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Energy Regulation in Vermont: Purpose, Means, History, Trends

House Committee on Energy and Technology

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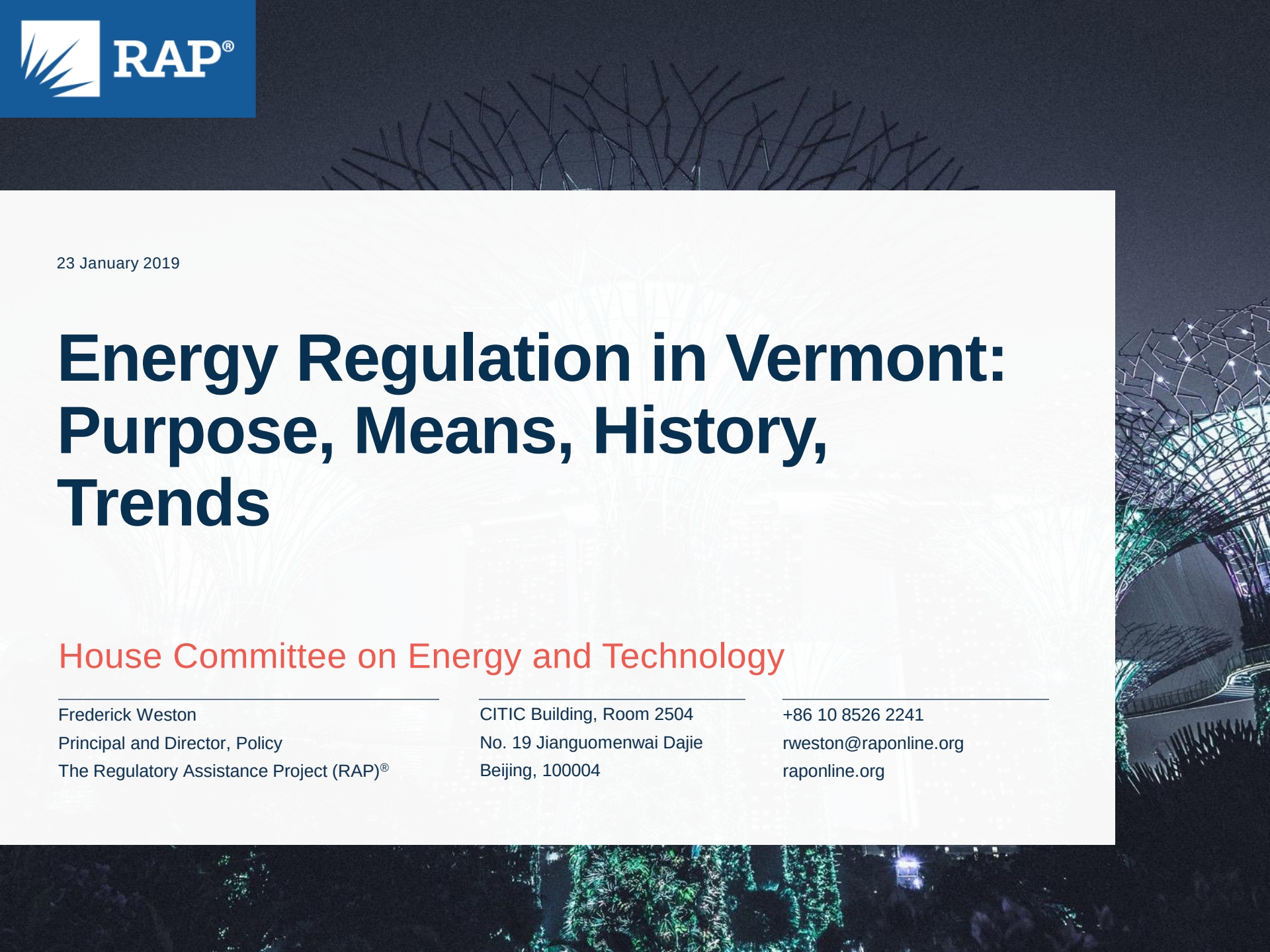


Why do we focus on power?

- Electricity is the defining feature of a modern economy
- The industry is undergoing terrific change
  - Technological changes
  - Changing economics of energy, and
  - Urgent environmental challenges
- Some of this is absolute (technology, costs, consumer choices) and will happen regardless of policy
- Some of this seems imperative (address environmental issues, retain fairness) but is a policy choice
- To meet today's challenges we must: align the private interest with the public good, and balance regulation with market forces

Vermont Matters

A state, even a little one, can make a difference.

Exports:

- Computer chips, maple syrup
- Efficiency and integrated resource planning
- *Efficiency Vermont*
- The Regional Greenhouse Gas Initiative
  - Allowance auctions and revenues “recycled” into clean energy investment
- Leadership on energy, environment, and climate policy (among other things)

WHAT HAPPENS IN
VERMONT
GOES GLOBAL!

Who is RAP?

- Non-profit, non-partisan NGO
- Former utility and environmental regulators, consumer advocates, industry officials, and policymakers
- Mission: To help governments develop policies that will ensure the long-term economic and environmental sustainability of the power, gas, and energy sectors
- Not advocates:
  - We don't take positions in regulatory or other litigated proceedings
  - Work directly with decision-makers in government and industry
- Global perspective: programs in the US, China, Europe, and India

Frederick Weston: RAP's Policy Director, formerly China Program Director. Economist and Hearing Officer at the VT PSB (now PUC) for 11 years, consultant on energy policy in Boston, with AIG in the Middle East, holds advanced degree from the Fletcher School of Law and Diplomacy.

1 The Purpose of Regulation

Promoting the Public Good

What is a utility and what is its role?

- It operates under a franchise granted by the state
- Most are **natural monopolies**; all provide an essential service
- It has “an obligation to serve”
- It must provide service at posted prices, available to all who qualify for them
  - “Undue discrimination” is illegal
- A utility performs an important function in a society, which is not entirely commercial:
  - Striking a sound balance between its public service role and its compensation enables capital to flow at reasonable costs, and consumer expectations to be reasonably met

What is economic regulation?

- An exercise of the police power of the state
  - Constrained by the state and federal Constitutions
    - Takings and due process
- It is not a contract with the regulated entity
  - There is no “regulatory compact”
    - Not necessarily true in other countries, where the terms of regulation are often set out in contracts
- Fundamental objectives:
  - Preventing abuses of monopoly power by industries “affected with the public good”
  - Efficiency and fairness

The regulator's role

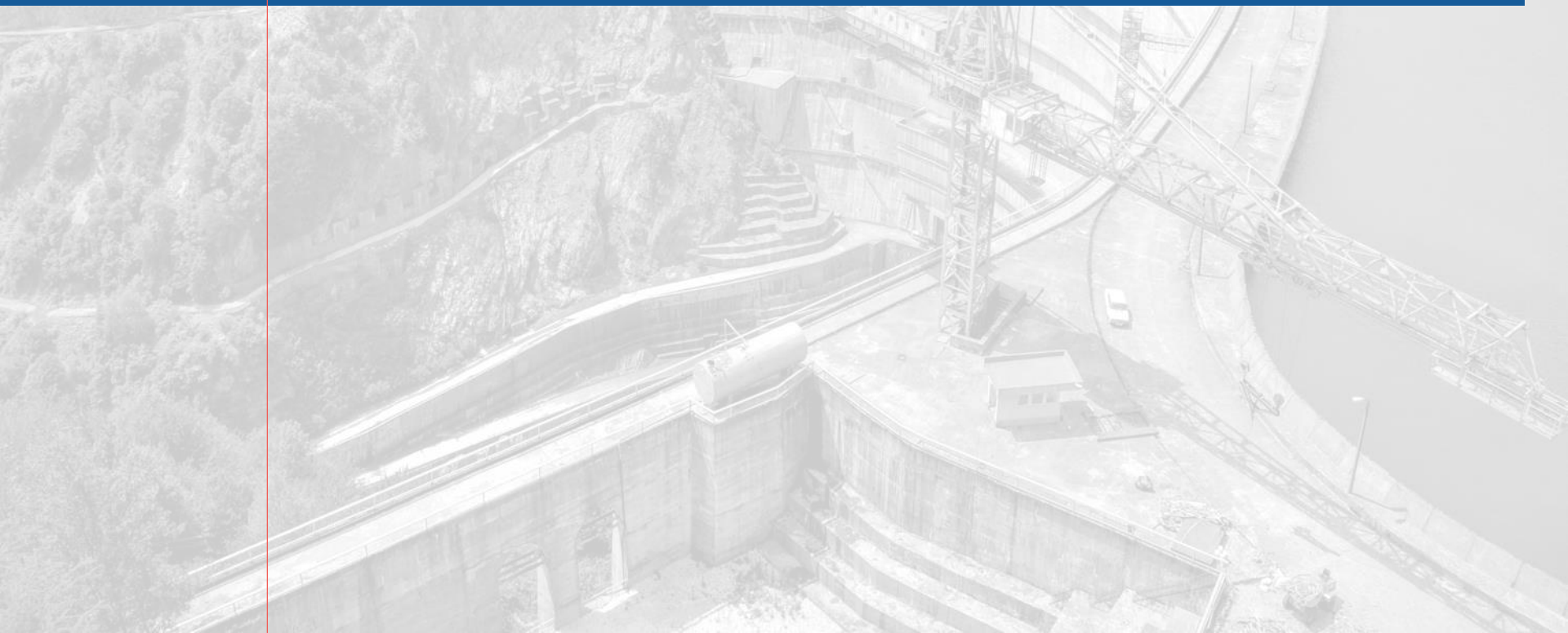
- Extensions of legislatures, executing powers and oversight originally exercised by legislatures
- Independent
  - Removed from the political process to a significant degree, empowered to make decisions that appropriately balance competing interests: they make the hard decisions
- Expert bodies
- Quasi-judicial, not merely tribunals for dispute resolution, but charged with "promoting the public good"
  - They can look forward, anticipate issues and directions, and clarify and, in so doing, minimize risk
  - They can open investigations on their own motion

