Cap and Trade and Complementary Policies

And their impact on compliance and costs

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EPRI-IETA Joint Symposium

San Francisco, CA

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Cap and Trade and ~~Complementary~~ *Competing* Policies??

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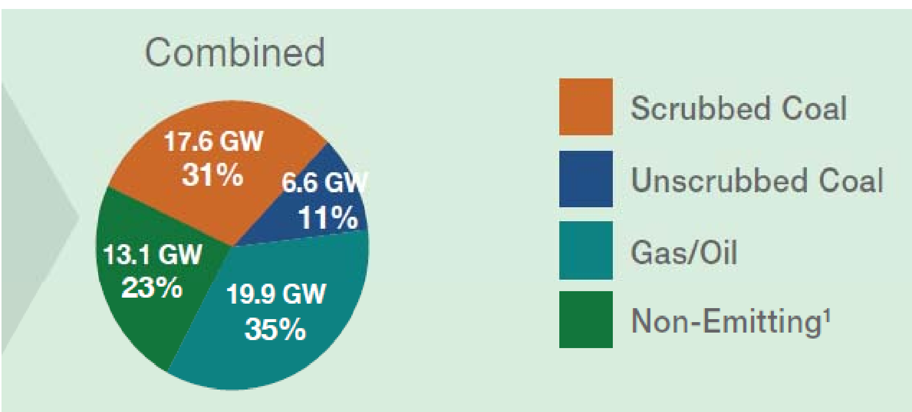
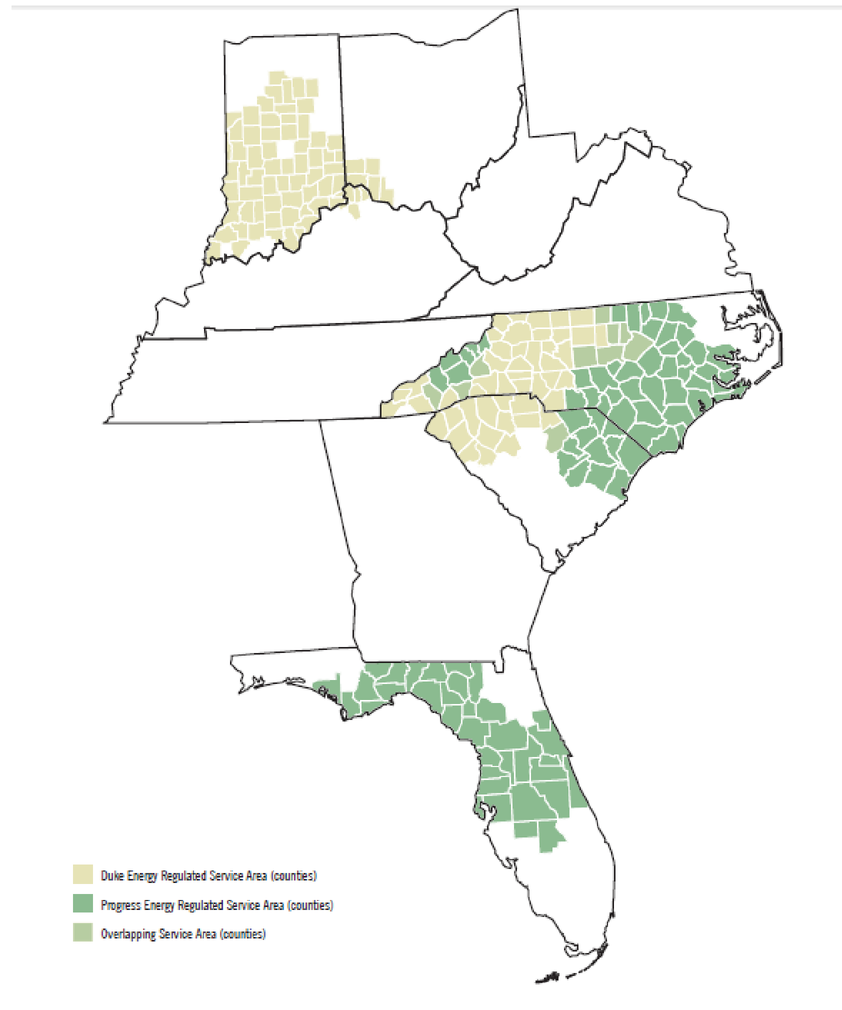
Disclaimer

