Modeling Exercise to Support e21 Collaborative

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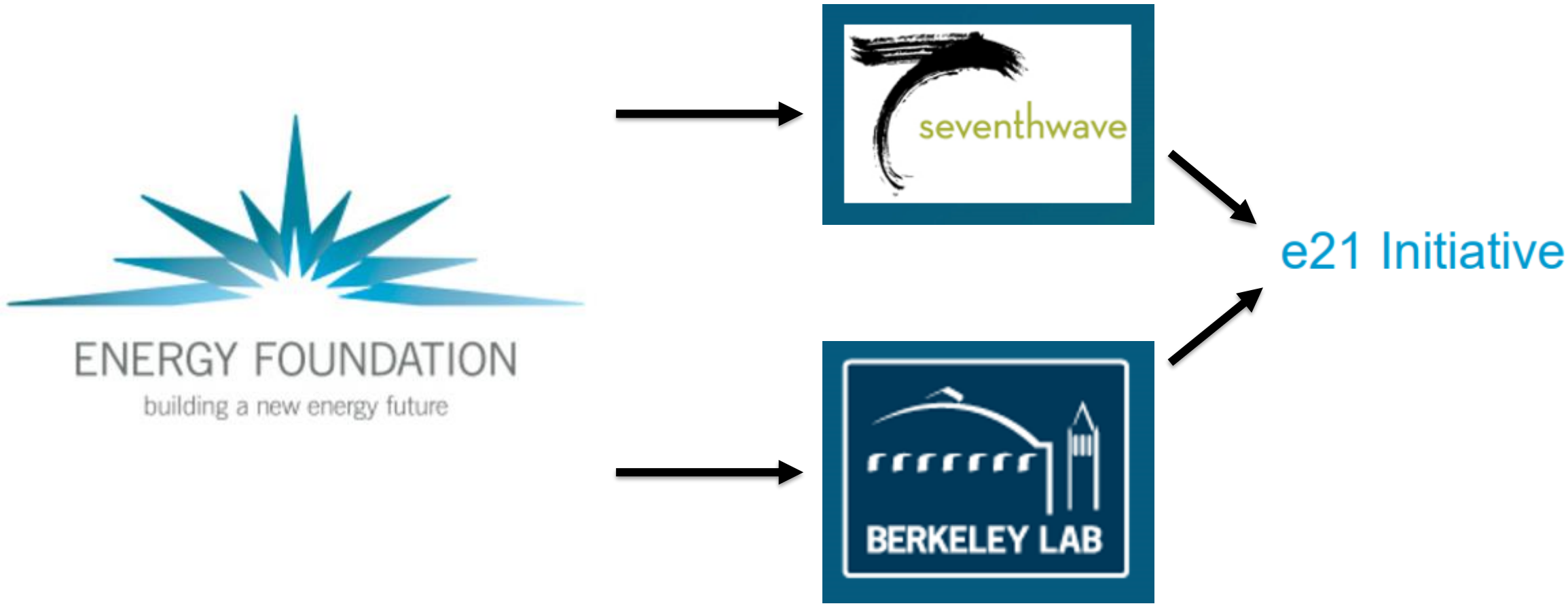
Organizational structure