The regulator's role

- Process is important
  - Provides notice
  - Fair: decisions based on evidence
  - Access
    - Affected parties can participate
    - Visible to the public and press
  - Disciplined: process obeyed and decisions are made
- Regulation is not a popularity contest, and sometimes unpopular choices are in the best public interest
- There are inherent dilemmas in regulation, balance is typical. **Courage, leavened with realism, is essential.**

2 Ratemaking: The Essential Regulatory Act

Just and Reasonable Prices



Objectives of Economic Regulation

- Economic efficiency
- Fair prices
  - To consumers and revenue adequacy for the utility
- Reasonable service, with nondiscriminatory access for all
- Adequate quality and reliability
- Other policy considerations

Pricing: Efficient and Fair

- "Just and reasonable" rates
  - Posted tariffs
  - Fair, equitable, based on the general principle that the cost-causer pays
  - Rates sufficient but no more than necessary to cover the costs of meeting demand, including investment and return on investment
  - Most efficient if rates send proper economic signals to end-users, who are making usage and investment decisions routinely
    - "Efficient" means that the cumulative result of regulated prices drives investment by the utility and the consumer that is best for the state as a whole, however "best" is defined (overall cost, or cost plus other factors)
- Rate design
  - Structure and periodicity of prices

1-Minute Lesson in Traditional Ratemaking

- The basic formula for determining rates is simple

Price = Cost of Service / Sales

- But, in its details, it can be very complicated
- Utilities make money by (1) cutting costs and (2) increasing sales
  - The “throughput” incentive
- Regulatory reforms over the last 25 years have given us tools with which to address these shortcomings

3 The Evolving Power Sector and its Regulation

Lowest societal cost over the long-run

Evolution of the Regulatory Model

- Realization that the entire network, from fuel to end-use, constitutes the thing that is “affected with the public interest” and should be the object of public policy
- Investment and expenditure decisions should be subject to a rigorous public review
  - Before or after?
- 1980s-90s: Integrated Resource Planning
  - 30 VSA §218c(a)(1)
- More recently – Performance-Based Regulation

Cost v. Value: “Compared to What?”

- Resource choices cannot be made simply on the basis of costs (or prices)
- The lower-cost resource is not always the most *valuable* resource
- How do we determine the value of a resource option? What is its value to us?
- Integrated resource planning (IRP) is the process by which resource options are compared and aggregated to meet demand for service to produce the highest value at the lowest total cost over the long-term

Wholesale Markets

- Technological change, generation is no longer a natural monopoly
- How wholesale works
  - Bid-based merit order dispatch; locational pricing; capacity markets, ancillary services
- Wholesale markets co-exist with
  - An imperative for reliability
  - With environmental regulation
  - States and their priorities
  - Planning can tie it all together

All regulation is incentive regulation!

The trick is to understand what the incentives are and how they affect behavior

How Do Utilities Make Money under Traditional Regulation?

- Under traditional regulation:

  Price = Cost of Service/sales

- But:

  Actual Revenues = Price * Quantity

  Where: Quantity = actual sales

- Which means that:

  Net income (profit) = **Actual** Revenues – **Actual** Costs

- The utility makes money by:
  - Reducing costs and
  - Increasing sales

Traditional Regulation: The Problem

- Traditional ROR regulation sets *prices*, not *revenues*
  - The revenue requirement is only an estimate of the total cost to provide service, used only as the basis for determining rates
- By themselves, consumption-based rates ($/kWh and $/kW) link profits to sales
  - The more kilowatt-hours a utility sells, the more money it makes
  - This is because, in most hours, the price of electricity is greater than the cost to produce it
    - Utility makes money even when the additional usage is wasteful, and loses it even when the reduced sales are efficient
- The incentive to increase sales is *extremely powerful*
  - This is the “throughput incentive”

Alternative regulatory methods: “Decoupling” and Performance-Based Ratemaking (PBR)

- PBR is not a new concept: It refers to any variation on traditional (price-based) regulation that aims to encourage, by the application of specific rewards and penalties, identified outcomes and behavior
  - Used extensively in telecom regulation
- “Decoupling”: a foundation for PBR
  - Breaking the link between profits and sales
  - GMP and VGS both operate under PBRs that decouple cost recovery of the network (wires and pipes) from sales of kWhs and therms

Decoupling's Simple

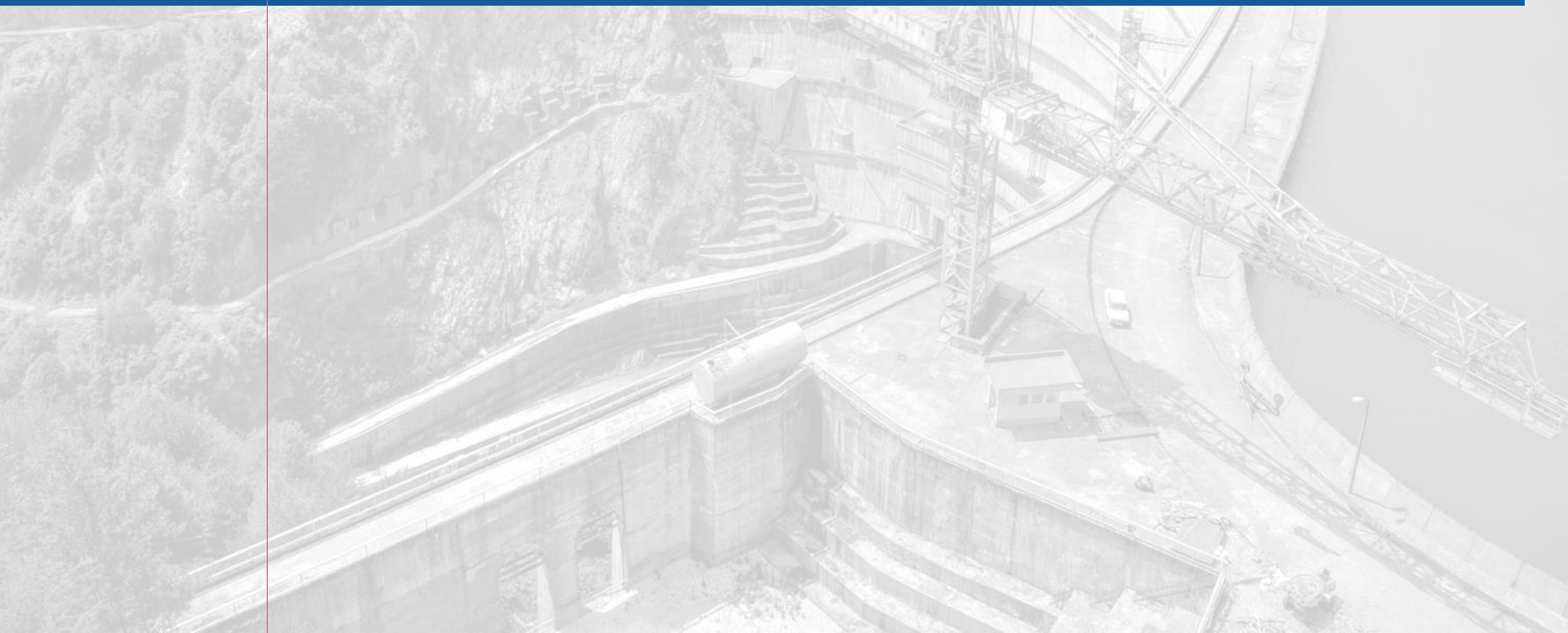
- Prices are set the old-fashioned way: through a rate case
- But now the amount of revenues that the company will receive is fixed
  - The "revenue requirement" becomes the company's "allowed revenue"
- Differences between actual revenues and allowed revenues are trued-up through periodic rate adjustments (monthly, quarterly, yearly)

Illustrative performance metrics under PBR

- Typically, overlaid on a decoupling regulatory plan
  - In various forms, used in more than half the states and in Europe and Latin America
- Financial incentives (penalties) for achievement (failure to achieve) specified outcomes, e.g.:
  - Service quality (outages, response times, complaints)
  - Operational cost savings/smart grid investment
    - Line loss reductions
  - Power cost savings
  - Increased end-use efficiency
  - Renewables and distributed energy resources
  - Emissions reductions (per MWh)
  - Demand response participation

4 Regulation in Vermont

Institutions and History



Public Utility Commission (PUC)

- Origins in legislative attempts to regulate railroads, then Railroad Commission
- “Public good” mandate across various regulated utilities (energy, water, telco, other)
- Quasi-judicial body, 3 Members with 6-year terms, screened by the Judicial Nominating Board
- Can open investigations on its own motion
- Can proceed via rulemakings, contested cases, or via informal proceedings (workshops, stakeholder dialogues, etc.)

