Energy Efficiency Resource Standards: Economics and Policy

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"Advances in Electricity Planning & Policy Modeling"

AEG/FERC Energy Modeling

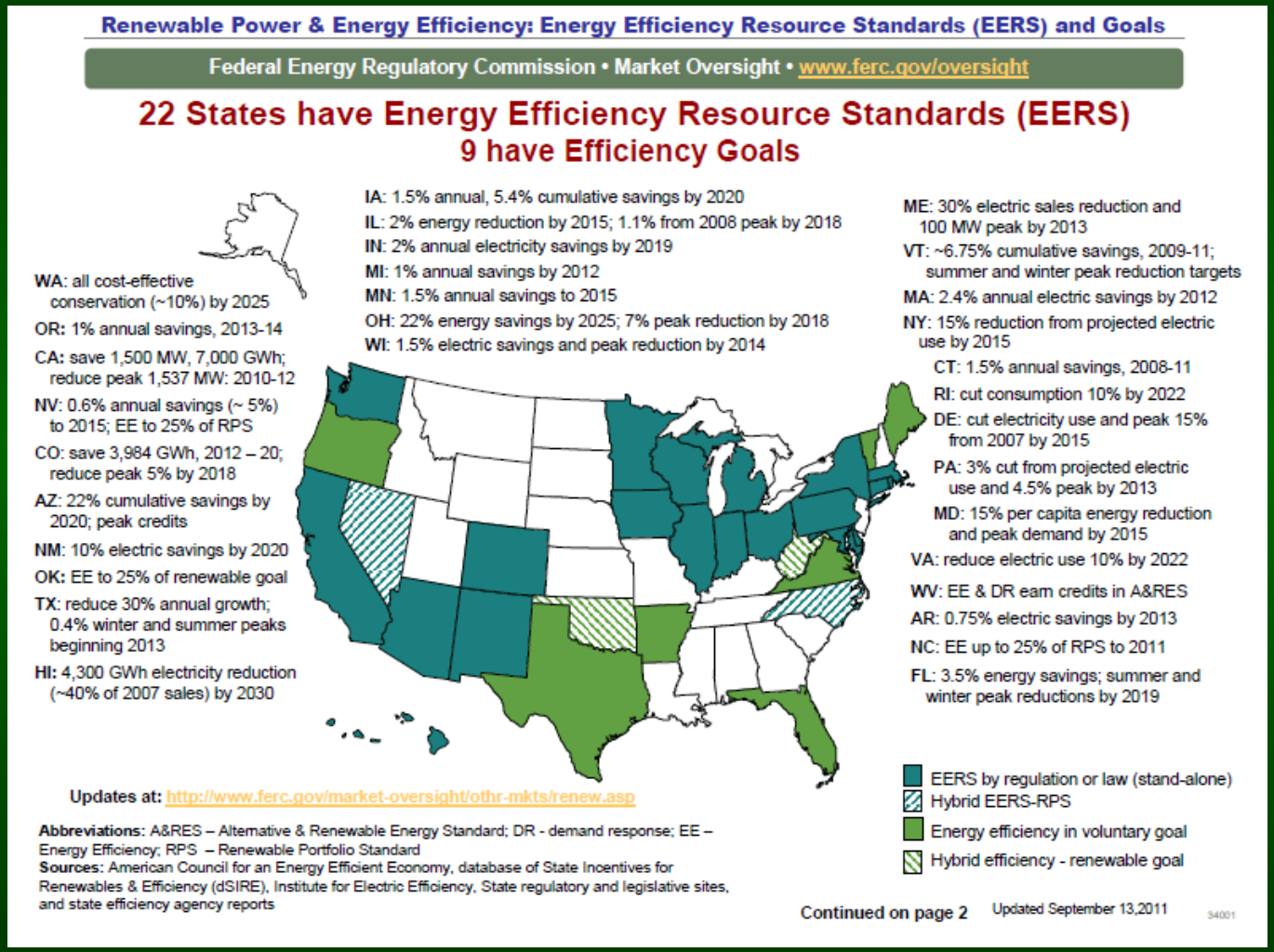
Federal Energy Regulatory Commission
Washington, DC