- Speaking for myself – not Duke Energy
- In some instances numbers are approximations and some data is old.
- Translating from other's work to put forward the generalized views.
- Before citing anything – go to original sources.

What is Duke Energy?

- Serve 22 million people (about 58% of California but across six states)
- 57,700 MW in US
- 4,900 MW in Latin America
- 29,250 employees
- $100 B of assets





Duke Energy Renewables

Wind

- Business model: develop/acquire, build, own and operate utility-scale wind power facilities throughout the U.S.
- 19 operating facilities totaling 1,627 MW

Solar

- Business model: develop/acquire, build, own and operate solar projects throughout the U.S.
  - Primary focus on utility-scale PV projects
  - Also distributed-scale projects through INDU Solar Holdings joint venture with Integrys Energy Services
- 32 operating facilities totaling 81 MWac (net)

And lots of Energy Efficiency

Impact of Complementary Policies on GHG Compliance Strategies

- Within the cap and trade program…
  - Today's price changes generation operations – what generation assets are dispatched/operated to meet demand – if comp pol depress prices, we emit more now
  - The outlook for future prices impacts investment decisions – how much and what kind of low emitting technologies should be built when – need confidence that beyond 2030 will have relatively high prices
  - Comp pols which lower risk of CO2 market unraveling increase confidence in big capital investments --
  - Policies which lower tech risks (thru RDD&D) cause deployment at lower CO2 prices

Two Types of Complementary Policies

- Facilitating
  - Permitting Reform
  - Basic Technology Research
  - Technology Development & Demonstration Subsidies (10 projects, not “30%”)
  - Energy Efficiency Regulatory Reforms
- Competing
  - Renewables Standards
  - Performance Standards
  - Technology Deployment Subsidies (renewables & EE)
    - Using revenues from Cap and Trade program
    - Feed-In Tariffs

Important Clarification

- Complementary policies impact carbon market ONLY when they impact emissions sources already covered by the cap and trade program
- Policies which impact sources NOT in the cap and trade program do not harm the market

- Carbon offset policies help bring emissions sources NOT in the market INTO the market
  - If they are lower cost sources of reductions, will cost effectively lower the cost of the emissions program
  - This is more cost effective than perf standards on these sources

Impact of Complementary Policies on GHG Compliance Strategies

- Generally, Emitters comply regardless of complementary polices – will buy emissions allowances or make emissions reductions, whichever is least costly
- HOWEVER …
  - Low price expectations, investment plans will be less aggressive. Higher, ***politically sustainable*** price expectations, plans will be more aggressive
  - *Anything that changes the longer term price outlook impacts our longer term technology and investment strategy*
  - *If market looks like it will be undone, will cause utilities to hold back*