Roles

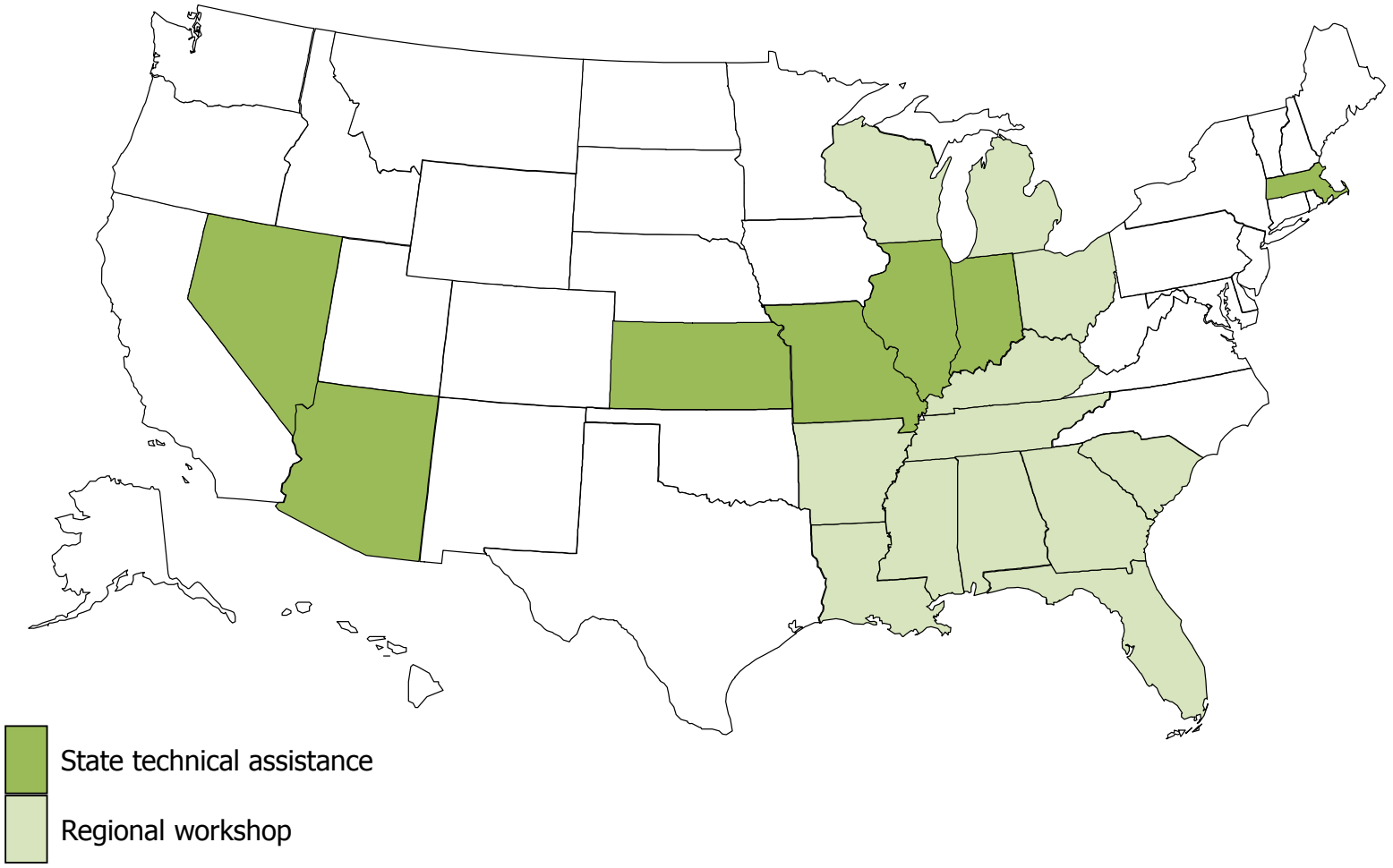
e21 technical subgroup

utility results

stock prices

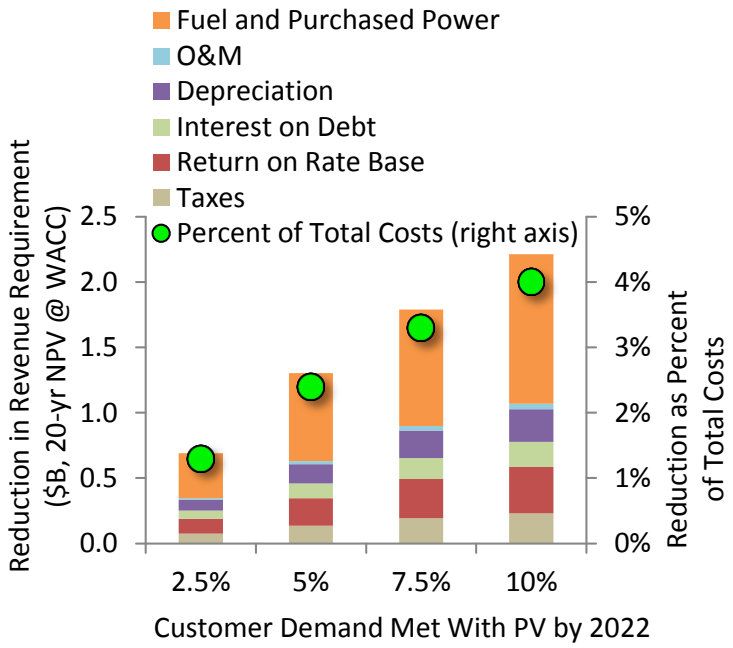
Utility Revenue and Earnings Model

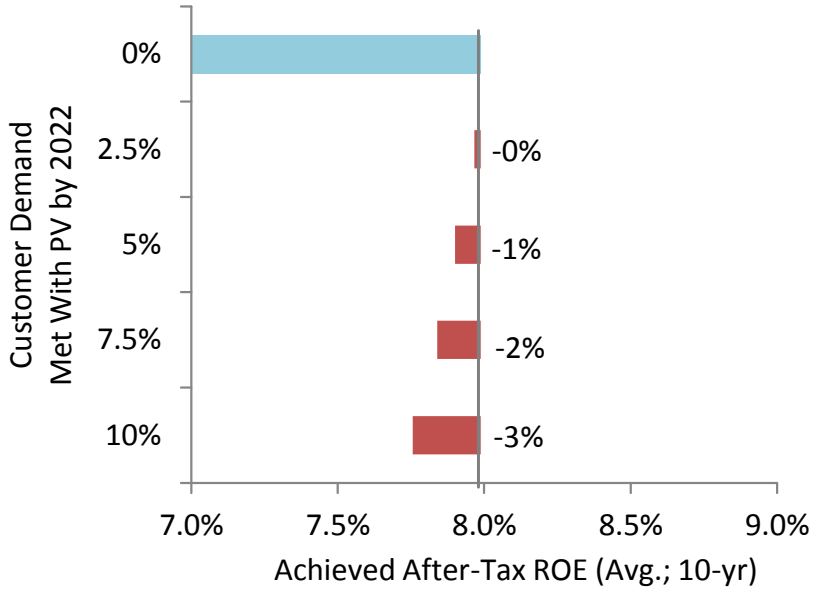
LBNL Work at the Intersection of Distributed Resources and Utility Regulatory and Business Models

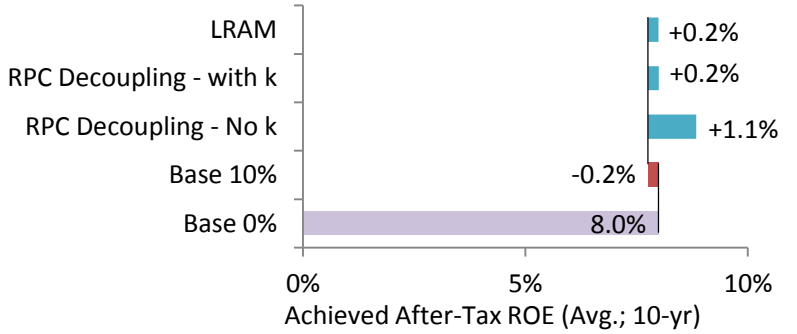


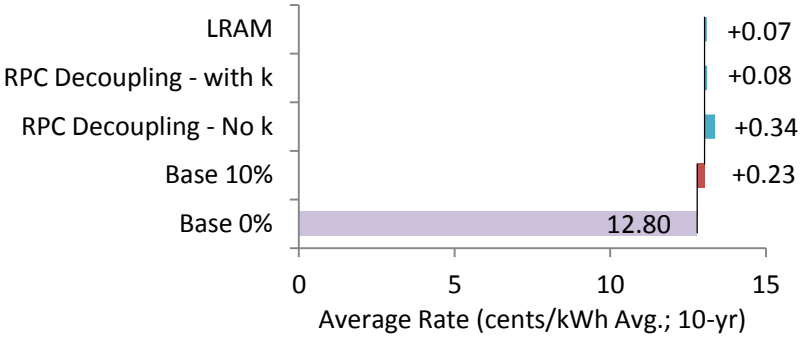
- LBNL provides technical assistance to state PUCs on utility business models **to align utility profit motivation and profit achievement with state policy goals**
- Quantitative modeling of the financial impacts to utility shareholders and ratepayers
- Also assess the efficacy of alternative approaches to the traditional utility business model

Quantifying the Financial Impacts of DERs on Utility Shareholders and Ratepayers









PV reduces fuel and non-fuel utility costs

Utility achieved earnings and ROE decreases as PV penetration increases

Existing ratemaking and regulatory approaches can mitigate some or all negative utility financial impacts

Satchwell et al., 2014. Prototypical southwest utility results shown. See entire report at: https://emp.lbl.gov/publications/financial-impacts-net-metered-pv

Understanding and analyzing utility financial incentives using an investment scale, risk, and return framework

- Utility Stock Analysis Tool quantifies changes in utility stock price given different assumptions about investment scale, risk, and return
- Funded by EPSA Finance, Incentives, and Program Office

Results from Kihm, Cappers, and Satchwell, 2016. Available at: aceee.org/files/proceedings/2016/data/papers/6_553.pdf

Objective

- Better understand financial implications associated with incrementally or fundamentally changing the utility business model to performance based compensation (PBC)

