 29
    - Scope: production of fuel feed stocks
    - Subsidy: ~$1.12/MMbtu
  - Section 45
    - Scope: electric generation by closed-loop biomass
    - Subsidy: ~$18/MWh
  - Do operating revenues and tax credit "revenues" have the same risk profiles?

- Environmental Benefits
  - $SO_2/NO_X/CO_2$ Production

	tons/GWh		
	CO_2	SO_2	NO_X
Coal	1,000.00	6.70	3.80
Natural Gas	520.00	0.04	0.90
Wind	-	-	-
Wood/Coal	550.00	6.03	2.86

  - Dollar values of environmental benefits (as avoided costs under a "3P+1" scenario)

	$/MWh Allowance Costs		
	CO_2	SO_2	NO_X
Coal	$ 25.00	$ 1.00	$ 7.60
Natural Gas	$ 13.00	$ -	$ 1.80
Wind	$ -	$ -	$ -
Wood/Coal	$ 13.75	$ 0.90	$ 5.72
	$25/ton	*$150/ton*	*$2,000/ton*

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Convergence of Factors

- Environmental and tax benefits have long been present
- The recent emergence of a pure economic justification has dramatically increased the portfolio viability of renewable generation

- Additionally, *economically competitive* renewable capacity can be used effectively as part of a portfolio risk management strategy

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A Risk Analysis Perspective

- Risks
  - Environmental Uncertainty
    - Co-firing as a hedge option for coal plants
    - Synthetic vs physical SO_2/NO_X reduction costs
  - Fuel Price Volatility
    - Adding the relative stability of biomass fuel costs to coal costs can reduce overall fuel expense volatility
    - Are consumers willing to pay a premium for stable prices? How much?
    - Stable cash flows are worth more to investors

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A SERC Case Study

- SERC coal plant co-fires with wood waste
- 20 year old, 70 MW combined wood/coal cogeneration facility
- Project operating flexibility allows facility to alter mix of coal and wood in response to market conditions
- Explicit value drivers
  - Competitive fuel economics
- Implicit value drivers
  - Option to switch
  - "Portfolio" effect

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A South Carolina Case Study

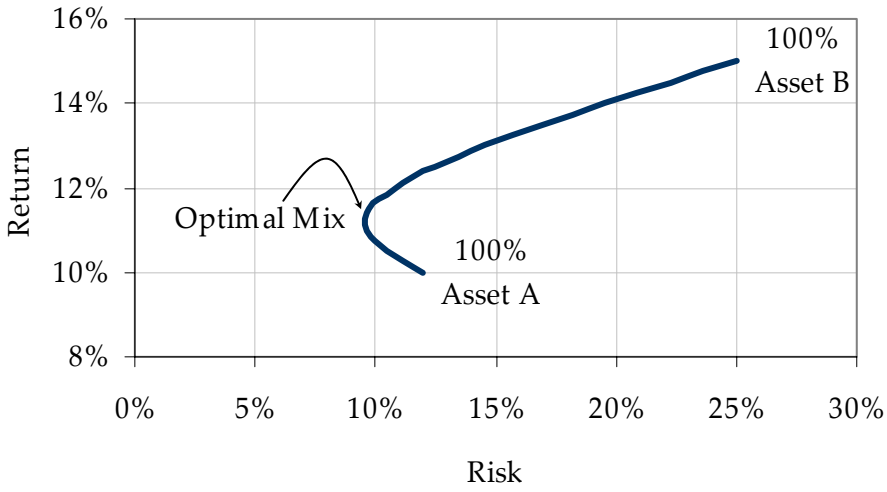
- Basic management decision is two-fold:
  - What should we co-fire with?
  - How much co-firing should be done?