Department of Public Service (DPS)

- Executive Branch Utility Policy
- Statewide Planning
  - And data analysis
- Public Advocacy
  - With staff experts and bill-back authority
- Consumer Affairs (answering the 800-line)
- State Energy Office (liaison to US DOE)
- Safety

DPS and PSB (PUC) assumed current structure in 1981 – Why?

- **Gov. Snelling instigated the change. He wanted:**
  - Accountability for state's positions in regulatory matters, as the state's top elected official
    - Rather than a special council attorney making the decisions on how to represent the state
  - Bring together key utility functions for synergies, post Oil Embargo
  - PSB (PUC) would remain independent

Evolution of the Vermont power mix

- Early days – hydro and Village systems
- Fossil fuels critical for growth (Moran)
- Nuclear arrives
- Canadian hydropower
- Energy Efficiency and Renewables
- Natural Gas
- “Resource of the Decade”

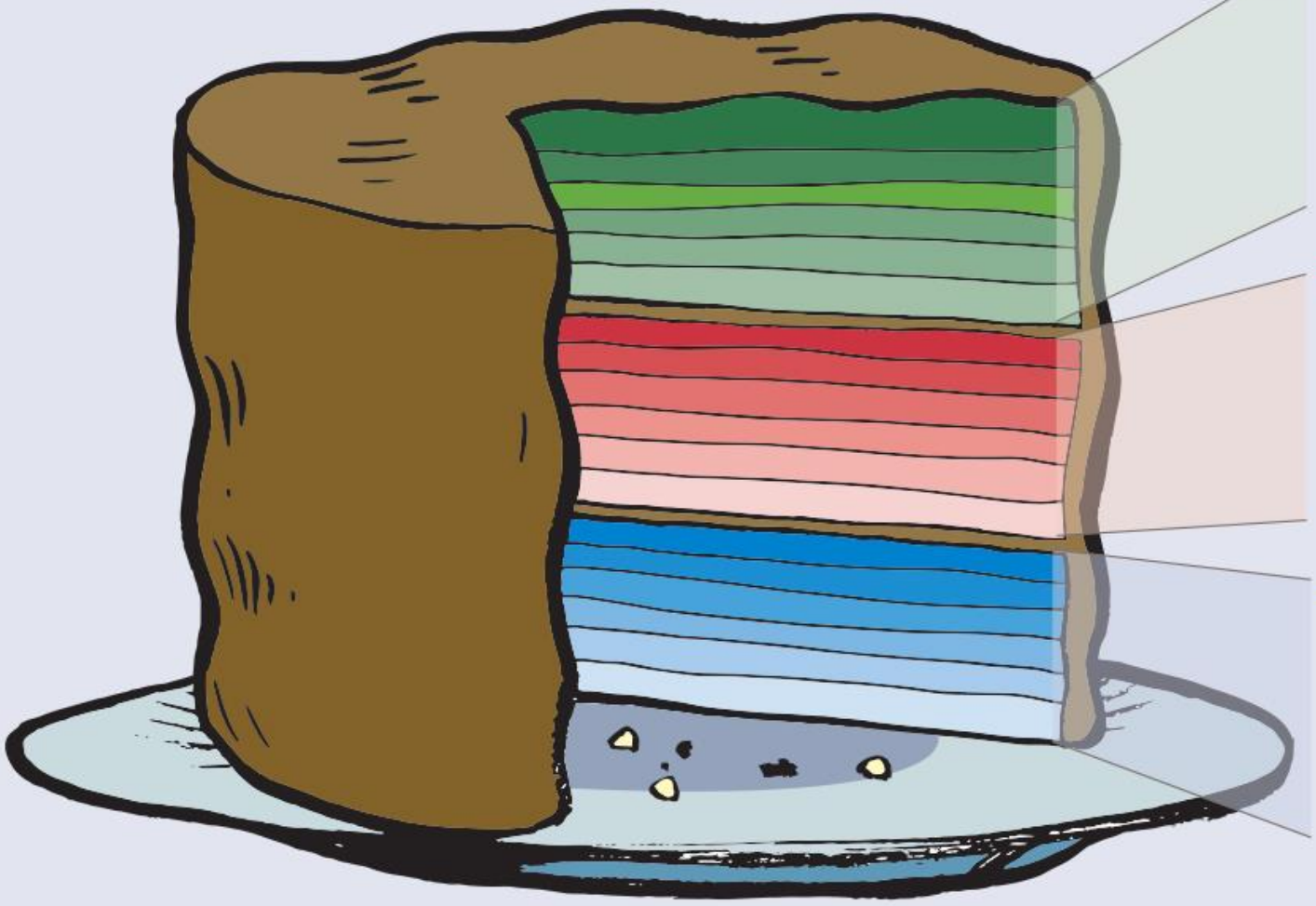
Integrated Resource Planning (IRP) and Efficiency (EE) as a Resource

- Docket 5270 opened 2/88; Order issued 4/90
  - Required all utilities to engage in IRP and to implement programs to acquire all cost-effective EE resources, as identified by the IRP
  - IRPs to be reviewed and approved by PSB
  - Prescribed ratemaking treatment for adverse financial impacts on utilities from EE
    - Potential rewards for superior performance
- Early to mid-1990s
  - Utility EE performance varied

End-Use Energy Efficiency: The "First Fuel"

- Three decades of analysis and implementation have confirmed that energy efficiency is the lowest cost, lowest risk resource
- Market barriers to efficiency:
  - Higher up-front capital costs
  - Information
  - High private discount rates (short payback periods)
  - The utility's "throughput" incentive
- Aligning private interest with public policy
  - How best to design and deliver EE programs?

A Layer Cake of Benefits from Investments in System Resources



Utility System Benefits
- Power Supply
- T&D Capacity
- Environmental
- Losses and reserves
- Risk
- Credit and Collection

Participant Benefits
- Other Fuels
- Water, Sewer
- O&M Costs
- Health Impacts
- Employee Productivity
- Comfort

Societal Benefits
- Air Quality
- Water
- Solid Waste
- Energy Security
- Economic Development
- Health Impacts

IRP and EE in Industry Restructuring

1995-96: Restructuring debate

- Docket 5854: Report to Legislature
- Who should deliver EE in a restructured industry?
  - PSB concluded 3rd-party "energy efficiency utility"
    - Not government: political and budgetary entanglements
    - Not distribution utilities, given performance to date and the large number of small companies
    - 3rd party EEU: State-wide single purpose entity

Efficiency Vermont

- 1997-1999: Docket 5980
  - 2½-year investigation
  - Board order establishment of EVT in 9/99
- 2000: EVT established
  - Performance-based contract, since evolved into performance-based franchise
- Globally-significant model for delivering EE as a money-saving resource

Renewables in the Vermont Power Mix

- Historic hydro a significant part of the mix
- McNeil & Ryegate wood-chip generation
- PURPA and the independent power producers
  - Creative approaches by PSB and DPS
- Some utility hydro (Bolton Falls)
- Net metering and the growth of PV
- Searsburg – notable utility-built wind project
- Hydro-Québec
- Modern wind systems

The sweep of history

- Things change -- “resource of the decade”
- A hydro- and fossil-based power sector evolves to one dominated by natural gas regionally (49%)
- Nuclear power still important but declining (regionally)
- Wind and solar are growing exponentially, but remain a small fraction
- Economies of scale drove bigger plants for decades; this is now turning around
- And energy efficiency is lowering costs and minimizing supply risk
- Next: cost-effective electrification of heating and transportation

Net Metering

- Vermont among early adopters
- Simple for consumers to use
- Industry developed promptly
  - Exponential growth, energy fraction still small
- Innovation to include farms, and groups
- Utilities learning to plan for customer generation

ISO-New England: Paying for Reliability

- How does the region support reliability?
- Companies own supply resources
- Transmission links can improve reliability
- Demand side also supports reliability

ISO-New England: Paying for Reliability

- What if the right answer to a reliability problem is an incremental dose of EE, DR, DG?
- FERC will not order ISO-NE to pay for the non-transmission solution(s)
  - Practice calls for cost of transmission solutions (not others) to be shared across all New England
- As a result, the region pays more for the line
- As this happens over and over, cost-effective solutions are bypassed for more costly and intrusive solutions

ISO-New England: Paying for Reliability

- Vermont policy on this is clear
- ISO-NE practice should be changed
- All substitutes should be eligible for ISO-NE tariff support, best set wins
- VELCO argues for this in ISO-NE governance
- More states would need to see how this raises costs for all and can be changed with consensus among states, which is lacking now

History Lessons – Recurring Resource Battles

- Hydro and public power battles since the 1920s
- Churchill Falls vs. Vermont Yankee
- Seabrook, Millstone, and the era of nuclear cost overruns
- NYPA and the DPS role in power sales
- Hydro Quebec, HVDC line, and utility contracts
- Energy efficiency & integrated resource planning

History Lessons: Challenges of today's resource choices

- Searsburg and utility-scale wind
- PV and net metering
- Diversity as an issue – the challenge of too much gas-fired power
- ISO-New England's transmission expansion process; socializing reliability