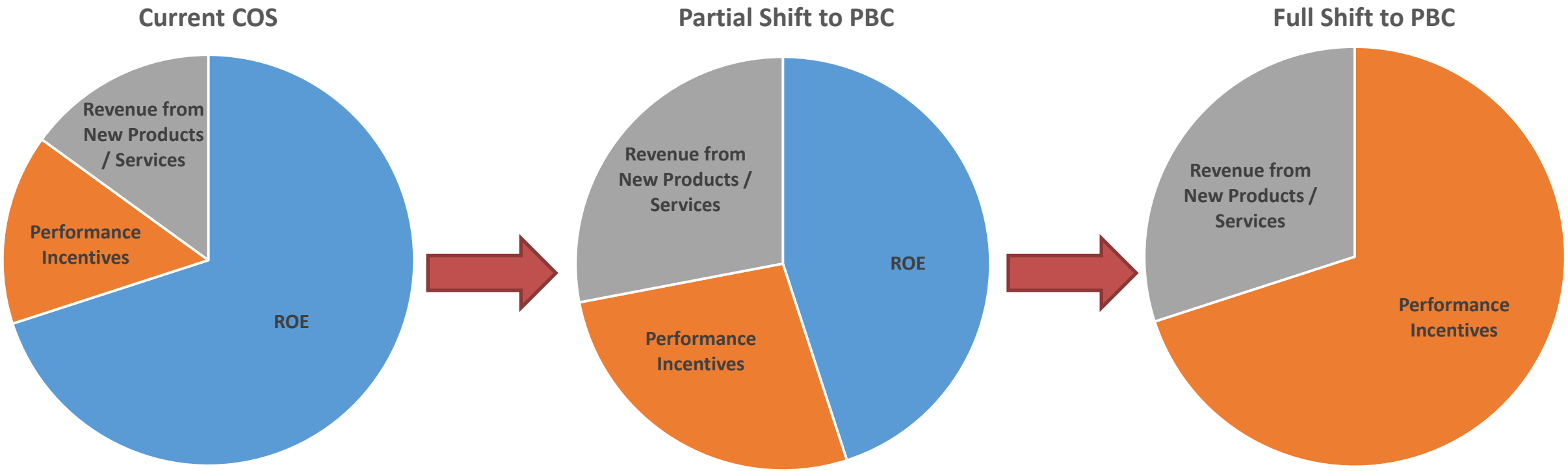


Figure source: e21 Initiative Phase II Report, 2016.

Research Questions

- What does a change in the utility business model mean practically from a $ standpoint in the allocation amongst ROE, performance incentive (PI) and Products/Services revenue (PSR)?
- How much of each performance outcome would need to be achieved to generate a performance incentive sufficient to make up for the reduction in ROE?
- How much of each product/service would need to be bought/sold to achieve PSRs sufficient to make up for the reduction in ROE?
- By how much does the cost of delivering products or services increase/decrease as allocation and attribution of PI and PSR revenues changes?
- How does a change in the utility business model impact shareholder profitability and customer rates due to achievement of performance outcomes?

Method

- Develop a public tool in MS Excel
- Tool would calculate a utility's annual cost of service, collected revenue, achieved earnings and achieved ROE over a 5 year rate cycle using a simplified pro-forma financial model
- Tool would have pre-set levels for various inputs which users could dynamically change to see how outputs are affected
- Tool would include feedback effects of changes in utility business model on performance outcomes of interest
- Results would also be used to assess impacts on utility valuation given changes in utility investment scale, risk, and return

Tool Overview

Performance Outcomes (PO)

- DER Output (kWh)
- Peak Demand Reduction (kW)
- Energy Efficiency (kWh)
- Customer Engagement (Cust.)
- Pollution Mitigation (CO2 Tons)
- Product/Service Offering (Heat pumps, EV charging, data analytics)

Penetration goals and avoided costs for first year (2018) values and compound annual growth values (2019-2022)

Utility Characterization

- Fuel Costs
- Ratebase
- Incr. CapEx
- Depreciation
- Non-fuel O&M
- Capital Structure
- Sales, peak demand, and customers

First year (2018) values and compound annual growth values (2019-2022)

Utility Business Model (UBM)

- Share of earnings coming from ROE vs. PI vs. PSR
- Share of earnings coming from each PO element

Feedback Effects

- % change in PO elements & cost of equity due to change in UBM

MS Excel Pro-Forma Financial Model

Output Metrics

- Annual COS, collected revenue, rates, earnings, & achieved ROE
- Normalize each output metric by attributable PO elements

Utility Characterization

- Base Case outputs will be based on “prototypical Minnesota utility” characterization
- Model inputs and assumptions will generally represent a Minnesota electric utility with cost and revenue growth rates approximating a mid-point of Otter Tail, Northern States Power, Minnesota Power, and Northwestern Wisconsin Electric
- Seeking assistance from e21 stakeholders and subcommittee to develop prototypical utility assumptions

Value of Approach

- Allows all stakeholders to better understand general magnitude and direction of changes to shareholder and ratepayer financial metrics when various performance outcomes are (or are not) achieved
- Forms a basis for broader discussions about tradeoffs in PBC designs, performance outcome level settings, cost vs. value of achievement

Stock Valuation:
Foundation and Application

Early regulatory legal standard regarding utility value

Regulation must be based on market value not book value (eventually overturned)

Rates which are not sufficient to yield a reasonable return on the ***value of the property used at the time it is being used*** *to render the service are unjust, unreasonable, and confiscatory, and their enforcement deprives the public utility company of its property in violation of the Fourteenth Amendment.* ***This is so well settled by numerous decisions of this Court that citation of the cases is scarcely necessary****.*

Smyth v. Ames, (**1898**) 169 U. S. 467, 169 U. S. 547.