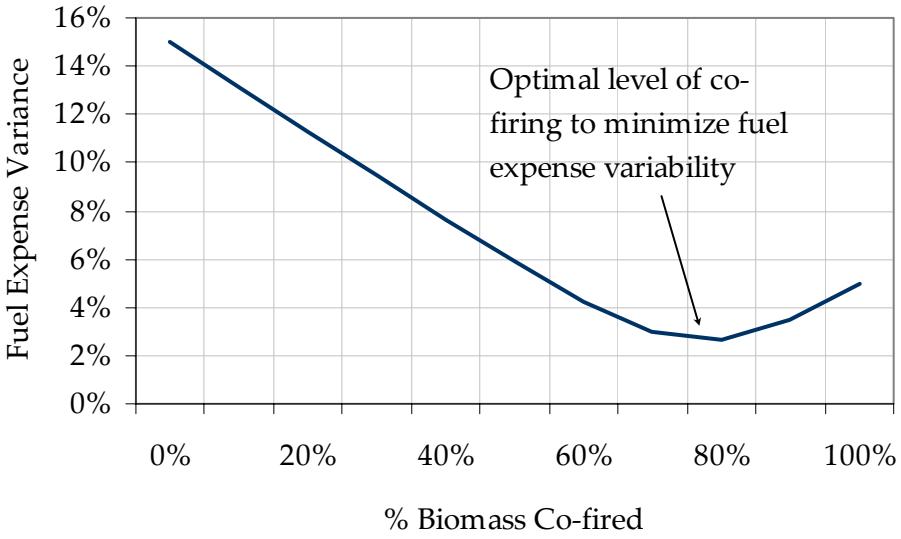
- Here, we abstract to one single issue: can risk management motives be a new value driver for renewables?

- This is a "portfolio problem"
  - 0%? 100%?
  - If it's not at the extremes, there must be a methodology by which to select the optimal mix
    - *Optimal along which dimensions???*
  - "Quantifying" fuel diversity as a strategic objective

Variable Cost "Efficient Frontier"

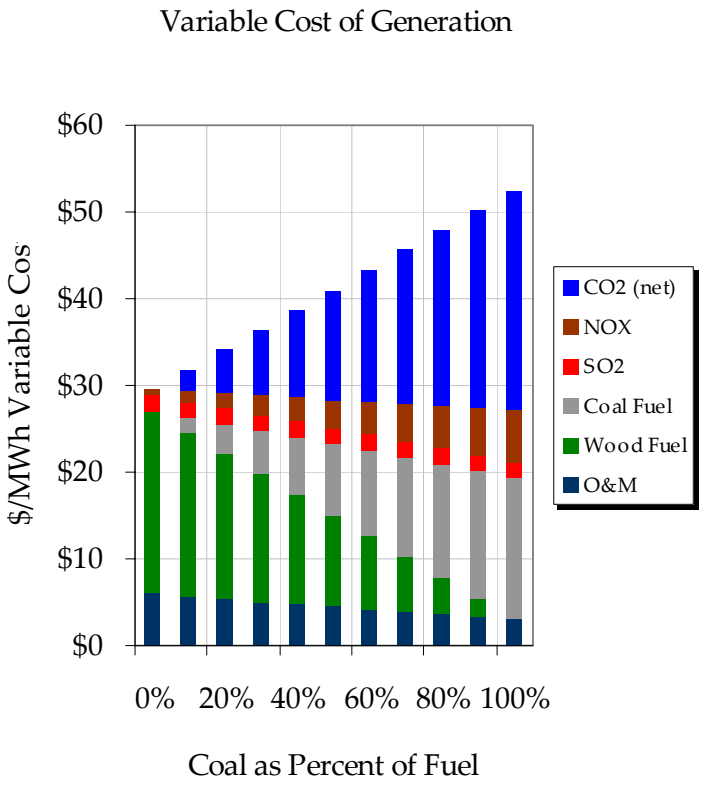
The "traditional" efficient frontier
Risk vs. Return





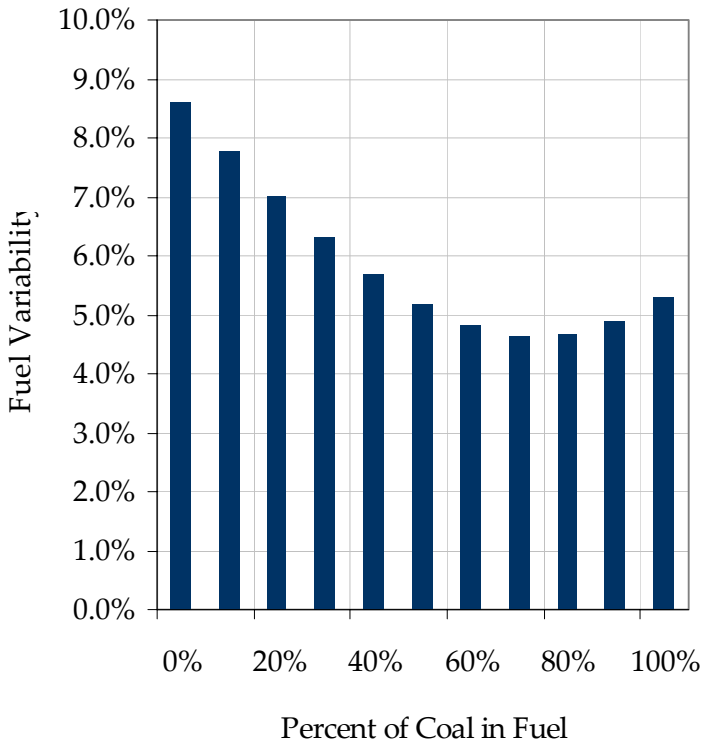
Co-Firing Variable Cost Frontier
Mixture vs. Cost Variability