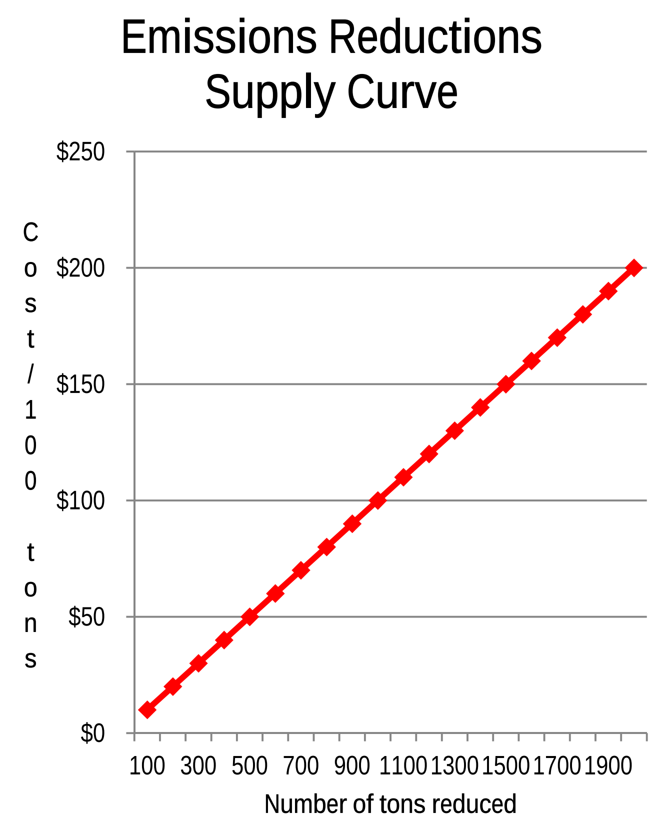
What are the objectives of complementary policies?

- Push favored technologies? "Sure, we want lower emissions. AND we really want all energy from this technology!"
- Address other public policy issues (traffic congestion, local air quality)
- Lower total program costs (meet the objective with smaller economic impact)
- Overcome "market barriers" ("People don't respond to a price signal!")
- Fear of high prices
- Hidden subsidy to those vulnerable to high CO2 prices?

Let's explore Cap and trade with some complementary policies via very simple model

- Example: Cap requires that we reduce emissions by 1000 tons
- Assume:
  - 20 things we can do to reduce emissions, each one reduces 100 tons.
  - The first block of 100 tons cost $10, the second block cost $20, the third block $30 and so on.
  - The market value of these reductions is determined by how much people are willing to pay to avoid the emissions from the activity (<u>assume curve is perfect – no "mispriced opportunities" buried within)</u>
  - The "supply curve" looks like this →

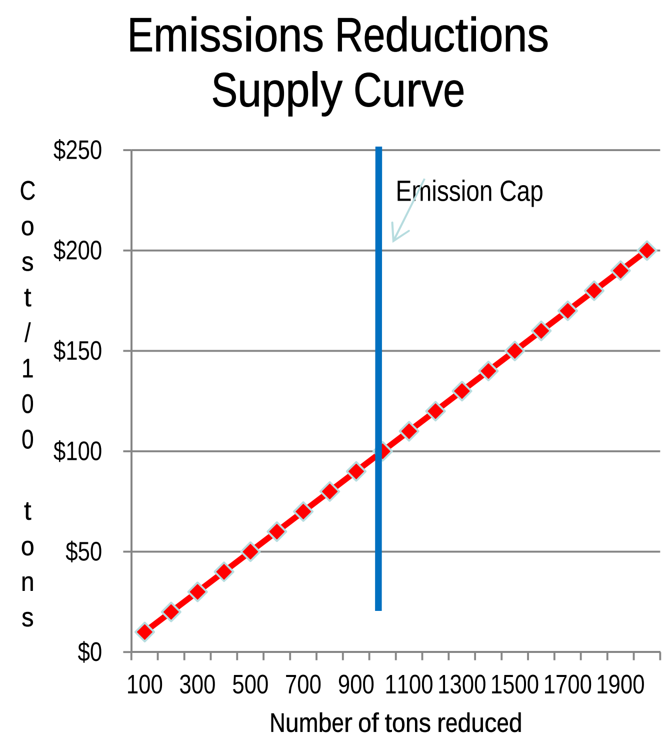
Cost	Cumulative Tons Reduced
$10	100
$20	200
$30	300
$40	400
$50	500
$60	600
$70	700
$80	800
$90	900
$100	1000
$110	1100
$120	1200
$130	1300
$140	1400
$150	1500
$160	1600
$170	1700
$180	1800
$190	1900
$200	2000