Nov. 10, 2011

Energy Efficiency Resource Standards

- State policies to achieve reductions in energy use
  - Electricity total
  - Electricity peak
  - Natural gas
- What are these things?
- Why have them?
  - Energy–related externalities
  - Consumer error
  - Would other policies make sense?
- Can an EERS give the "right" answer?
  - Moving demand for electricity use
- Implementation observations

EERS throughout the country



What an EERS is not

- It's not a cap
  - Not Kyoto-like target
  - Not like a cap for cap-and-trade
- It's also not a tax
  - Motivated by cutting energy costs
  - But may be like a tax—utilities bear costs, converted into electricity rates
- Is it even a policy?
  - Aspirational objective for other policies
  - Are other policies substitutes or complements?
- Who's responsible? Utilities? Government? Everyone?
  - If target isn't met, does anyone get punished? Maybe.

What an EERS can be

- Subtract a target quantity from "business as usual" use
  - E.g., A state's energy use in some future year should be less than it would have been under BAU by X% of the use in some baseline year, or some nominal amount.
  - Not that use by some future year must be (100 – X)% of the use in the base year.
- Base year may move over time, e.g., be a reduction based on percentage of use in prior year(s)
  - Low energy use in Year T means less reduction in T+1
- Target may also be percentage below BAU in that year
- In either case, factors causing BAU use to go up will permit more energy use
  - Again, an EERS is not a cap

How much do they matter?

- [Credit to Sam Grausz and Blair Beasley at RFF; apologies to you and them if I screw up.]
- Preliminary figures: Only four states would have use requirements as much as 10% below BAU
  - Hawaii ≅ 35%; New York, Delaware, Maryland ≅ 15-16%
  - Some of these may use pre-program EE-related savings
- Of 24 states they've checked, 15 are less than 3%
- Rhetoric vs. reality?
  - Hawaii least susceptible to relocation competition
- How to count savings if EERS not a cap?
  - Recession reductions don't count; economic growth not penalty
  - Rebound effect? "Free rider"?

Rationales and other policies – environment

- Harmful emissions
  - SO_2, NOx, particulates, Hg
  - CO_2; climate change
- Different emissions profiles for different energy sources
  - Coal, then natural gas on the fossil fuel side – but fracking?
  - Nuclear
  - Wind, solar
- EERS treats all energy sources equally
  - Most expensive generation at margin may have lower emissions
- Discourage using electricity for dirtier energy sources
  - Plug-in cars, PHEVs, mass transit
- Why not tax, cap emissions?

Rationales and other policies – peak load

- Electricity supply must meet demand by the minute
  - Absent non-prohibitive cost storage (beyond pumped hydro?)
- Critical peak transmission, generation expensive
  - Top 15% used < 1% typical
  - Prices to cover costs could be 50-100 times baseload
  - Wholesale price limitations lead to capacity markets
- General EERS will not address; total energy small
- Real time pricing first-best; higher prices or rebates
  - MD: Rebates paid from sale of demand response in capacity market
- 11 states have separate EERS for peak demand
  - Little environmental gain, but big operational saving

Rationales and other policies – consumer error

- Consumers apparently reluctant to invest in energy efficiency despite high savings
  - Predates climate concern; Hausman (1979), Gately (1980)
- Possible explanations (Gillingham, Newell, Palmer)
  - Financing constraints—can people borrow? (Do elsewhere)
  - Inadequate information (Private incentives, policy response)
  - Landlord, resale inability to capture benefits (Other amenities?)
- Or are consumers just too dim? Behavioral economics
  - EERS for their own good
- Non-paternalistic benefit-cost analysis?
  - How to do BCA when revealed preference isn't "true" WTP?