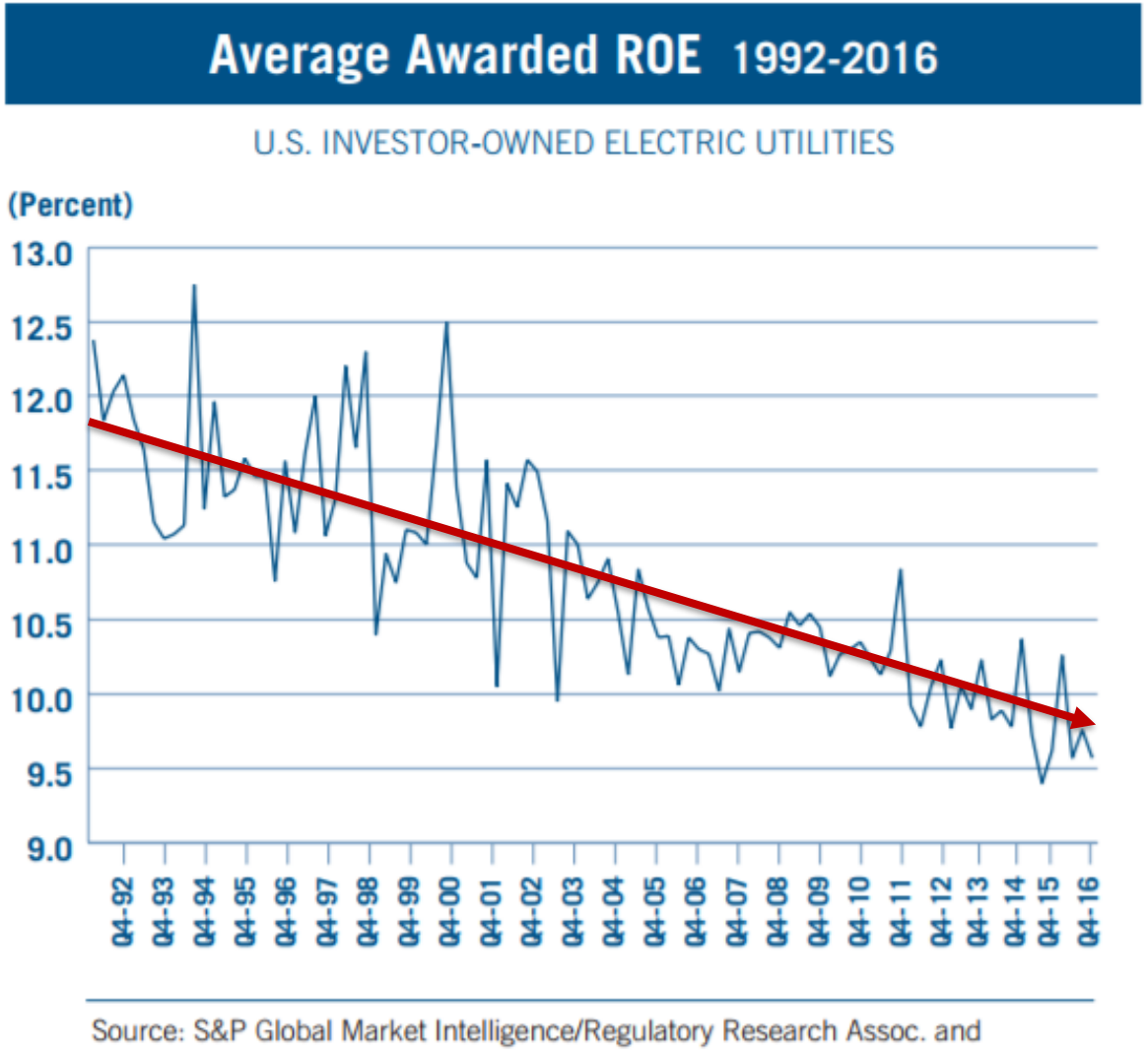
A shift away from market valuation

***FPC v. Hope* (1944)—[regulators should focus on book value]**

The fixing of prices, like other applications of the police power, may reduce the value of the property which is being regulated. ***But the fact that the value is reduced does not mean that the regulation is invalid****. Fair value is the* ***end product of the process of ratemaking, not the starting point****, as the Circuit Court of Appeals held. The heart of the matter is that* ***rates cannot be made to depend upon "fair value" when the value of the going enterprise depends on earnings under whatever rates may be anticipated****.*

Regulatory perspective (utility accounting)

RETURN



Edison Electric Institute
2016 Financial Review

Dow Jones Utility Index (same period)

The ability to earn a return is not an incentive to invest

While current practices probably will not result in widespread electricity shortages, the nation's electricity supply could become less cost-effective if regulatory incentives continue to bias utilities away from capital investments regardless of their technical or economic merit.

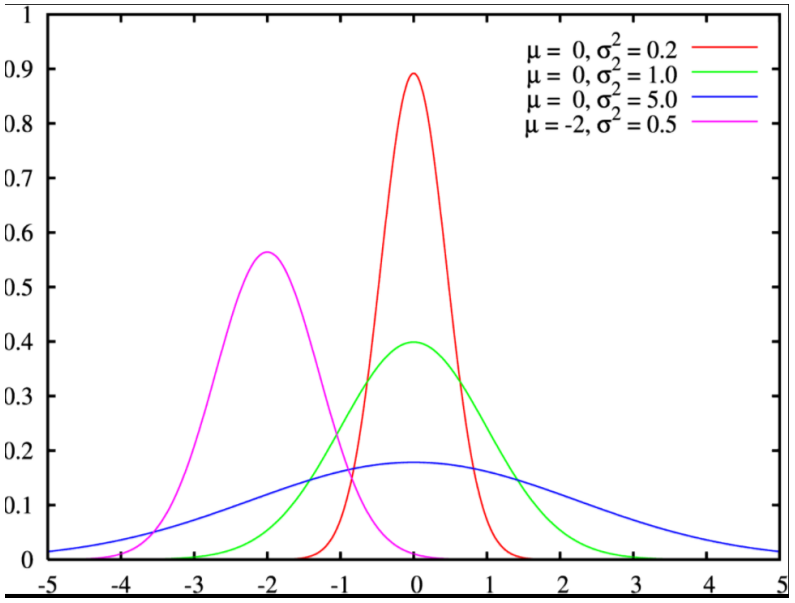
Source: Congressional Budget Office, *Financial Condition of the U.S. Electric Utility Industry*, **March 1986**

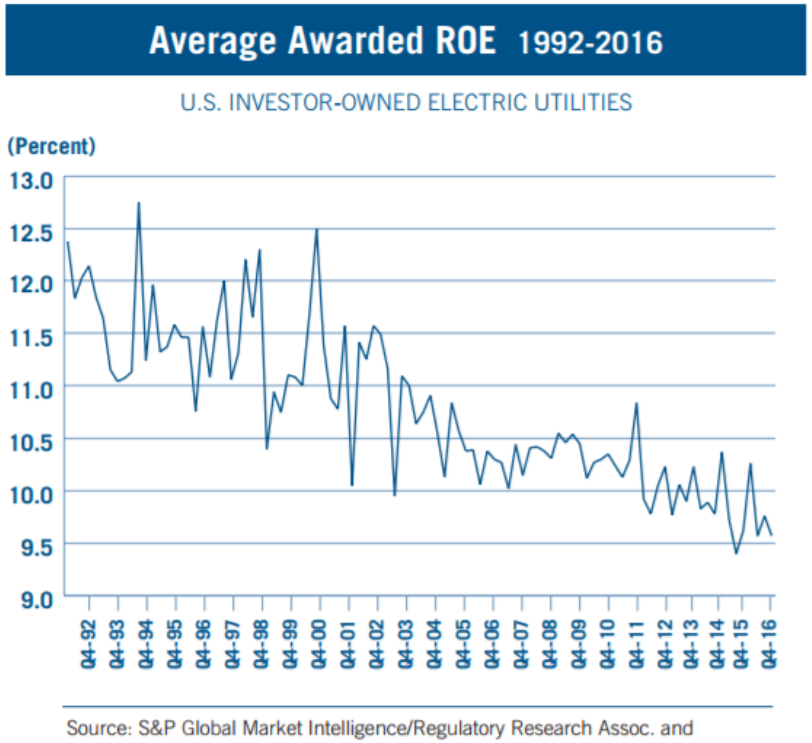
Returns on equity cannot explain this; *the valuation framework can*.