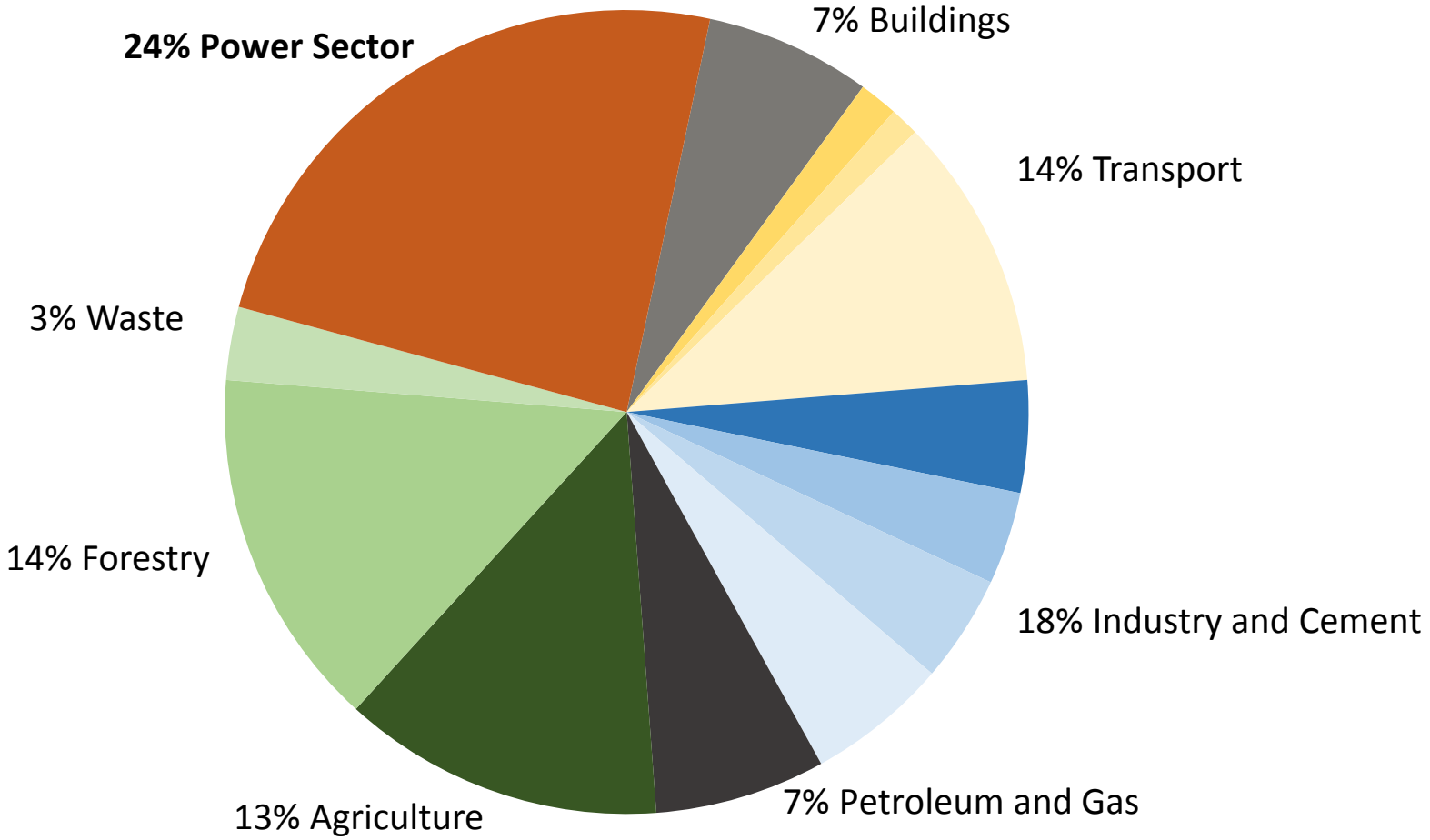
5 Climate Change and the Power Sector

The Logic of “Carbon Revenue Recycling”

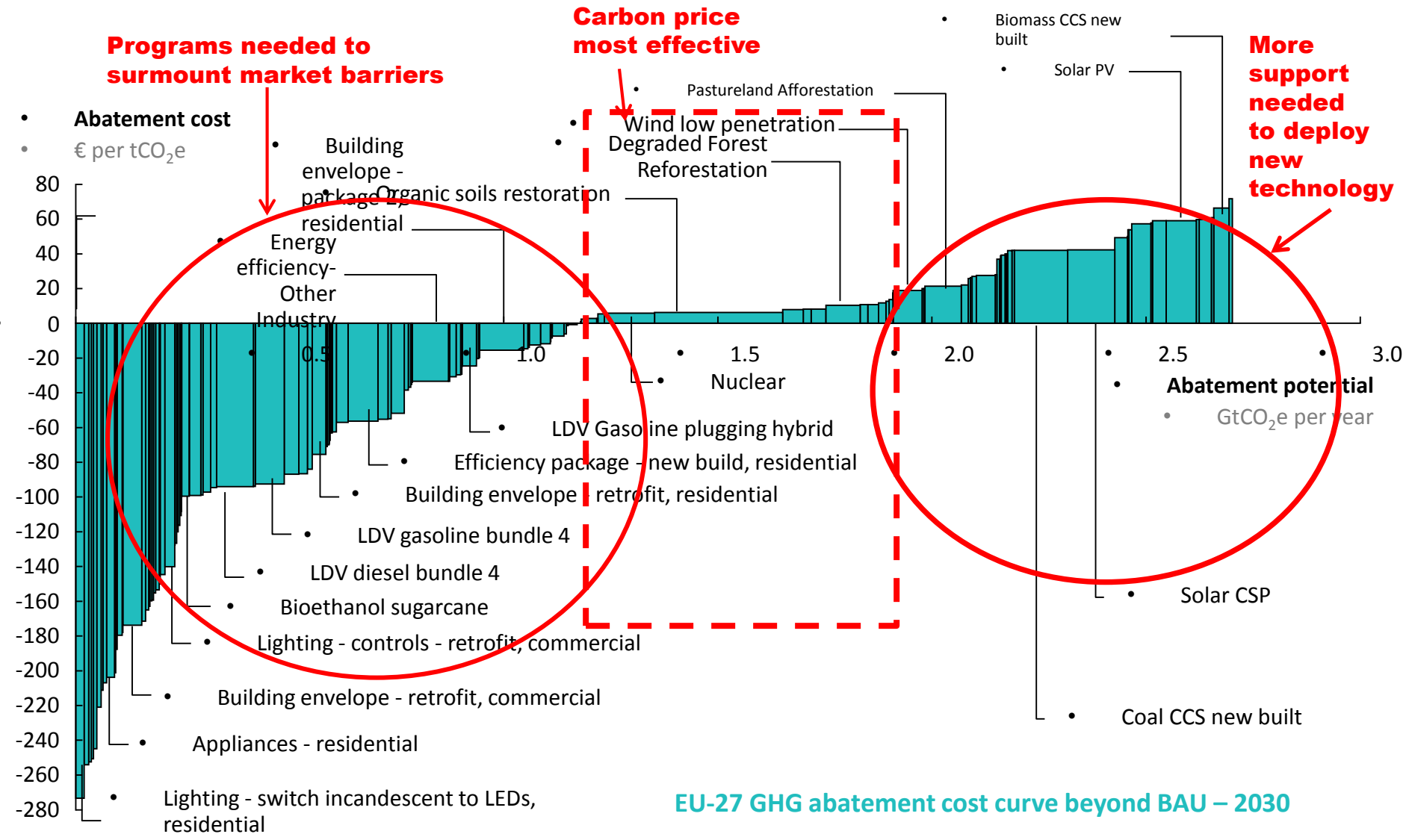
Daily Climate News

Global GHG Emissions

51 Gt CO_2e in 2010



Carbon prices/taxes alone will deliver only a part of the abatement needed



EU-27 GHG abatement cost curve beyond BAU – 2030

Where do power sector emissions reductions actually come from?

