

The Value of Renewables: Portfolio Diversification, Energy Security and Free Hedging?

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SPRU Energy Group

University of Sussex, UK

- **SPRU: One of the oldest & largest institutes for the study of science and technology policy**

- 50 faculty, 70 Ph.D. / 50 MSc students

- **Energy Group Focus**

- Transition to a low carbon, sustainable energy economy for the UK



Can All Fossil Risk Be Hedged?

- In Electricity generation fossil risk generally takes two forms – *micro* and *macro* level risks
- **Micro level risk:** financial or market (β) risk
 - e.g.: Risk that future fossil costs will fluctuate over time
 - Individual investors can hedge, but not society
- **Macro level risk:** Oil/Gas volatility produces negative consequences on GDP
 - Cannot be effectively hedged
 - But renewable technologies can *reduce* this risk

Macroeconomic Fossil Risk

The Oil/Gas-GDP Effect

Macroeconomic Consequences of Fossil Price Risk:

- **Fossil volatility hurts employment & GDP growth in oil consuming & producing nations**
 - Widely accepted in academic literature and the press
- **US: 1970-2000 Oil Price Volatility Imposed \$7 Trillion Costs (Oak Ridge, 2000)**
- **EU: Macroeconomic cost of 2000-04 oil spikes = €400 Billion**
- **Every MWH of non-gas generation in the US saves consumers \$7.50 - \$20.00 (Bolinger Wiser LBNL, 2005)**
- **1% nat-gas demand reduction → long-term price reductions of 0.8% to 2%**

Avoided GDP Losses for 10% RE Addition

				Avoided GDP Losses (USD \$Billions)			
Loss Estimation							
GDP Elasticity Measure	GDP Elasticity	Oil Price Reduction	GDP Loss %	US	EU-25	OECD	World
PANEL I: Long Term Oil-Gas Correlation ($\rho = .75$)							
Pre-1986 Average	-9.8%	-6.2%	0.61%	\$66	\$67	\$113	\$221
1986 Inclusive Average	-7.3%	-6.2%	0.45%	\$49	\$49	\$84	\$164
Leiby (2004) Average	-6.4%	-6.2%	0.40%	\$43	\$43	\$74	\$144
Averages				\$53	\$53	\$90	\$176
Avoided GDP Losses per KW:							
Wind/Solar: \$200-\$300							
Geothermal: \$600-\$800							
Leiby (2004) Average	-2.6%	-8.4%	0.21%	\$36	\$36	\$61	\$119
Averages				\$29	\$29	\$49	\$95
GDP				\$10,882	\$10,970	\$18,659	\$36,356

Mexico: \$3 - \$5 billion
(GDP: \$1,066 billion)

a. Based on USEIA RESE targets

MARKET (MICRO) RISK

**Valuing Energy Technologies
Necessarily Involves
an Assessment of Financial Risk**

Market Risk Affects KWh Cost Estimates

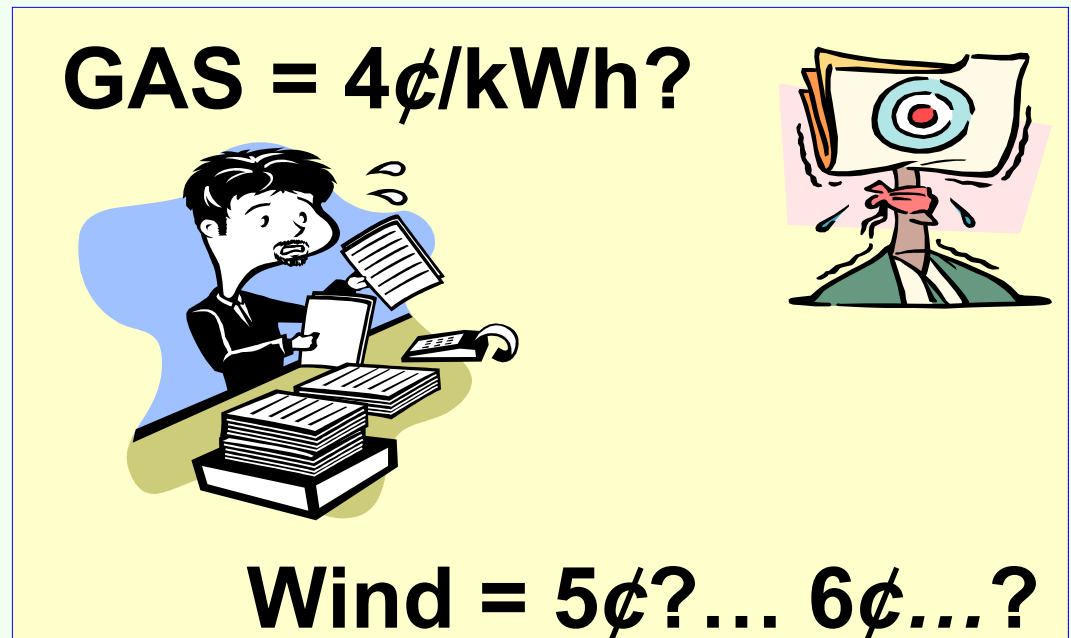
- Risk affects *value* and economic *expectations*