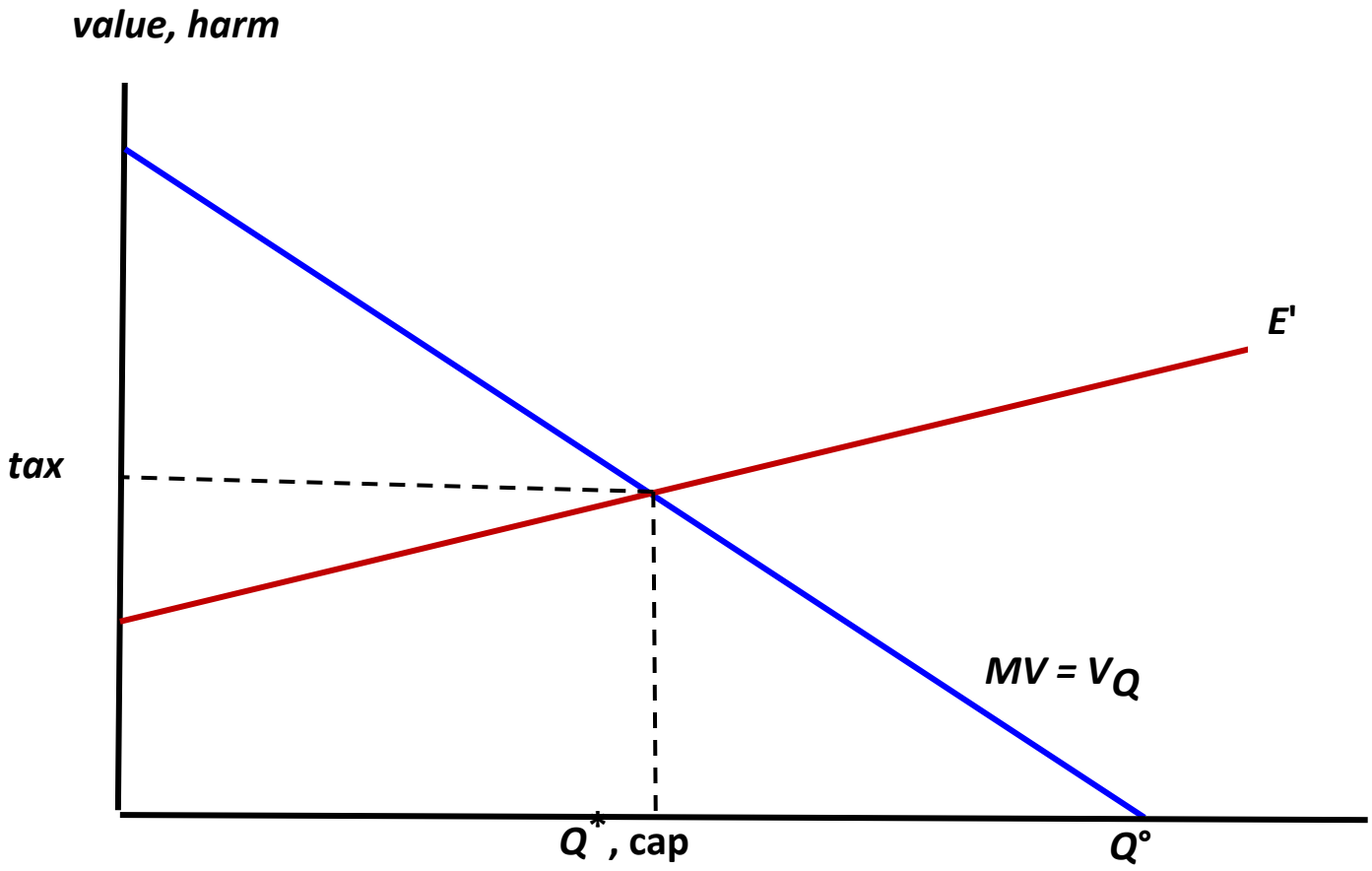
Rationales: Green jobs, energy security

- Energy security first
  - Not much electricity is generated from imported energy (oil)
  - Substitution away from oil (home heating, transportation) involves using more electricity, not less
- Green jobs?
  - You can't make an economy better off by raising the cost of its inputs (unless it raises costs of competitors elsewhere more)
  - Public investment reallocates employment, doesn't increase it
  - EERS could hurt renewable generation at the margin
- Does recession change the story?
  - With underemployment equilibrium, could be a net jobs growth
  - But what investments are best? Mining coal? Building roads?