Four main possibilities:

- Reduce **consumption**
- **Re-dispatch** the existing fleet and/or
- **Shut down** high-carbon units
- Lower the emission profile of **new generation** (including repowering)

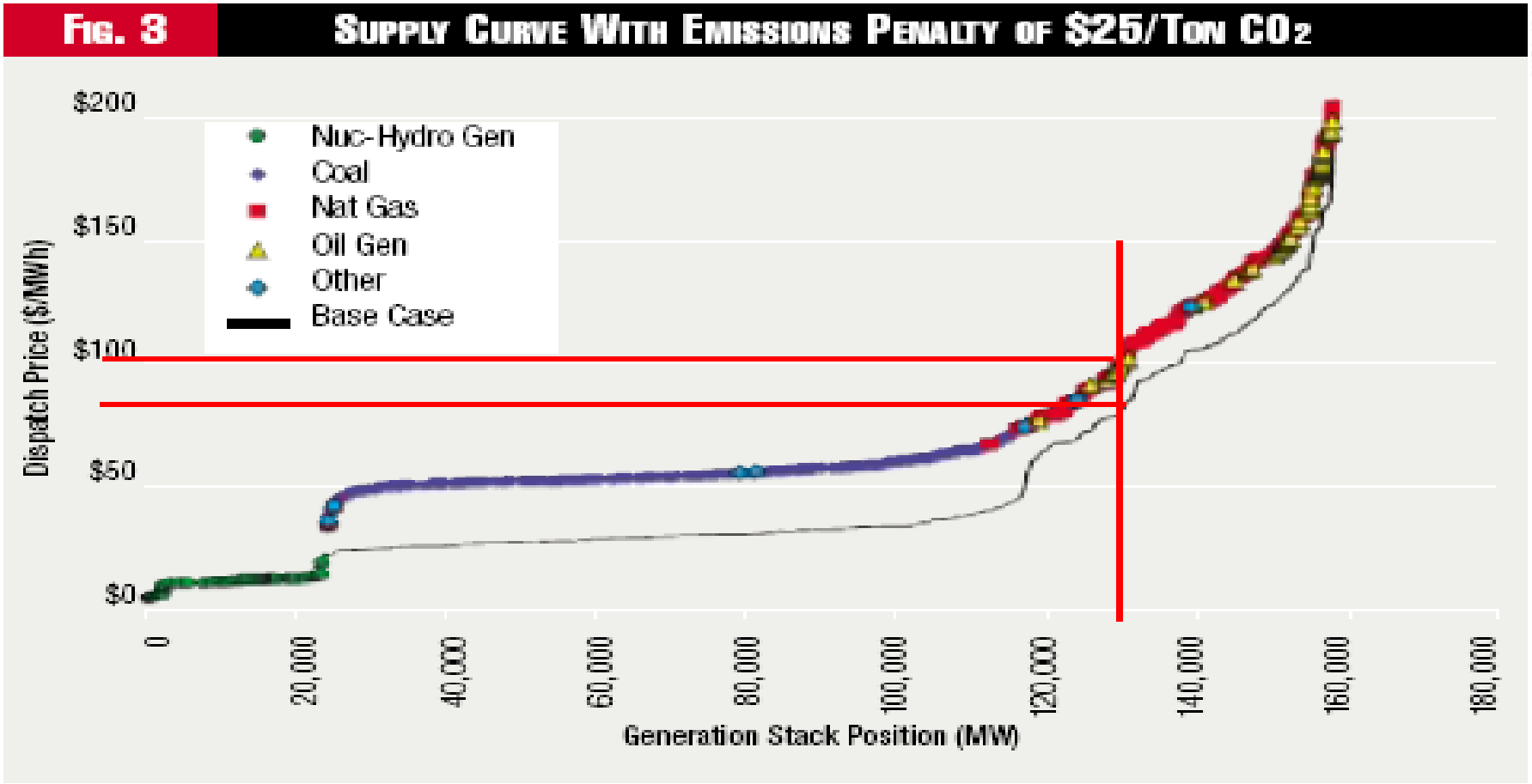
For each opportunity, ask:

1. How many tons will it avoid?
2. How much will it cost society *(or, cost consumers per ton)?*
3. What tools – including what kind of carbon caps -- get the best results on #1 & #2 ?

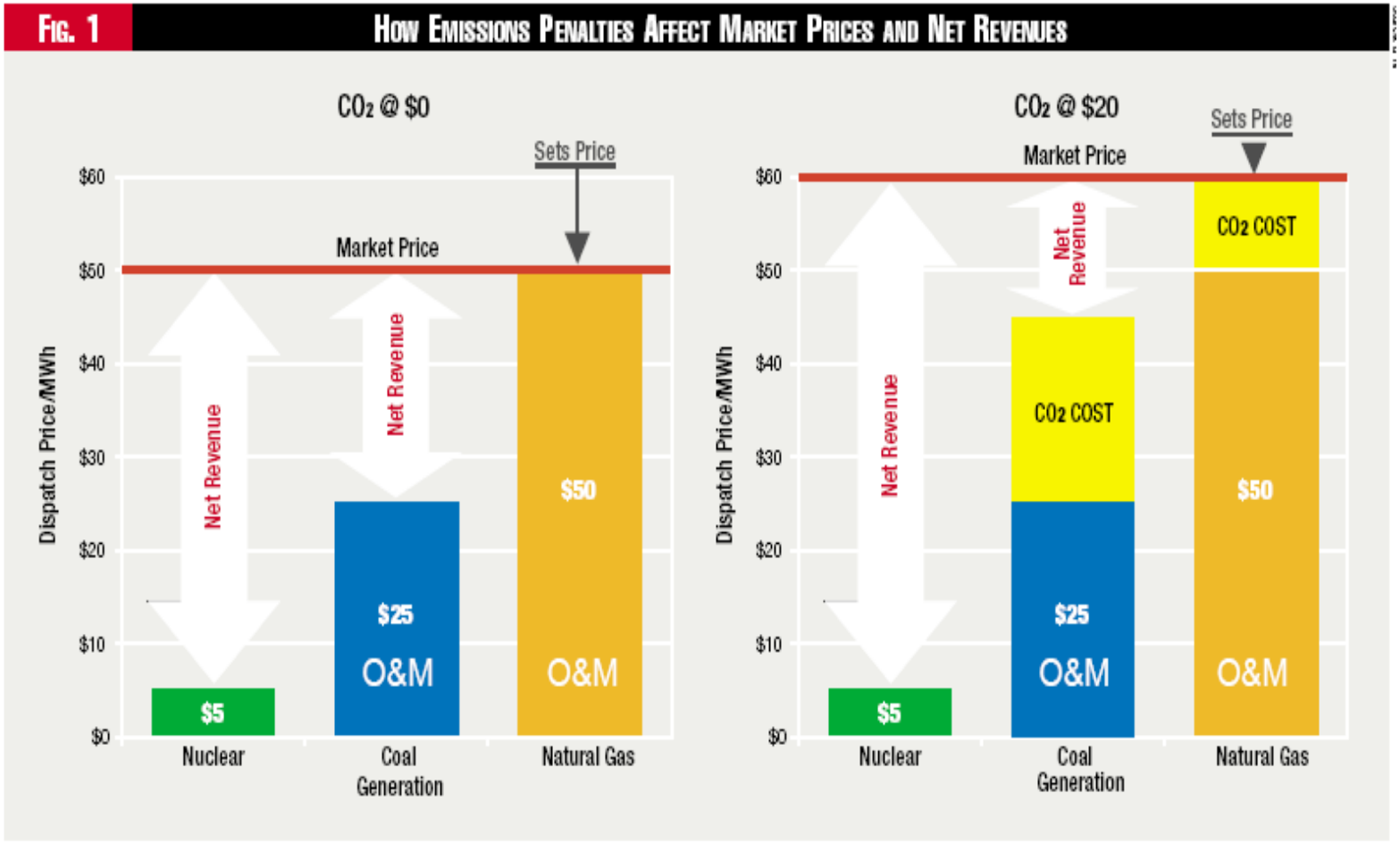
Challenge #1: It's hard to affect demand (enough) with carbon prices alone

- To decarbonize power while adding electric transport, BAU demand must be reduced by about 40% by 2050
- Demand for electricity is relatively inelastic
- Long-term price-elasticity of demand is about -0,2 to -0,3. (A +10% increase in price yields a 2% to 3% decrease in demand)
- BUT: the income-elasticity of demand is positive (as incomes rise, so does demand)
- What price increase would be needed to turn load growth negative with rising incomes and modern economies?

Challenge #2: Carbon prices to generators can increase wholesale power prices with little effect on dispatch or emissions