Variable Costs: One Dimension



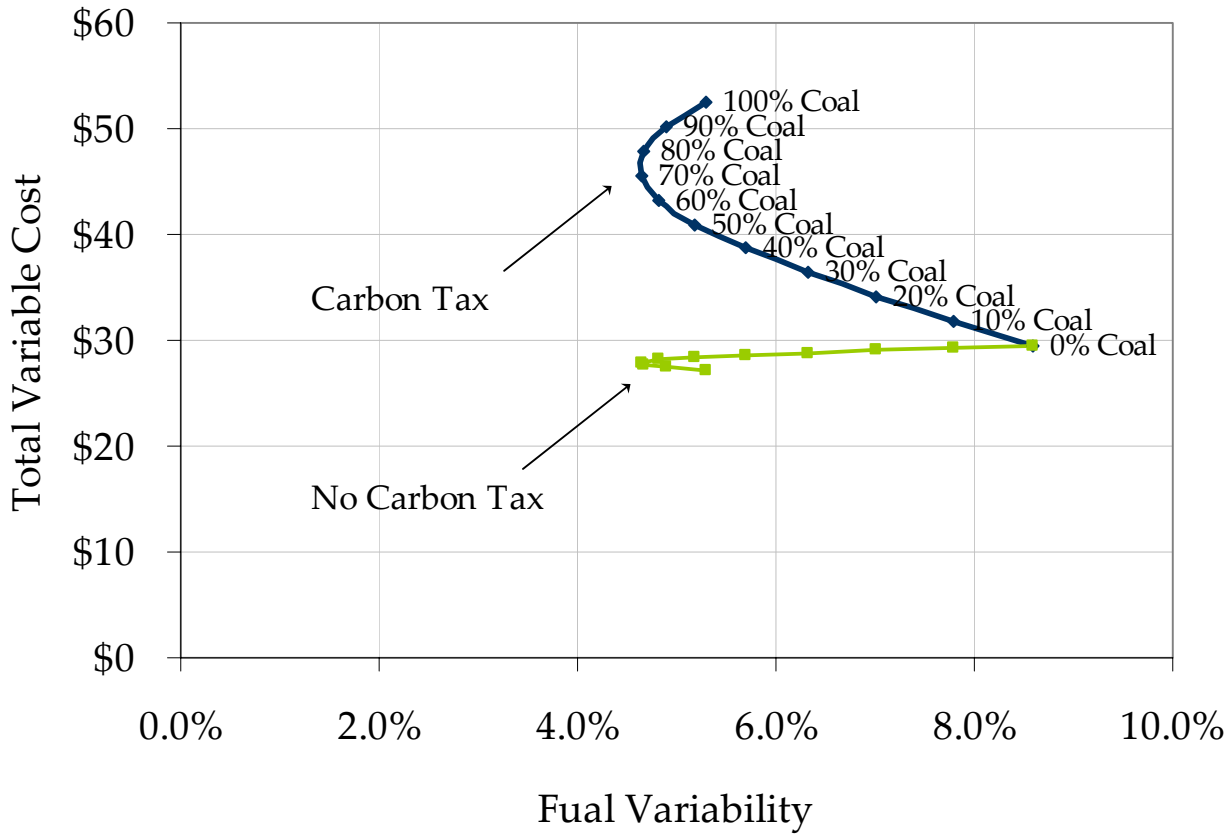
"Mean"

Assumes no net carbon release from biomass



"Variance"

Variable Costs: Two Dimensions



Assumes no net carbon release from biomass

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Summary

- Higher electricity and coal prices have increased the pure economic viability of biomass capacity
- In addition to the standard benefits to renewable generation, the new economic rationale for biomass co-firing (among other types of renewables) suggests some novel risk management opportunities that are now available

- DAI has the experience with the technological, operational, financial, and risk management aspects of renewable power generation to improve over risk-reward ratios

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