Moving from ROE to stock price

The market valuation framework

Investor perspective (stock price)





RISK **RETURN** **SCALE**

Utility stock pricing model

$$P = \frac{BVPS \times ROE \times payout}{k - (1 - payout) \times ROE}$$

There's a lot more driving stock value than just ROE

Basic inputs we need for valuation analysis

- Stock price (***P***)
- Book value per share (***BVPS***)
- Return on equity (***ROE***)
- Dividend payout rate (***payout***)
- Minimum threshold return (***k***) ⟵ ?

Understanding the minimum threshold return

- The return is **so low** that when earned by the firm:
  - it **eliminates any shareholder gains** from firm investment (managers would not be concerned if **all capital investment opportunities disappeared**)

we need to determine the level of this very low return for valuation purposes; it is not a target return for the ROE

Morningstar investment advisory service

The minimum return for almost all the electric utilities Morningstar follows is the same (which is good finance).

7.5%

Train, *Optimal Regulation*

- Firms that **just earn the minimum return** would do just as well by their investors if they **ceased operations and sold their assets**.

If utility *ROE* = 7.5% today

then new investment would not propel the utility value engine forward

It's all about incentives and promoting progress

Setting the return on equity at the minimum threshold makes sense only in a ***static world*** where technology and preferences are not changing. If regulators want to provide ***incentives for utilities to participate in economic progress***, the return on equity must exceed the threshold minimum return.

Kahn (1988), *The Economics of Regulation*

It's the difference between the returns that the value proposition

- Koller, Goedhart, & Wessels (2015), *Valuation: Measuring and Managing the Value of Companies*

(ROE – *k*) > 0	growth **creates** shareholder value
(*ROE* - *k*) = 0	growth **has no effect on** shareholder value
(*ROE* - *k*) < 0	growth **destroys** shareholder value

Why did profitable investment destroy value?

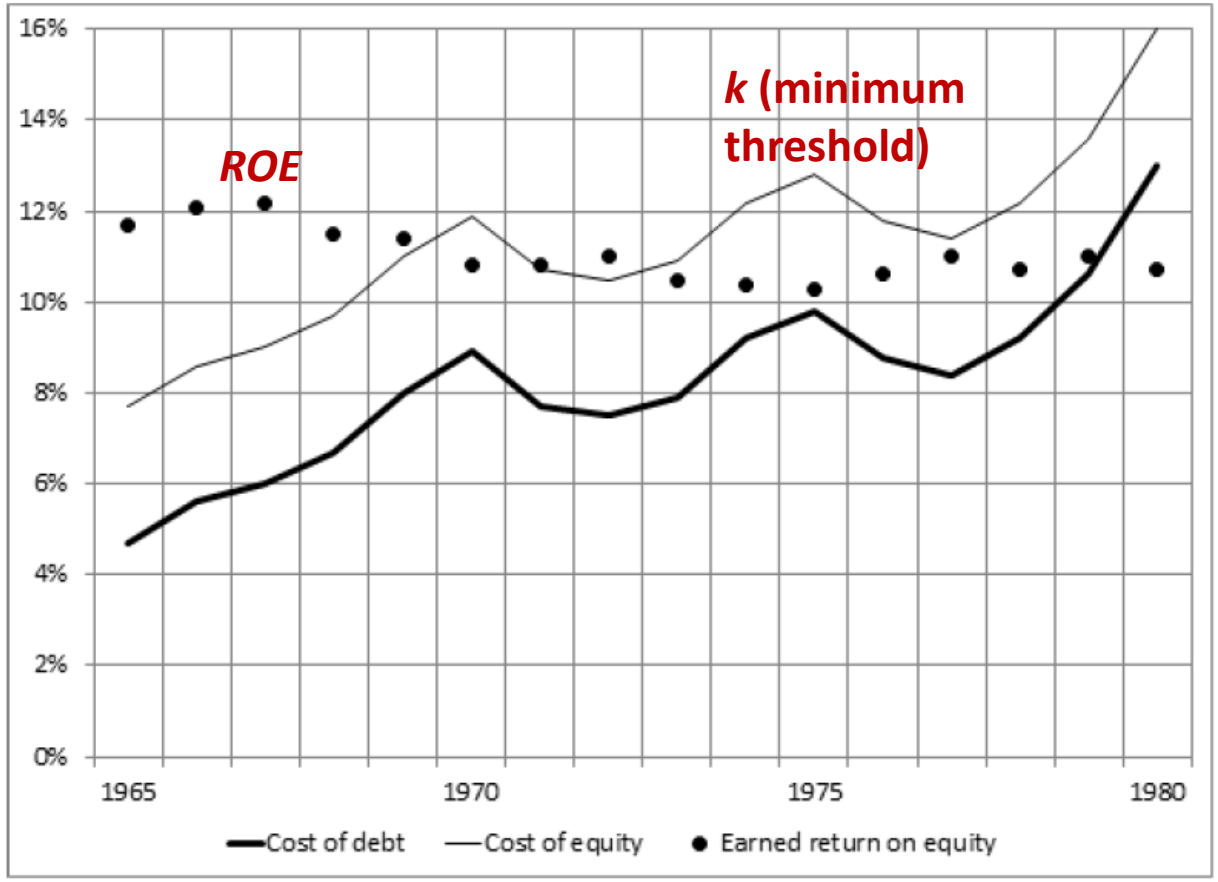


Figure 3. Utility Bond Yields, Estimated Cost of Equity (1965-1980) and Earned Returns on Equity for Moody's Electric Utility Stock Index. Source: *Moody's Public Utility Manual*.

Why did profitable investment destroy value?