- Gas → variable rate mortgage

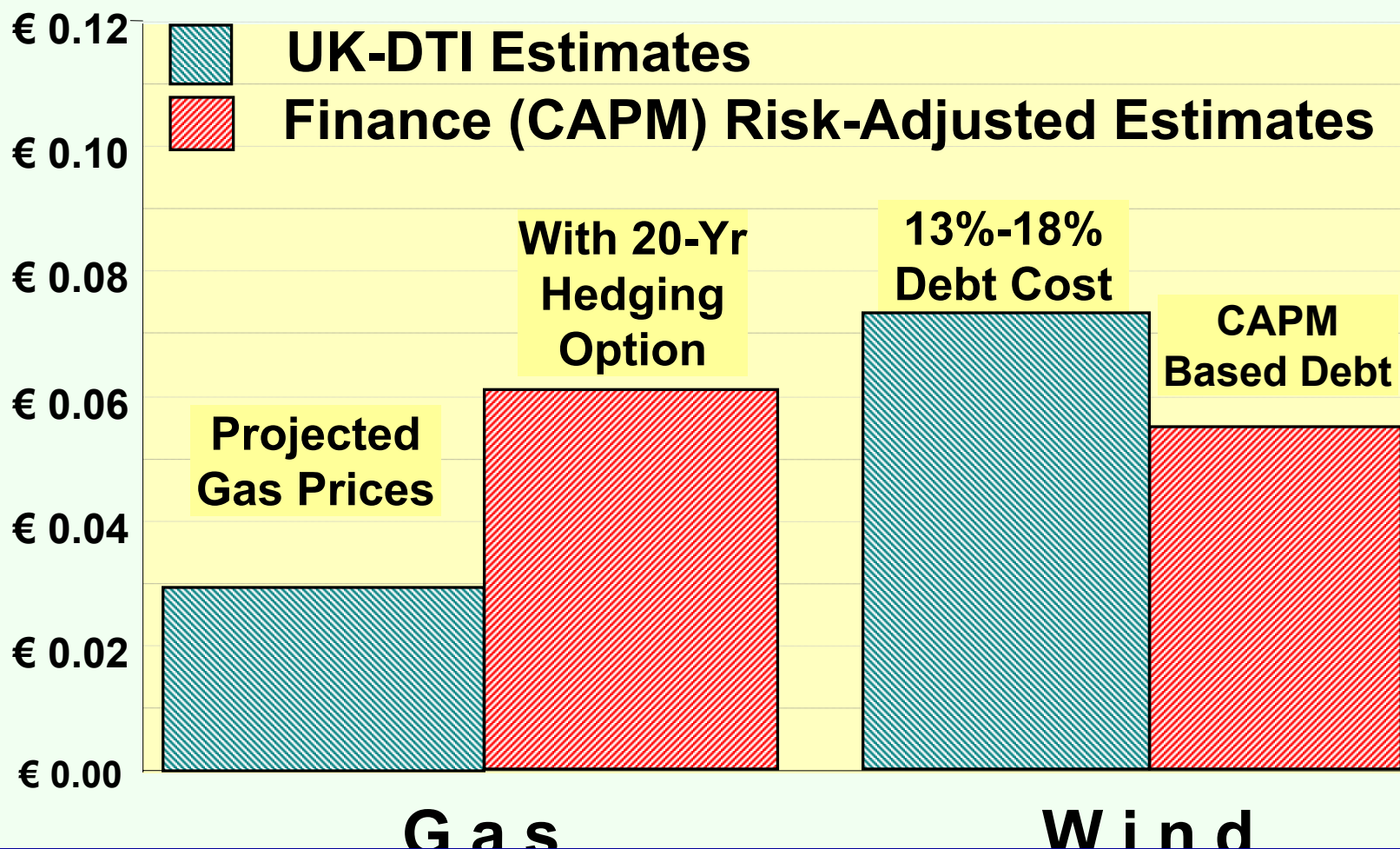
- Engineering kWh cost estimates have no economic interpretation