Policies directed at energy

- Define value V of energy Q, $V(Q)$ = consumer plus producer surplus
- Marginal value $V_Q(Q)$ = difference between marginal WTP for energy and marginal cost
- Let $E(Q)$ be the external harm
  - Emissions, usually, but fill in the blank with your favorites
- Optimal energy use Q^* where $V_Q(Q^*) = E'(Q^*)$ (assuming second-order conditions hold: they may not!)
- No policy use Q° where $V_Q(Q^\circ) = 0$ (assuming no other market failures)
- $Q^* < Q^\circ$

Standard picture



Standard stories

- Absent uncertainty, set energy tax equal to E'(Q*)
- Adopt cap-and-trade with quantity set at Q*
- Giving away permits can buy political support for policy
- With uncertainty, choose the policy that best matches harm: standard Weitzman (1974) story
  - E' close to constant => energy tax
  - E jumps at Q* => fix harm with permits
- With prior tax distortions, may need to use tax revenues to reduce other taxes (Oates and Parry, 2000)
  - Policy with freely allocated permits may reduce welfare
  - Second-best argument

How does EERS fit?

- As noted earlier, it's neither a tax nor a cap
- Nevertheless, it can act like a cap if $V_Q(Q)$ known
  - Assume that $E'(Q)$ known
- Set absolute reduction to come out equal to $Q^\circ - Q^*$
- Set percentage reduction at $X\%$ so $Q^* = [1 - X\%]Q^\circ$
- But what if economy demand for energy can change over time?
- Let θ be a parameter representing shift in total value $V(Q, \theta)$, marginal value $V_Q(Q, \theta)$

Can an EERS work if demand changes?

- Condition for an absolute energy reduction relative to business as usual Q° to get to Q^{*} for any θ:

$$\frac{V_{Q\theta}^{\circ}}{V_{QQ}^{\circ}} = \frac{V_{Q\theta}^{*}}{V_{QQ}^{*} - E''^{*}}$$

- Condition for an fixed percentage energy reduction relative to business as usual Q° to get to Q^{*} for any θ:

$$\frac{Q^{\circ}V_{Q\theta}^{*}}{V_{QQ}^{*} - E''^{*}} = \frac{Q^{*}V_{Q\theta}^{\circ}}{V_{QQ}^{\circ}}$$