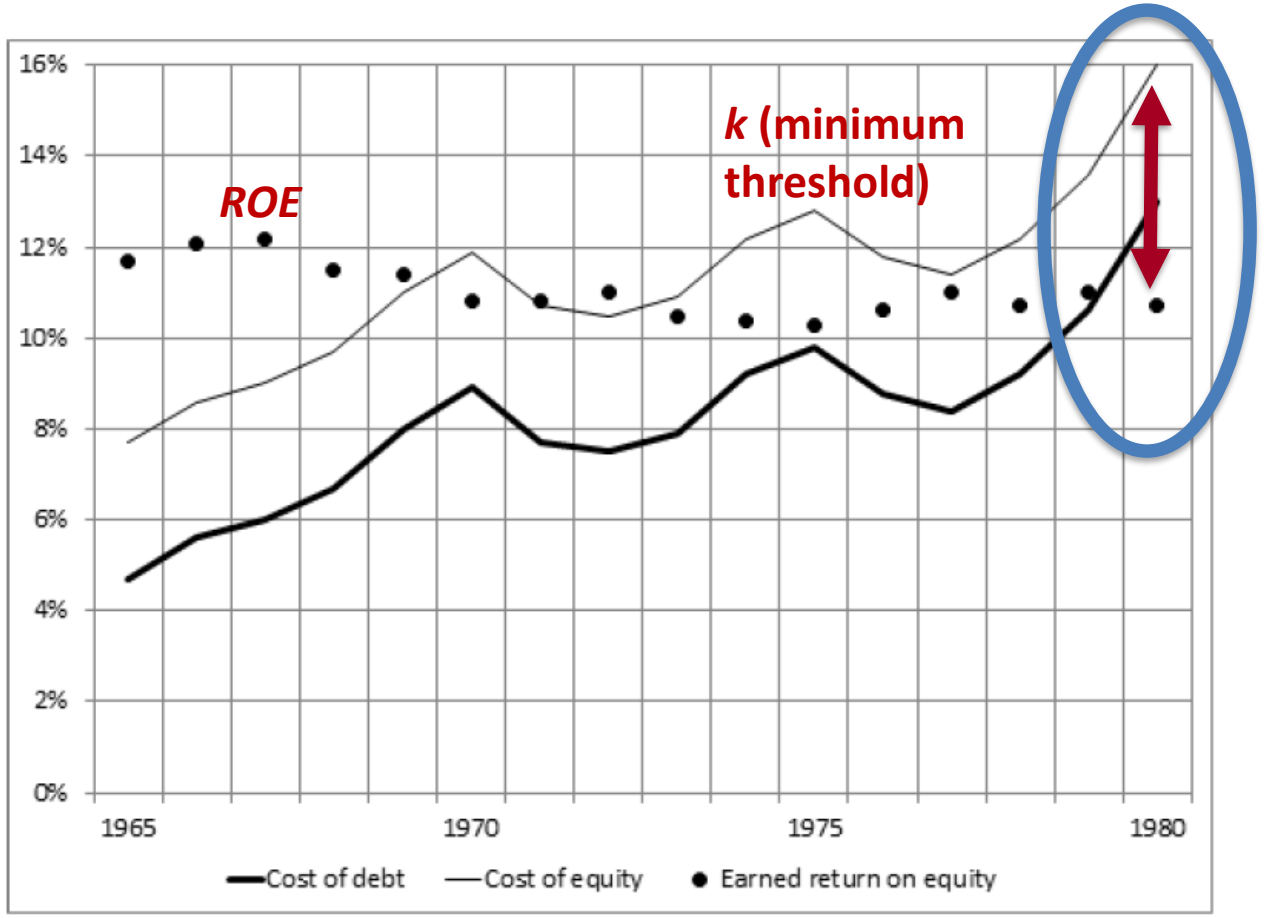


Figure 3. Utility Bond Yields, Estimated Cost of Equity (1965-1980) and Earned Returns on Equity for Moody's Electric Utility Stock Index. Source: *Moody's Public Utility Manual*.

The valuation model explains stock prices

This is why in the early 1980s utility managers wanted to avoid capital investment

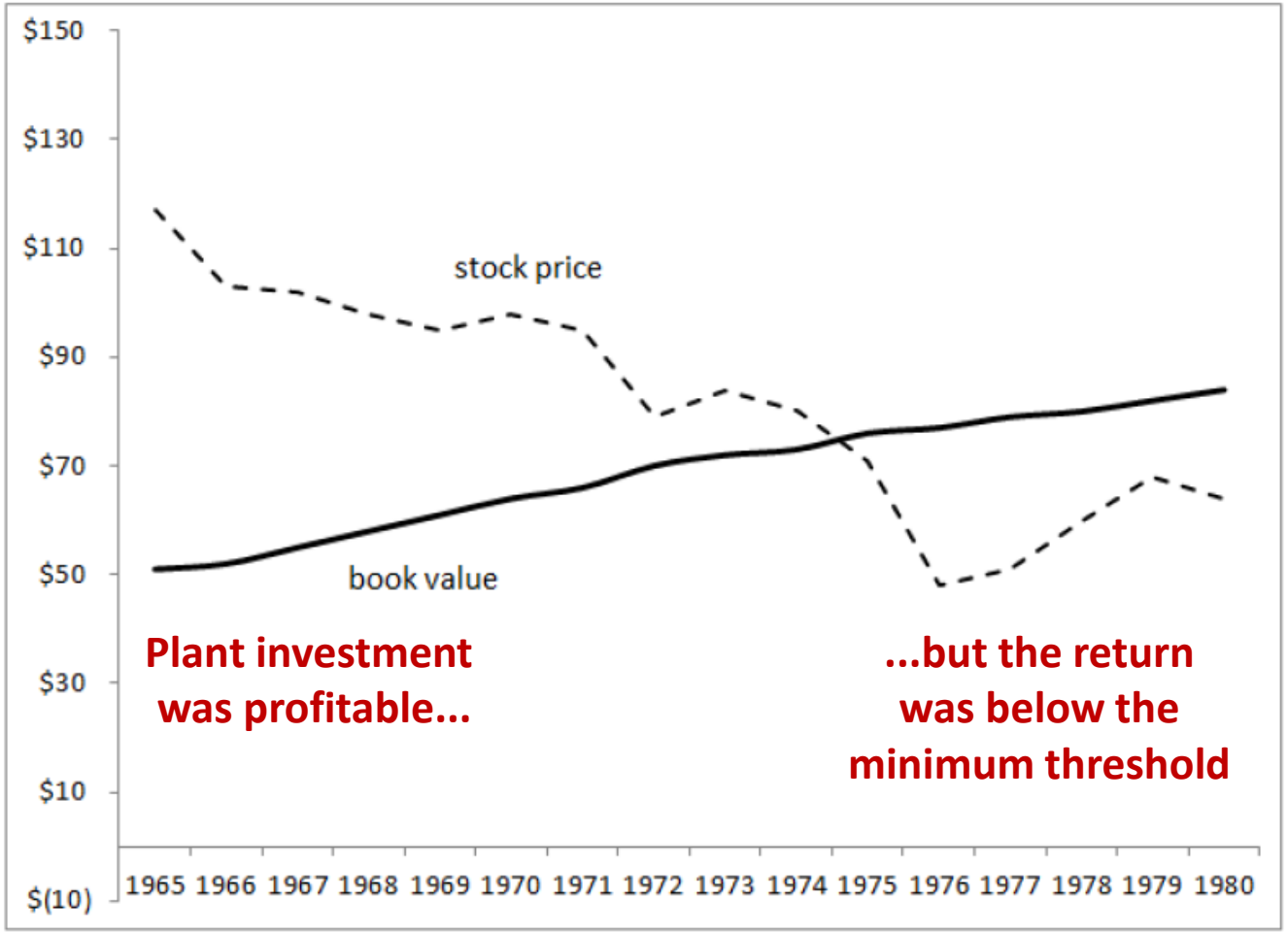


Figure 7. Moody's Electric Utility Index book value per share and stock price per share (1965-1980). Source: Moody's Public Utility Manual.

Now we know why this was the case

While current practices probably will not result in widespread electricity shortages, the nation's electricity supply could become less cost-effective if regulatory incentives continue to bias utilities away from capital investments regardless of their technical or economic merit.