Carbon price can raise prices without changing dispatch or emissions

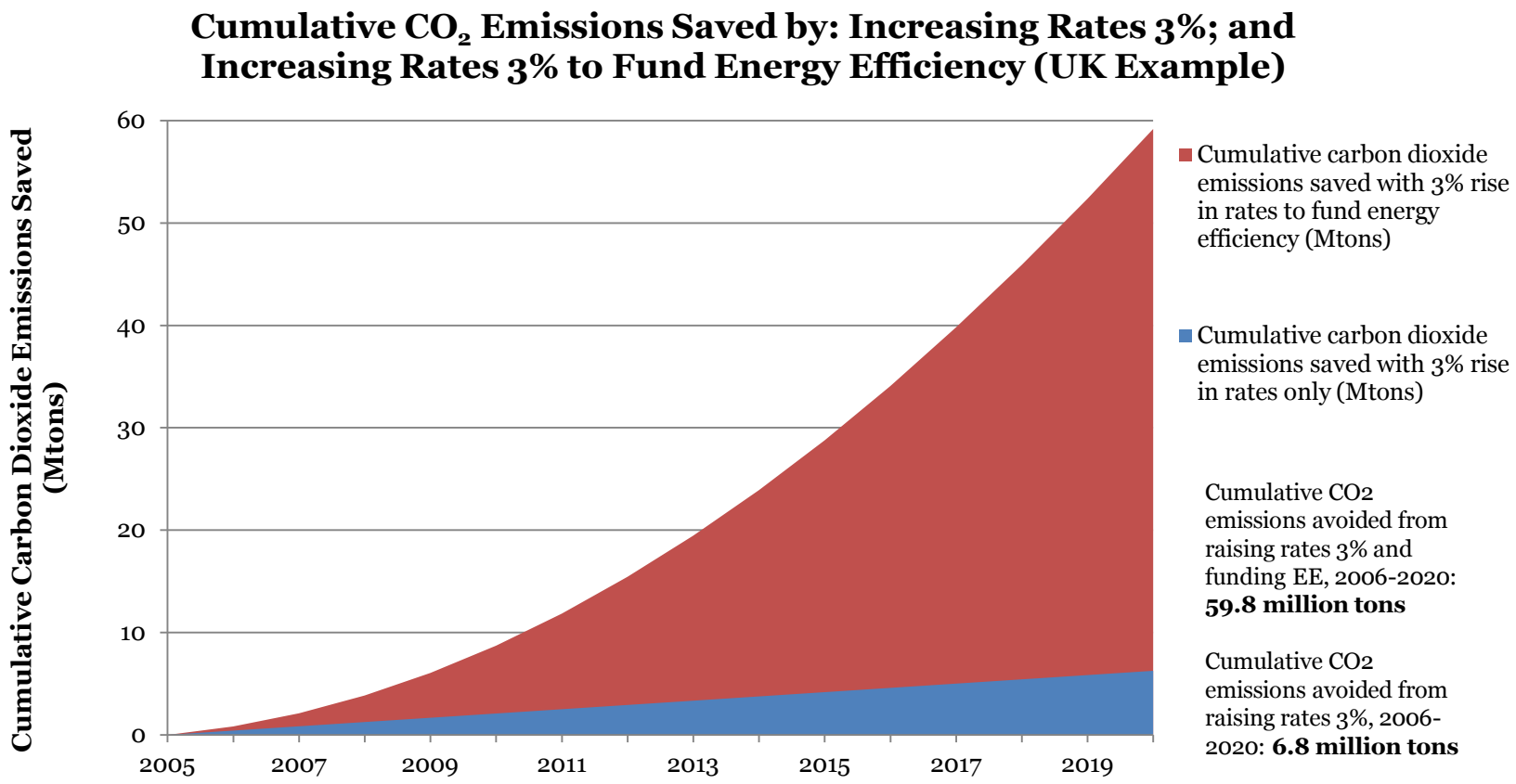


Source: “The Change in Profit Climate” -- Public Utilities Fortnightly May 2007 - Victor Niemeyer, EPRI

High Cost Tons: Study by PJM

	Carbon @ $20	Carbon @ $40	Carbon @ $60
Power price increase per MWh	$15/MWh	$30/MWh	$45/MWh
Total consumer cost increase	$12 billion Per year	$24 billion per year	$36 billion per year
Number of tonnes reduced via redispatch	14 MT		
Consumer cost per tonne reduced	$850 /tonne	$348/tonne	$1440/tonne
Multiple of carbon price	>40 times	>8 times	

Efficiency Programmes Save 9x More Carbon Per Consumer GBP Than Carbon Taxes Or Prices

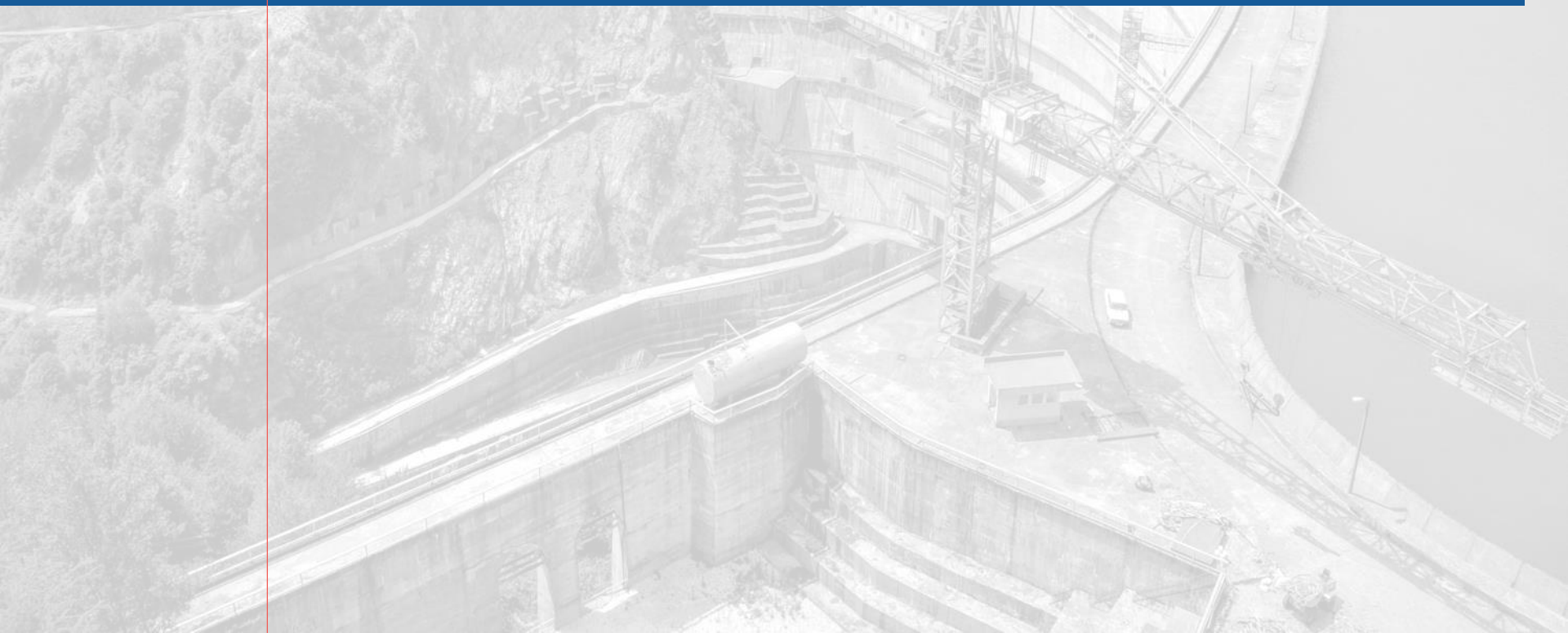


Carbon revenues are a powerful tool to leverage carbon price

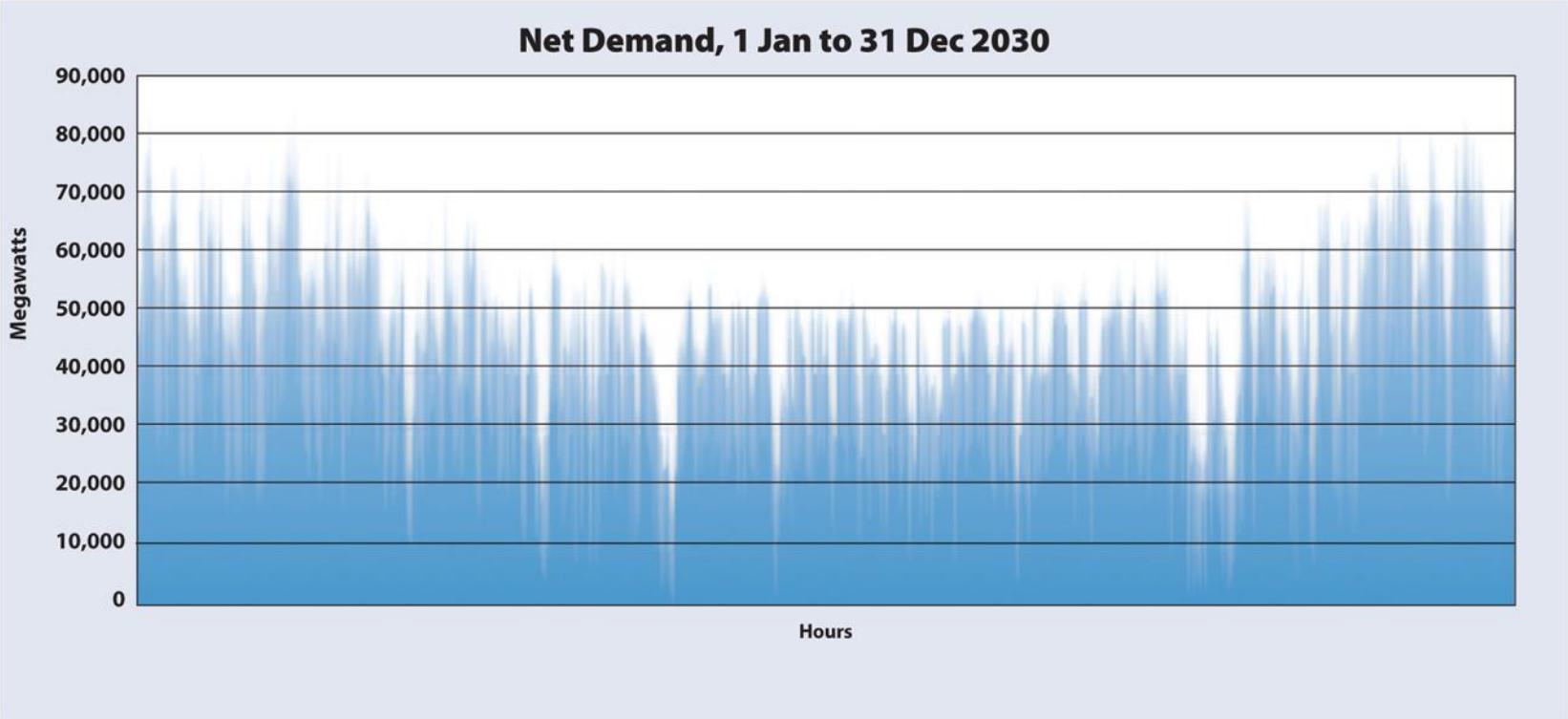
- Key idea: Sell allowances, invest carbon revenue in low-cost carbon reduction—especially EE
- Northeast US: 9 RGGI states now dedicate >80% of allowance value to clean energy (~55% to EE)
- Even with low (~$3/ton) CO_2 prices, RGGI has raised over $500 million for EE programs—avoiding CO_2 at a cost of (minus) -$73 per ton!
- So far: adding $1.6 billion to the regional economy, and supporting 16,000 new jobs
- Political lesson: RGGI renewed 2013, cap lowered. Lowered again in 2018
- Germany, France, Czech Republic – have programs and/or plans to invest substantial carbon revenues in EE