- Use cost models developed with the Model-T FORD
 - Should carry no weight in policy making

**Talking about kWh cost without also talking about risk is like watching a movie.....
With the sound turned off!**



Even if Markets Develop: Long Term Hedging is Costly



**Wind hedges gas price risk -
'Apples to apples' Gas costs more**

Market Risk of Fossil Can Be Hedged With Financial Instruments or Fixed Cost Renewables

- **Financial hedging is not free**
 - e.g.: six-year gas hedge: 0.8¢/kWh (Bolinger-Wiser)
- **Financial hedging does not *eliminate* risk**
 - Only shifts it
- **Does it help electricity customers?**
 - Ex: Hedged gas producers withhold generation capacity when gas prices rise
 - Reduces available generation in the market
 - Helps generator – probably not customer

Hedging With Renewables In the Generating Portfolio

**‘Portfolio Effect’ May Produce
The Only ‘Free’ Hedging**

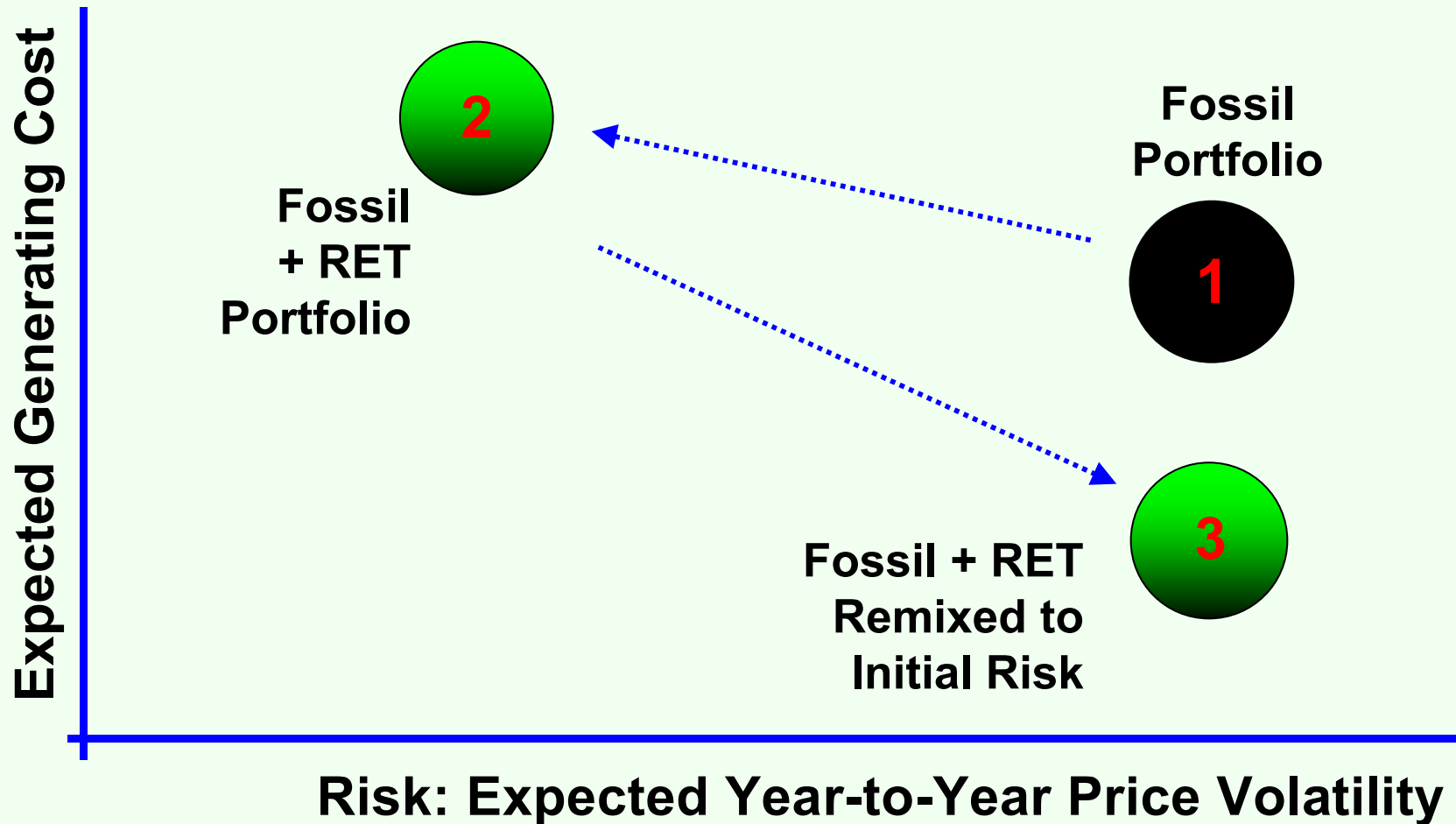
.... Take a Cue From Financial Investors