Letting the market work
(yellow highlights are reductions pursued)

- Select the least costly options first until reduction target hit. In this case, 1000 tons.
- Adding up the total cost: \$10+\$20+\$30+\$40 … +\$100 = \$550
- Market clearing price for reductions = \$100

Cost	Tons Reduced
\$10	100
\$20	200
\$30	300
\$40	400
\$50	500
\$60	600
\$70	700
\$80	800
\$90	900
\$100	1000
\$110	1100
\$120	1200
\$130	1300
\$140	1400
\$150	1500
\$160	1600
\$170	1700
\$180	1800
\$190	1900
\$200	2000



Now, same target, using only “complementary” policies

- Arbitrarily select reduction options via perf standards – because we lack perfect information, we implement every other one (in yellow) – so miss some less costly options and pursue higher cost possibilities.
- Total cost: 20+40+60+80+100+120+ 140+160+180+$200=$1,110
- Market clearing price for reductions = $0 (no market)
- Similar results to Cap with No Trade

Cost	Tons Reduced
$10	100
$20	200
$30	300
$40	400
$50	500
$60	600
$70	700
$80	800
$90	900
$100	1000
$110	1100
$120	1200
$130	1300
$140	1400
$150	1500
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$170	1700
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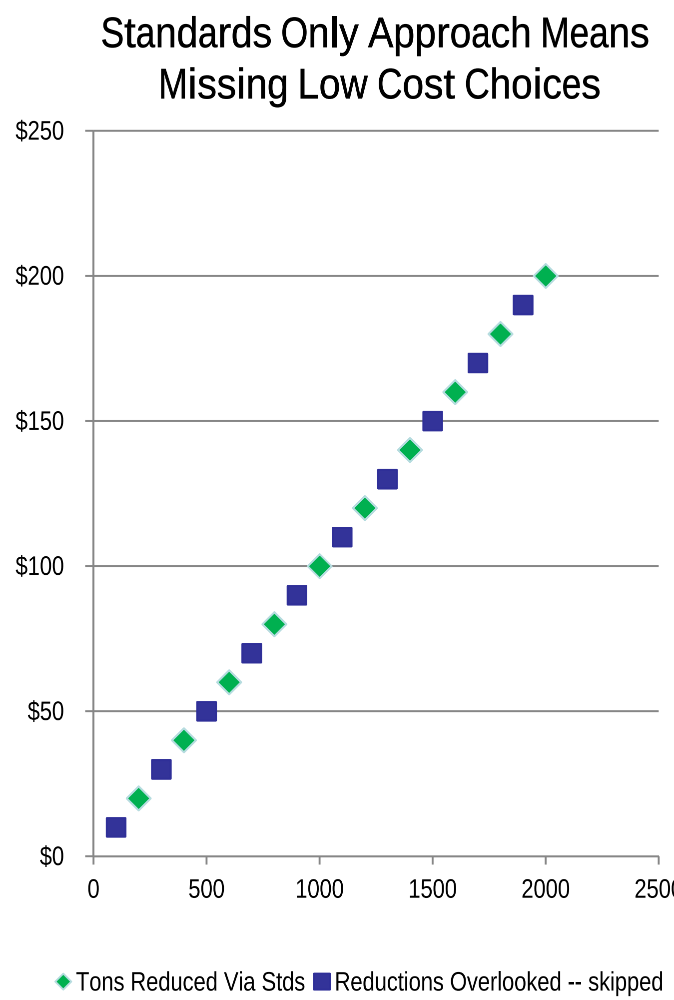
$200	2000