Source: Congressional Budget Office, *Financial Condition of the U.S. Electric Utility Industry*, March 1986

Returns on equity cannot explain this; *the valuation framework can*.

***ROE* was higher** $(ROE - k) < 0$

Calibrating the valuation model

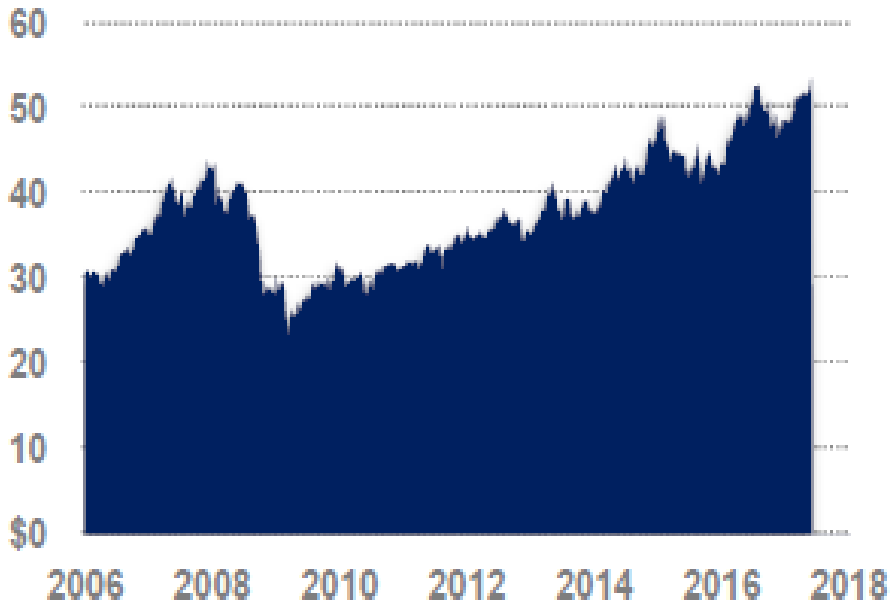
Our source for utility data (28 utility stocks)

Utilities Select Sector SPDR — XLU

Top 10 Holdings

NEXTERA ENERGY GROUP	9.8%
DUKE ENERGY CORP	8.2%
DOMINION RESOURCES INC/VA	7.5%
SOUTHERN CO	7.4%
AMERICAN ELECTRIC POWER	5.2%
P G & E CORP	5.1%
EXELON CORP	5.0%
SEMPRA ENERGY	4.3%
PPL CORPORATION	4.0%
EDISON INTERNATIONAL	3.9%
TOTAL	**60.4%**

Trading History



Inputs to valuation model

- **XLU (actual data)**
- Stock price **$52.10**
- Book value per share **$27.40**
- Return on equity **10.5%**
- Dividend payout **65%**
- Minimum threshold return **?**

Minimum threshold return (k)

- Dividend discount model

$$P = \frac{BVPS \times ROE \times payout}{k - (1 - payout) \times ROE}$$

$$k = \frac{BVPS \times ROE \times payout}{Price} + (1 - payout) \times ROE$$

Minimum threshold return (k)

$$k = \frac{BVPS \times ROE \times payout}{Price} + (1 - payout) \times ROE$$

$$k = \frac{\$27.40 \times 0.105 \times 0.65}{\$52.10} + (1 - 0.65) \times 0.105 = 0.073$$

7.3%

Morningstar says it's 7.5%

Verifying accuracy of 7.3% threshold return

- Back to original expression

$$P = \frac{BVPS \times ROE \times payout}{k - (1 - payout) \times ROE}$$

$$P = \frac{\$27.40 \times 0.105 \times 0.65}{0.073 - (1 - 0.65) \times 0.105} = \mathbf{\$52.10}$$

Policy analysis with the valuation model

Scenario analysis

e21 technical subgroup

utility revenue and earnings

ROE will range from 9.5% to 11.5%

How will that affect the stock price?

stock pricing (valuation)

Modeled as permanent change

$$P = \frac{\$27.40 \times \mathbf{0.115} \times 0.65}{0.073 - (1 - 0.65) \times \mathbf{0.115}} = \mathbf{\$63.23}$$

$$P = \frac{\$27.40 \times \mathbf{0.095} \times 0.65}{0.073 - (1 - 0.65) \times \mathbf{0.095}} = \mathbf{\$42.95}$$

immediate price reactions to the information

Modeled as transitory change

- Need multi-stage model (which we have)
- Higher ROE (11.5%) for five years, then return to base return (10.5%)

$52.10 → **$53.68**

- Lower ROE (9.5%) for five years, then return to base return (10.5%)

$52.10 → **$50.54**

The bigger issue is loss of investment opportunity

With reduced investment opportunities, dividend payout increases...

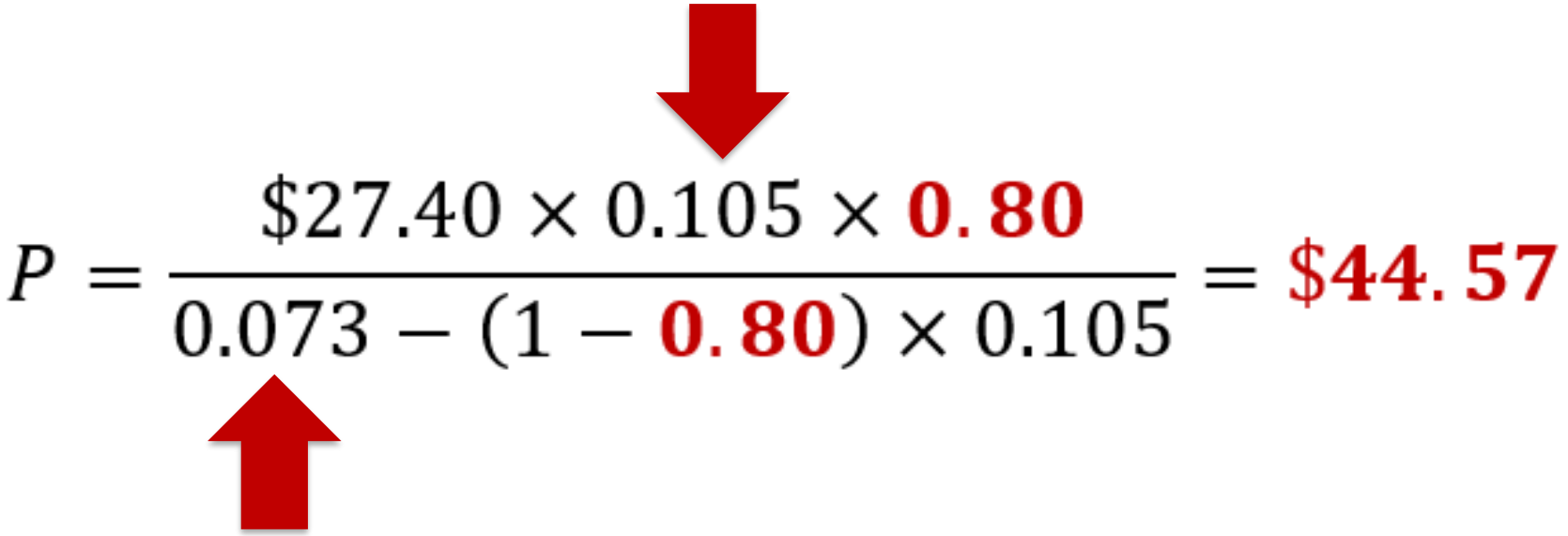
$$P = \frac{\$27.40 \times 0.105 \times \mathbf{0.80}}{0.073 - (1 - \mathbf{0.80}) \times 0.105} = \mathbf{\$44.57}$$