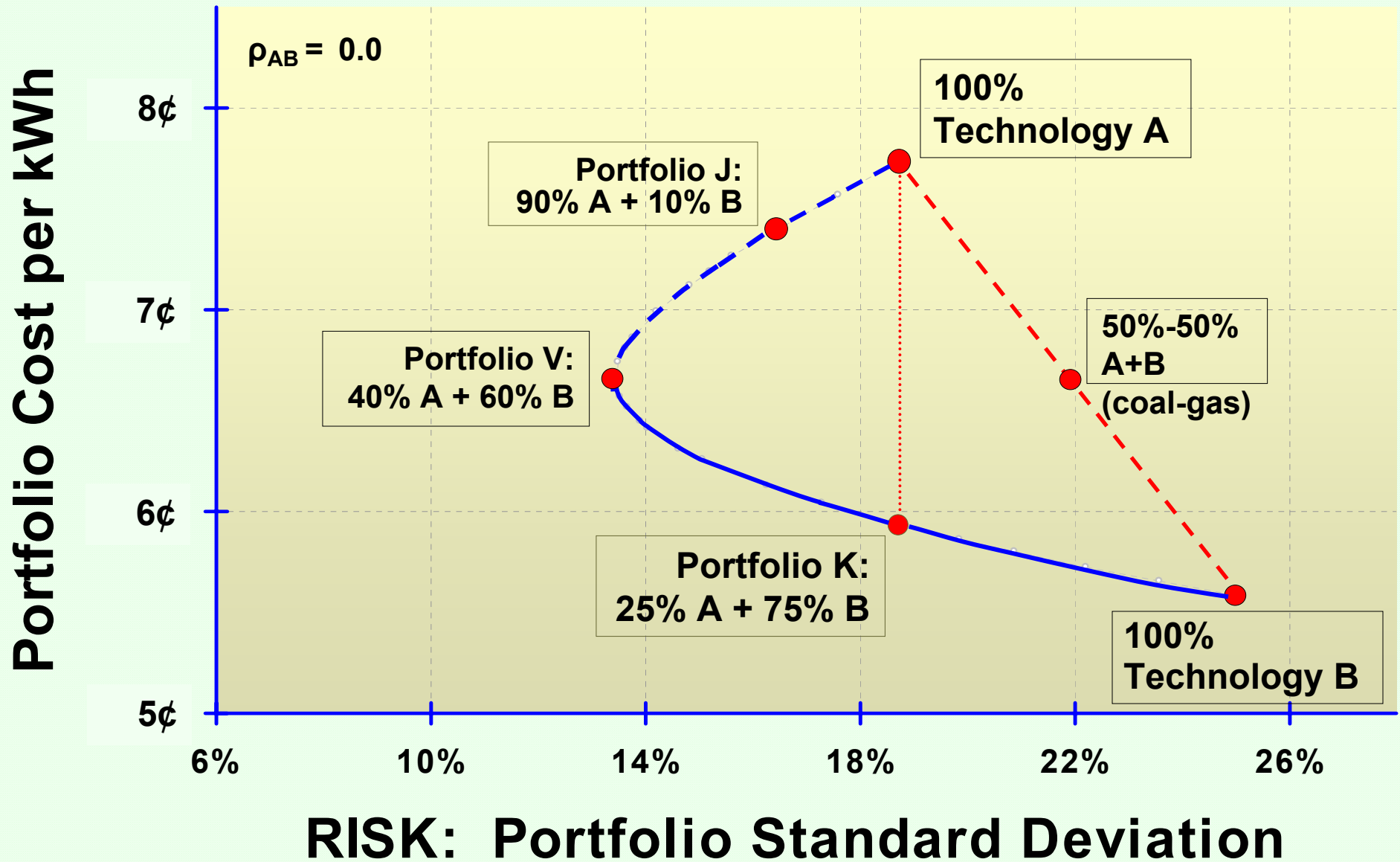
- **Are used to dealing with risk**
 - No one can predict stock markets or fossil prices
- **Investors hold efficient, diversified, balanced portfolios** - Best hedge against uncertain future
- **Is gas cheaper than RE?..... it matters little because:**
 - Even if true, picture could change dramatically
 - RE *reduces* portfolio cost-risk– even if it costs more
- **RE question not if – but only how much**
 - Relative cost dictates make-up of optimized mix