Now, same target, using cap and trade with Complementary policies

- Same 1000 ton cap
- Complementary policies – mandate reduction options via standards (some from middle of supply) for 500 tons of reductions
  - Remember, assumption in this model is that curve is accurate – these "high cost" choices really are high cost
- Use market for other 500
- Total cost (from yellow highlighted reductions): 10+20+30+40+50+100+110+120+130+140=$750
- Market clearing price for reductions = $50
- Standards increase costs while lowering price

Cost	Tons Reduced
$10	100
$20	200
$30	300
$40	400
$50	500
$60	600
$70	700
$80	800
$90	900
$100	1000
$110	1100
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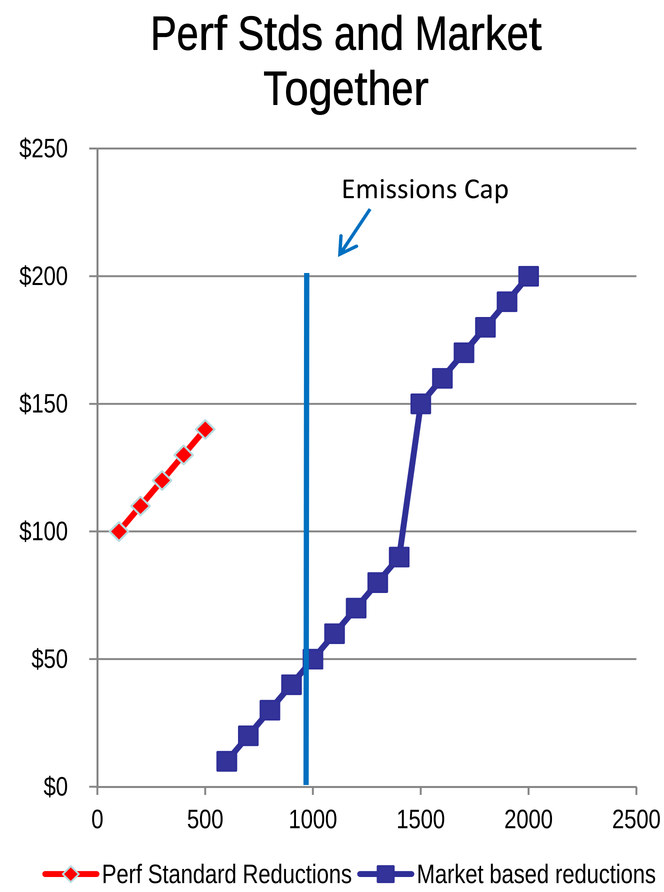