6 Climate Change and the Power Sector

Integrating Renewables

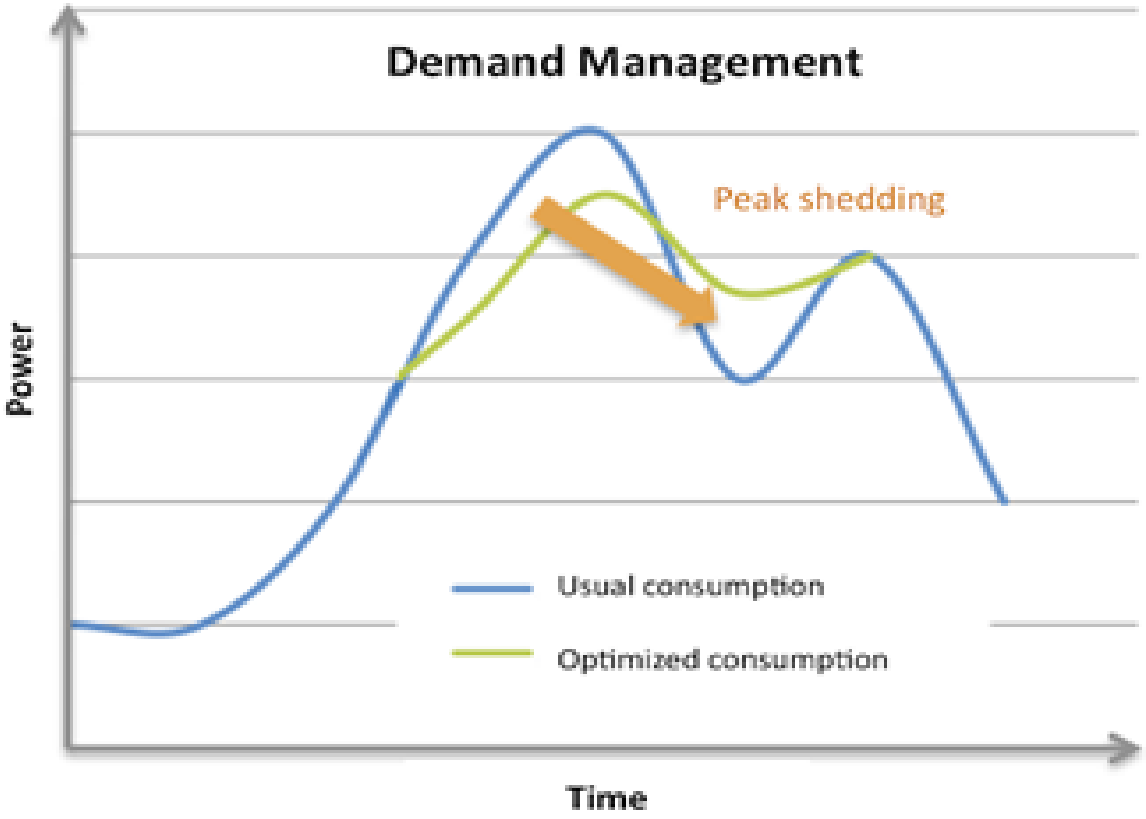


The Challenge: RE Variability



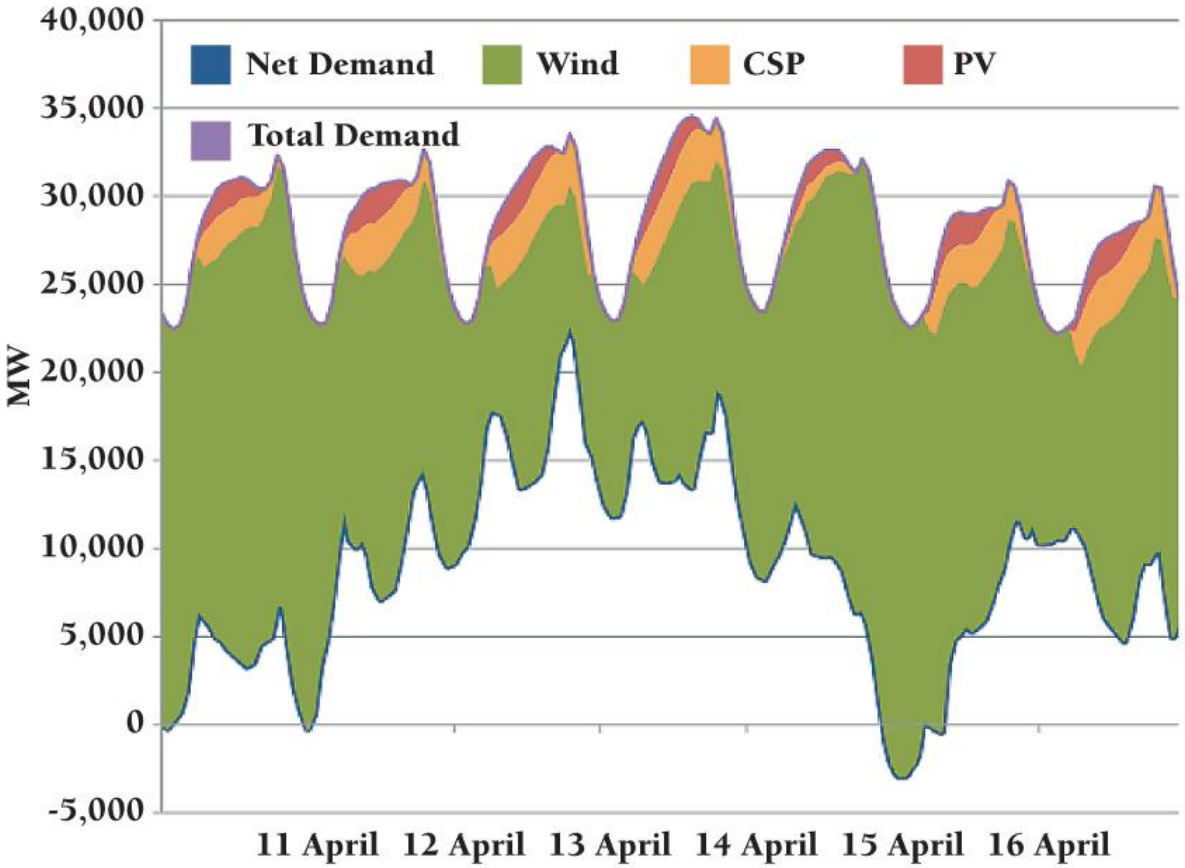
Net demand = gross demand minus demand effectively served by low-marginal-cost, variable RES supply. <Southern UK 2030 w 28% PV & wind>