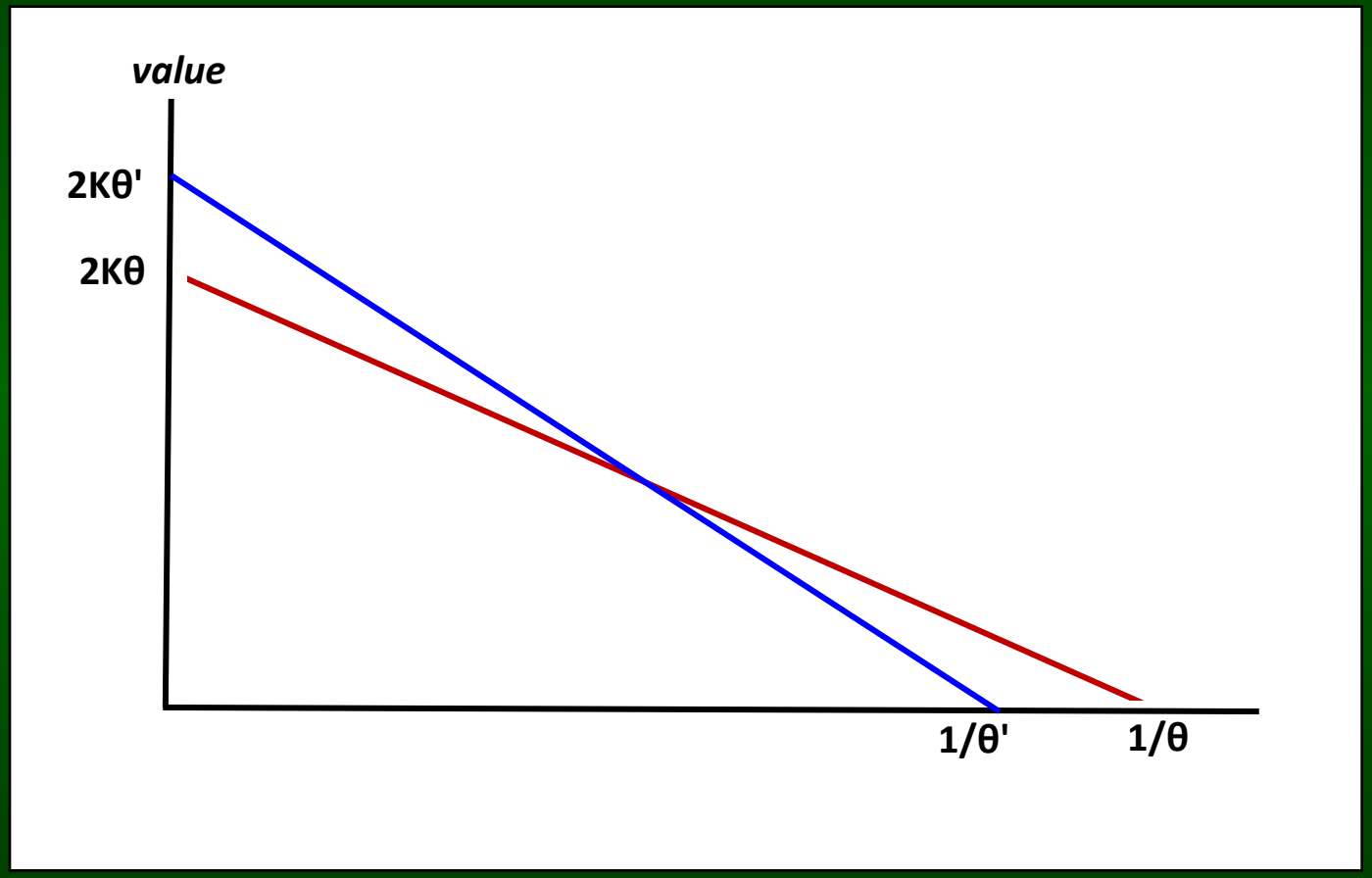
Yes, these conditions *can* hold

- Absolute quantity reduction EERS can hold if
  - Marginal harm from energy use is constant (E" = 0)
  - Marginal value (MV) curve is a straight line
  - Changing θ shifts out the MV curve in a parallel fashion
  - V_{QQ}, $V_{Q\theta}$ the same at Q° and Q^*
- Fixed percentage reduction EERS can hold if
  - Marginal harm from energy use is constant (E" = 0)
  - Marginal value (MV) curve is a straight line
  - Changing θ pivots the MV curve at the vertical intercept, changing proportionally the economy's demand for electricity at any tax
- Both EERS types work if E" is infinite at Q^* and changing θ has no effect on Q°
  - Both Q° and Q^* are fixed

EERS following energy efficiency? First, set it up

- Assume MV curve V_Q is a straight line
- Let $Q° = 1/\theta$
  - More energy efficiency reduces the quantity of electricity that has no additional net value to economy
- Area under V_Q up to $Q° = 1/\theta$ is a constant K
  - Energy efficiency gives the same value of energy service, achieved over a smaller quantity of electricity
- Implies vertical intercept must be $2K\theta$
  - Area under triangle is $\frac{1}{2}\,[2K\theta]\,[1/\theta] = K$
- $V_Q(Q, \theta) = 2K\theta - 2K\theta^2 Q$
  - $V_Q = 0$ when $Q = 1/\theta$