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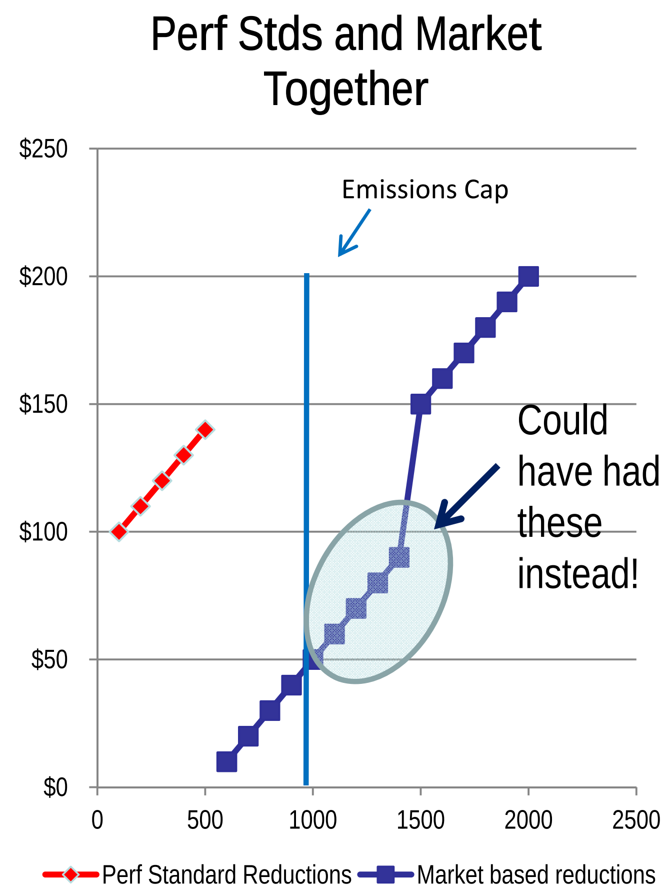
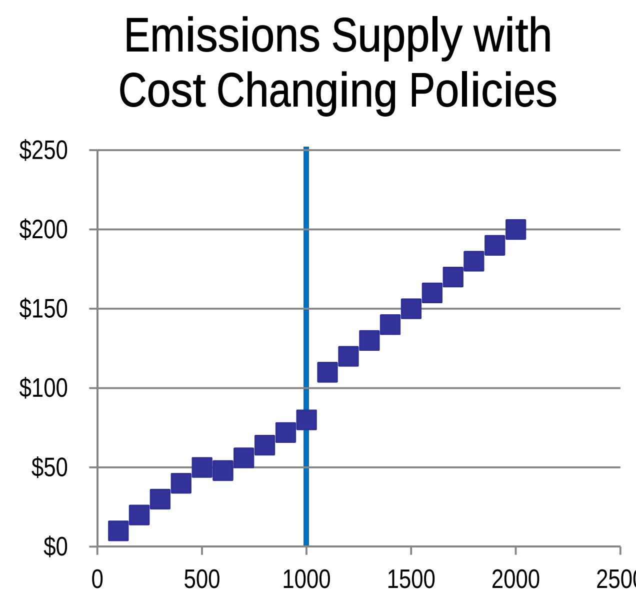


When are Complementary Policies truly Complementary?

- When they SHIFT THE SUPPLY CURVE!
- Investments made to lower the cost of key technologies can significantly impact total cost
- Same 1000 ton cap
- Early demonstration subsidies lower cost of 2nd tier by 20%
- Total cost (from yellow highlighted reductions): 10+20+30+40+50+48+56+64+72+80=$470
- New Market clearing price for reductions = $80
- Technology Development Policies, NOT DEPLOYMENT policies

Cost	Tons Reduced
$10	100
$20	200
$30	300
$40	400
$50	500
$60–12=48	600
$70-14=56	700
$80-16=64	800
$90-18=72	900
$100-20=80	1000
$110	1100
$120	1200
$130	1300
$140	1400
$150	1500
$160	1600
$170	1700
$180	1800
$190	1900
$200	2000



What is your policy objective?

- Keep CO2 prices low? (There are less costly/lower risk ways to do so.)
- Promote favored technologies?
- Minimize total costs?

Policy Choice	Tons Reduced	CO2 Price	Total Cost	"Hidden Cost"
Performance Standards	1000	$0	$1,100	$1,100
"Complementary" Policies + Cap and Trade	1000	$50	$750	$200
Cap and Trade Only	1000	$100	$550	$0
True Comp-lementary, Cost Reducing Policies	1000	$80	$470	*$80 benefit

Other policy objectives may be perfectly justified

- Local Air Quality?
- Traffic Congestion?
- Hidden industrial subsidy? (artificially keeping CO_2 price low to protect/mollify emission intensive industries)
- Political expediency? *If can't achieve support for a market without them, then they become part of "least cost solution"*

My favorites

- Research, Development and Early Deployment of
  - Alternative Nuclear Technologies
  - Small Modular Reactors
  - Carbon Capture and Geologic Sequestration
  - EPRI analysis shows approximate 40% reduction in cost to comply with Waxman-Markey (back when natural gas was expensive) See: http://www.rff.org/Documents/Events/Seminars/First_Wed_Seminars/090915_EPRI_Howard.pdf

- Move to plug-in hybrid vehicles
  - Minimize economy's exposure to global oil price spikes – but this isn't really an emissions policy