Traditional Demand Response: Peak Shaving



Challenge #3: Variable RE—Net demand is more volatile than overall demand

A challenging week for West Connect, USA, assuming 35% wind penetration

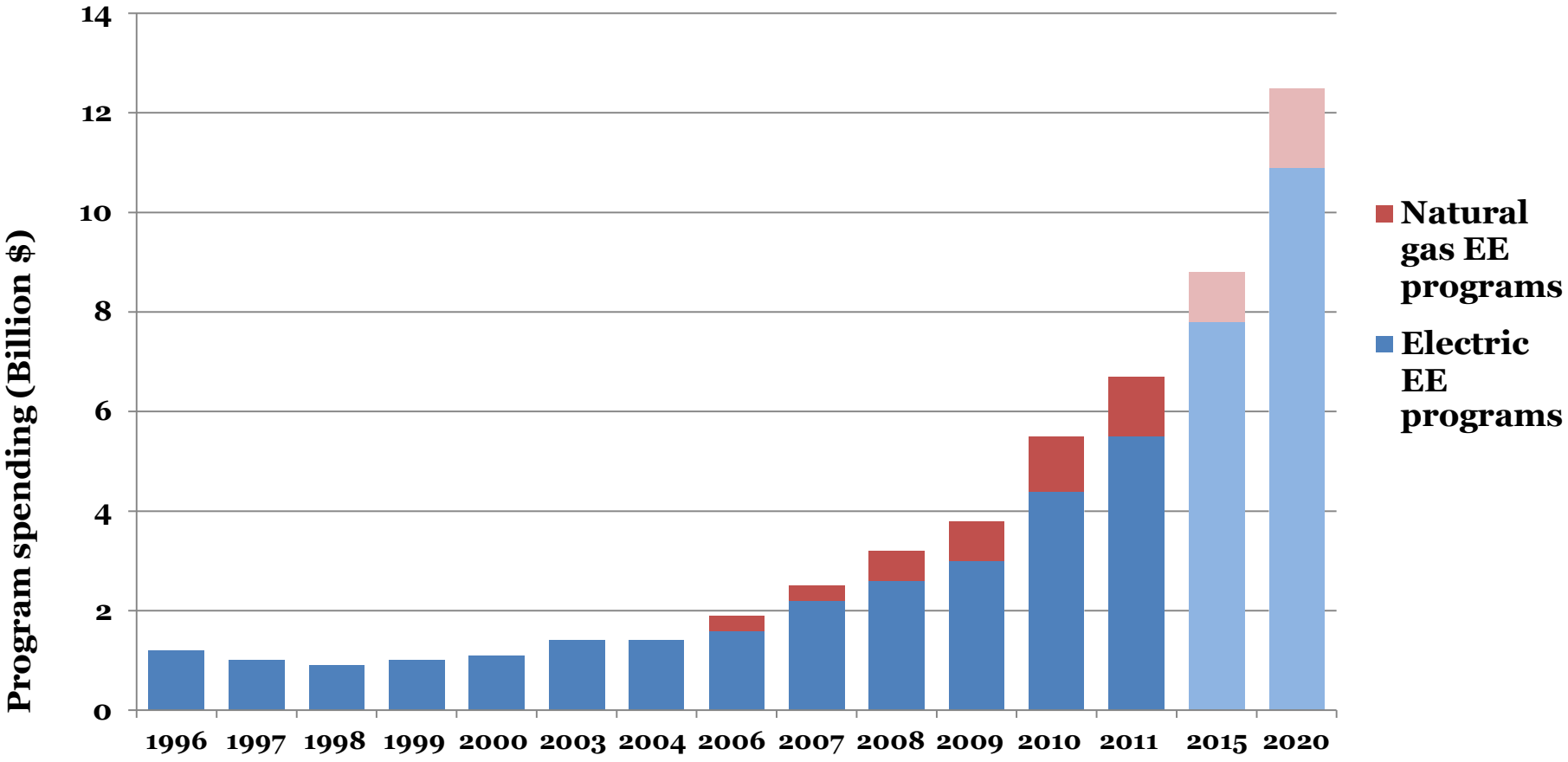


“If a problem cannot be solved, enlarge it” — Dwight Eisenhower

Recent legislative milestones

- Balance between legislative policy-making and inappropriate detailed interventions
- Some leading modern examples:
  - Least-cost utility planning
  - All-fuels charge and weatherization
  - Decision not to adopt retail competition
  - Creation of the Efficiency Utility
  - SPEED and Net Metering
  - Alternative regulation
  - RGGI and “carbon revenue recycling”

U.S. Utility EE Program Spending Now Over $7 Billion/Year and Still Growing



Note: 1993 - 2008 represents spending; 2009 represents spending among CEE members reporting to CEE; 2010 and 2011 represent budgets of CEE members reporting to CEE; 2015 and 2020 represent LBNL "high case" projections
Sources: ACEEE, The 2010 State Energy Efficiency Scorecard, October 2010; CEE, *State of the Efficiency Program Industry*, December 10, 2010, and March 14, 2012; LBNL, *The Shifting Landscape of Ratepayer-Funded Energy Efficiency in the U.S.* , 2009.

What Makes Electrification Beneficial?

Three Criteria: Achieve At Least One Without Adversely Impacting The Others

1. Saves Customers Money Long-Term; New Services

2. Reduces Environmental Impacts

3. Enables Better Grid Management

About RAP

The Regulatory Assistance Project (RAP)® is an independent, non-partisan, non-governmental organization dedicated to accelerating the transition to a clean, reliable, and efficient energy future.

Learn more about our work at raponline.org

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A Appendix

Theory of economic regulation, externalities, math, more Vermont history

Economic Regulation

- Economic regulation is the explicit public or governmental intervention into a market to achieve a public policy or social objective that the market fails to accomplish on its own
- Reasons:
  - The product is considered essential, and it is most efficiently provided by a single supplier
    - "Natural" monopoly
  - Other market failures
  - External (e.g., environmental) costs not full reflected in price
  - Consumer protection
  - Universal service
  - Economic efficiency
  - Other policy considerations

Externalities

- A recognition that not all costs are monetized and reflected in market values
- Both positive and negative
  - Improved amenity and health
  - Environmental damage
- How best to account for these costs?

How Changes in Sales Affect Earnings

	Revenue Change		Impact on Earnings		
% Change in Sales	Pre-tax	After-tax	Net Earnings	% Change	Actual ROE
5.00%	$9,047,538	$5,880,900	$15,780,900	**59.40%**	17.53%
4.00%	$7,238,031	$4,704,720	$14,604,720	**47.52%**	16.23%
3.00%	$5,428,523	$3,528,540	$13,428,540	**35.64%**	14.92%
2.00%	$3,619,015	$2,352,360	$12,252,360	**23.76%**	13.61%
1.00%	$1,809,508	$1,176,180	$11,076,180	**11.88%**	12.31%
0.00%	$0	$0	$9,900,000	**0.00%**	11.00%
-1.00%	-$1,809,508	-$1,176,180	$8,723,820	**-11.88%**	9.69%
-2.00%	-$3,619,015	-$2,352,360	$7,547,640	**-23.76%**	8.39%
-3.00%	-$5,428,523	-$3,528,540	$6,371,460	**-35.64%**	7.08%
-4.00%	-$7,238,031	-$4,704,720	$5,195,280	**-47.52%**	5.77%
-5.00%	-$9,047,538	-$5,880,900	$4,019,100	**-59.40%**	4.47%

Revenue-Sales Decoupling

- Breaks the mathematical link between sales volumes and revenues
  - Makes revenue levels immune to changes in sales volumes
  - It enables recovery of the utility's costs, including return on investment, in a way that doesn't create perverse incentives for unwanted actions and outcomes
- Two objectives:
  - To protect the utility from the financial harm associated with least-cost actions and
  - To remove the utility's incentive to increase profits by increasing sales
- Preserves the utility's incentive to improve its operational efficiency
- This is a revenue issue, not a pricing issue: it is not intended to decouple customers bills from consumption
  - Customers continue to see the cost implications of their consumption decisions
  - Use more, pay more. Use less, pay less

Vermont regulatory model – compared to other places

- Independence – Connecticut, China
- Elected commissioners – several states
- Consumer advocate inside the PUC - CA
- Backwards on ex parte – California
- Lack of authority – most of Europe
- Need for interstate regulator – EU v. US

Nuclear and Canadian Hydro

- **Nuclear arrives in the 60s with Yankee Rowe**
  - And becomes dominant in the 70s with Vermont Yankee
    - Helped Vermont ride through price spikes from oil embargoes of the 70s
- **Canadian Hydroelectric arrives in the 1970s**
  - Long connection with northern tier
  - Matches VY for dominance with state's Hydro-Quebec contract starting in 1985

Evolution of IRP & Efficiency in VT

- 1970s, ’80s:
  - Rising fuel prices (NE had significant oil-fired capacity)
  - Nuclear cost over-runs
  - Dissatisfaction with ex post prudence reviews
  - Flawed utility planning and poor risk management
  - Growing recognition of EE as a resource
- Mid-1980s:
  - Imminent need for new power resources
  - Recognition that §248 did not require a full IRP analysis of proposed investments/contracts

Searsburg

- First significant utility owned wind generation in the US in recent years
- Result of 14 years of project development effort
- Good experiment in how to “do” wind

Managing Environmental Impacts

- Siting: what is the relationship between Act 250 and Section 248?
- Side visit: no jurisdiction over interstate pipelines; (Champlain Pipeline)
- Application of environmental criteria to purchases as well (Hydro Quebec)
- “Light touch” review for small renewable projects
- Climate change [comes later]

High cost tonnes in the EU

Scenario	Carbon price 20 Euros	Carbon price 40 Euros	
Event/Result	*No demand response*	*Price-elasticity -.2*	
(a) Power price increase	€ 10.9 /MWh	€ 23.2 /MHz	
(b) Total sales	3016 TWh	2881 TWh	
(c) Total Cost increase	€ 33 Billion	€ 66.8 Billion	
(d) Emission reduction	133 Mt (all due to redispatch)	363 Mt (165 Mt from dispatch, 198 Mt from demand response)	
(e) Consumer cost per tonne reduced	**€ 248 per tonne**	**€ 184 per tonne**	

Source: Sijm, et al, The Impact of the EU ETS on Electricity Prices, Final Report to DG Environment, December 2008 (ECN-E-08-007)
[Row (e) is a RAP calculation based on Tables in the report, as shown.]

Natural Gas for Electricity

- Significant supplier of electric energy in New England
  - Roughly 49% of electricity in New England is generated by natural gas

Facilities Siting

- The utility system is a network
- Its value lies in its diversity of providers and consumers
- It is also a means by which public interest objectives can be accomplished
- Consumers benefit if resources can access the network, and if the network itself is built to a least-cost ideal
- A dilemma emerges as least-cost methods of generating and delivering energy create problems for all or for some
  - Social justice is implicated if a disadvantaged group tends also to receive the brunt of adverse impacts from utility siting
- States rely on the regulatory process to resolve these dilemmas
  - In many instances, the original intent of a proposal can be preserved while adverse consequences can be removed or reduced with money or ingenuity
  - Sometimes, in resolving such dilemmas, in determining “the public good”, some interests are upset or disappointed