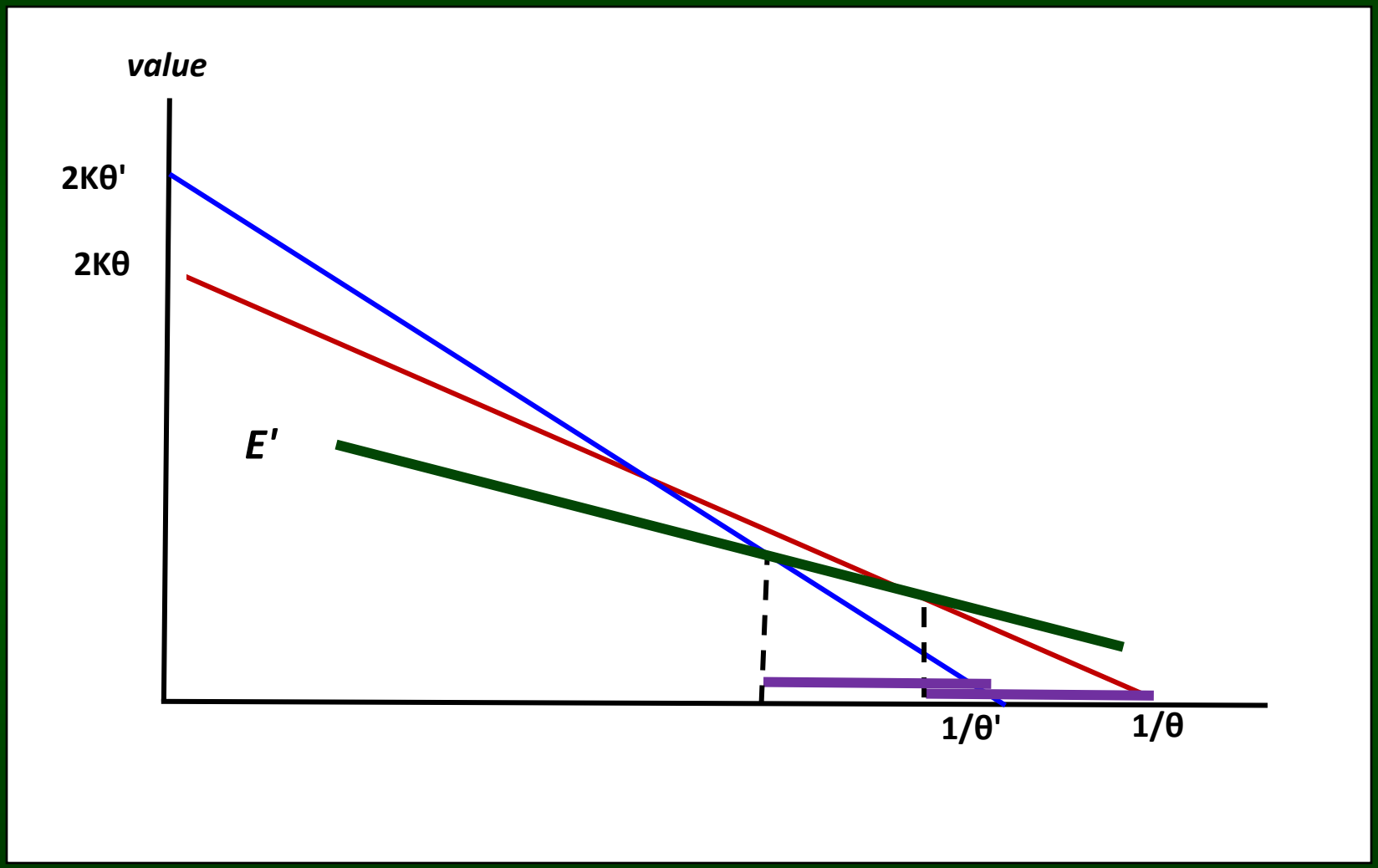
Energy efficiency effect picture



In this setting, EERS working => $E'' < 0$

- Visual intuition easier than the math
- If Q^* below the pivot point of V_Q as θ increases, Q^* falls with more energy efficiency
- With steeper MV curve, an absolute reduction from BAU Q° will lead to a higher MV at Q^*
- Thus, the intersection of V_Q with E' occurs at higher marginal harm with more energy efficiency, but at a lower Q^*
- Implies E' curve is falling, $E'' < 0$
- Same result holds, but not as strong with equal percentage reduction below BAU Q°
- But E'' could fall! Natural gas displacing coal

An illustration



A couple of implementation issues

- Use energy efficiency savings to count toward renewable requirement
  - Increased energy use at margin multiplies marginal RPS compliance cost
  - EERS: Use hypothetical rather than actual savings
  - Also, not a cap
- Letting distribution utilities handle it
  - Changing utilities from "energy" to "energy services"?
  - Flies in face of longstanding policy to keep regulated monopolies out of competitive markets (US v. AT&T; ISOs)
  - Discrimination, cross-subsidization risk
  - Why? Legislatures let PSCs raise taxes to cover EE costs

Overall …

- About 24 states have them
  - Not a cap, not clear if it's an independent policy
  - In only 4 states does it appear to bite
- Rationales better addressed with other policies
  - Environment, peak load
  - What to do about consumer mistakes?
  - Green jobs, energy security don't appear to have much traction
- Could do this through a tax, CAT, with usual arguments
  - Can work under special and not particularly realistic cases
  - With EE, works only if marginal external harm falls – and it might
- Should utilities run the show?