...and because investment creates value, reducing it lowers the current stock price.

base case

$$P = \frac{\$27.40 \times 0.105 \times 0.65}{0.073 - (1 - 0.65) \times 0.105} = \mathbf{\$52.10}$$

The bigger issue is loss of investment opportunity



***ROE* – *k* = 10.5% - 7.3% > 0**

shareholders want the utility to invest <u>more</u>, not less

A higher return doesn't necessarily mean higher value

- What if the regulators increase the ROE only from **10.5% to 11.0%**?

$$P = \frac{\$27.40 \times \mathbf{0.110} \times \mathbf{0.80}}{0.073 - (1 - \mathbf{0.80}) \times \mathbf{0.110}} = \mathbf{\$47.61}$$

Still a loss of value compared to base case ($52.10)

Compensation for lost investment with higher ROE

$$ROE = \frac{k}{\frac{BVPS \times payout}{Price} + (1 - payout)}$$

$$ROE = \frac{0.073}{\frac{\$27.40 \times 0.80}{\$52.10} + (1 - 0.80)} = 0.117$$

Verifying

$$P = \frac{\$27.40 \times \mathbf{0.105 \times 0.65}}{0.073 - (1 - \mathbf{0.65}) \times \mathbf{0.105}} = \$52.10$$

$$P = \frac{\$27.40 \times \mathbf{0.117 \times 0.80}}{0.073 - (1 - \mathbf{0.80}) \times \mathbf{0.117}} = \$52.10$$

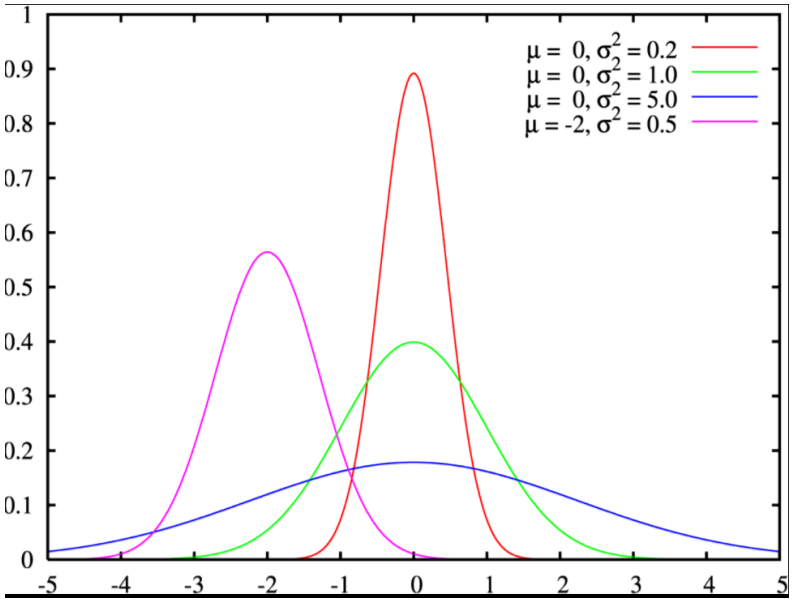
Joint interaction creating a win for shareholders

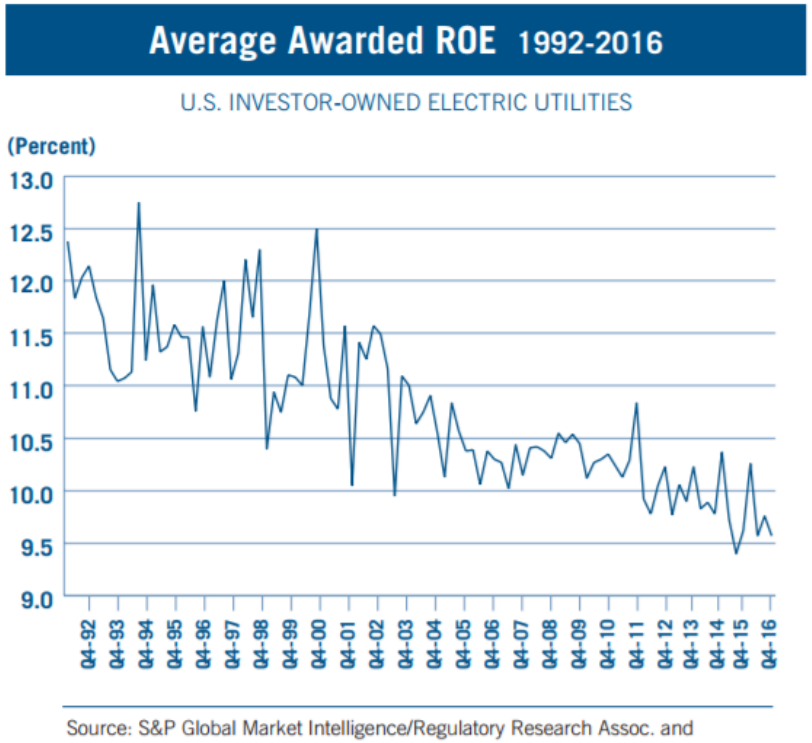
- What if regulators (1) increase the ROE from **10.5% to 11.0%** and (2) allow the utility to **invest in <u>some</u> distributed resources**?

$$P = \frac{\$27.40 \times \mathbf{0.110} \times \mathbf{0.70}}{0.073 - (1 - \mathbf{0.70}) \times \mathbf{0.110}} = \mathbf{\$53.22}$$

(this would work; is it achievable?
is it cost-effective for customers?)

Investor perspective (stock price)





RISK **RETURN** **SCALE**

Tentative timeline

- July 2017 – Winter 2018
  - Work with e21 technical subgroup to **ground models** and **develop scenarios**
- Spring 2018
  - Present **preliminary analyses** to full e21 group
  - **Receive feedback** as to changes or other analyses needed
- Summer 2018
  - Present **final analyses** to full e21 group
- Future work—the notion of a final analysis is a bit misleading. Once we all understand the framework there is likely to be **ongoing opportunity for further analyses**.

Questions?

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