Renewables Help the Generating Mix

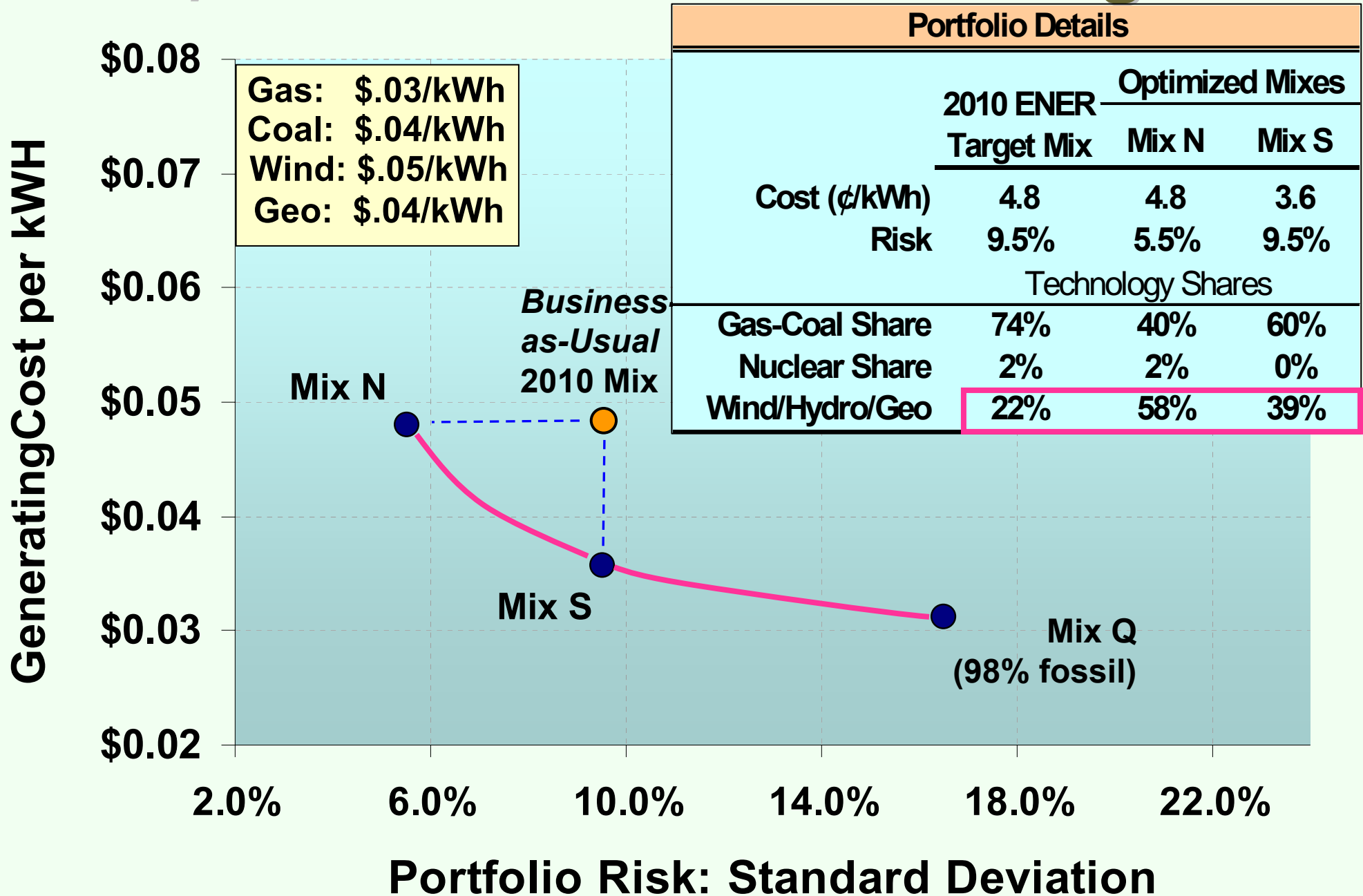
They Affect Portfolio Cost *and* Risk



The Portfolio Effect: The Only 'Free Lunch' in Economics

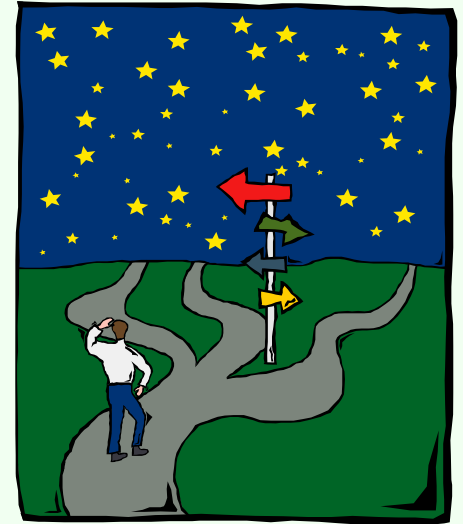


Wind/RE Lowers Mexico Generating Cost



Energy Security: A Powerful Joint Benefit of Optimized Generating Mixes

- Energy security concerns focus on catastrophic supply interruptions
- Exposure to fossil volatility represents more powerful *market-based* security concept
- ***Optimized* generating mixes:**
 - Minimize generating cost
 - Minimize exposure to Oil/Gas-GDP induced macro-economic losses
- **Energy Security costs less - like quality manufacturing**



Conclusions: “*Shifting The Grounds for Debate*” (J. Huacuz, IIE, Cuernavaca)

- **Risk-adjusted cost of many renewables is less than gas-fired electricity**
 - Suggests long-term financial gas hedging costs more
- **Portfolio Diversification may be the only *Free Lunch* for hedging fossil risk**
 - Even if you believe RETs cost more..... adding them to a fossil generating mix *reduces* overall cost-risk
- **Renewables produce energy + price certainty and they enhance energy security**

Final Thought..... where markets do not function

- **RE Investors cannot capture risk-mitigation benefits they provide for generating portfolio**
 - Leads to *under*-investment in RE relative to optimal societal levels
- **Gas investors in many countries have sufficient market power to externalize fuel risk to consumers**
 - Creates *over*-investment in gas relative to optimal societal levels
- **These imperfections arguably create economic basis for supporting renewables**

THANK YOU