Pricing Policies for Long-Run GHG-Reducing Decisions in the Electricity Sector

Lee S. Friedman
Professor of Public Policy
University of California at Berkeley
lfried@berkeley.edu

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Recommendations for California

- 1. The CA Legislature should act soon to create more certainty about the magnitude of GHG reductions that will be required 2020-2030.
- 2. More emphasis during 2015-2030 should be given to expanding partnerships and linkages with other jurisdictions adopting comparable GHG-reduction goals and policies.
- 3. Legislative restrictions that currently prevent most consumers from receiving any carbon price signal in their electricity rates should be revisited, especially as these consumers would receive dividend compensation.
- 4. California should begin soon to transition gradually all of its electricity customers on to time-varying marginal-cost based rate structures.

Outline: Carbon Pricing, Electricity Pricing, and their roles in Reaching CA LR GHG Emission Goals

- I. GHG Reductions will require cleaner electricity and more use of it as a substitute for dirtier fuels
- II. Choose the least-cost ways of reducing GHG emissions to maintain citizen support and to entice other jurisdictions to undertake comparable efforts
- III. Prices in market-based policies must equal social marginal cost in order to serve as good signals (for calculating least-cost ways).
- IV. Four Critical Reasons why prices diverge sharply from social marginal cost and policies to fix them
- V. Summary of Recommendations

I. Reducing GHG Emissions will require a cleaner (more decarbonized) electricity supply and greater use of it as a substitute for more carbon-intensive fuels

- But how quickly do we decarbonize?
- Which fossil-fueled activities do we switch to electricity, and when do we switch them?
- Who decides the answers to these questions?

II. Meet the environmental goal by choosing the least-costly set of GHG reducing actions

- Important for maintaining popular support, and encouraging other jurisdictions to act comparably
- Complications:
  - Great cost uncertainty
    - The amount of “inexpensive” energy efficiency improvements
    - The highly uneven pace of technological progress, a crucial source of cost reductions (PV prices dramatically lower in just a few years > $.30/kWh in 2008 but $.09/kWh in 2012)
    - The pace of linkages with non-California jurisdictions (a cost-reducing force) (Quebec to be linked soon, Australia a future possibility)
  - Who has best knowledge to decide? Huge variation in this provides strong rationale for an array of policies including market-based instruments like cap-and-trade that establish the carbon price signal.
- Market allowance prices signal the cost limit for identifying GHG-reducing actions that are efficient. The same signal applies to government decision-makers as well

Choose least-cost GHG-reducing actions (cont.)

- Short- and Long-Run Decisions
  - Short-run decisions refer to emissions-making energy usage decisions given the stock of capital (e.g. which generators to run, the thermostat setting in a factory).
  - Long-run decisions refer to changes in the emissions-making capital stock over time (e.g. what types of generators to build and to retire, replacing the factory's HVAC system)
  - Efficient short-run decisions are based on the current allowance price.
  - Efficient long-run decisions are based on the expectations of the future price path of allowances over the life of the capital
  - An efficient long-run abatement is one in which the present discounted value of the allowance savings exceeds the present discounted value of the abatement costs. (cost-benefit analysis)
- What might the price path look like?
  - Major federal effort, large team of economists from more than 12 federal agencies, report on the "social cost of carbon" to be used in valuing CO2e emissions reductions.

Carbon Price Paths based on Federal Social Cost of Carbon Study (revised 2013)

	2010	2030	2050
High Discount Estimate	$11	$16	$27
Central Estimate 1	$33	$52	$71
Central Estimate 2	$52	$76	$98
95th Percentile Adverse	$90	$159	$221

Notes

Estimates averages from DICE (Nordhaus), PAGE (Hope), and FUND (Tol) integrated assessment models
High Discount: 5%
Central 1: 2.5%
Central 2: 3.0%
95th Adverse (at 3.0%)

Choosing Least-cost GHG-Reducing Actions (cont.)

- Suppose the central price paths in the table applied as the plausible range for CA GHG allowances
- Much building retrofitting is $80/ton of CO_2e more than the same abatement during initial construction. These technically-possible but expensive actions are not likely to be efficient at all until near or after 2050, let alone 2030.
- Similarly, any very expensive effort necessary to completely decarbonize CA electricity (get rid of all natural gas ancillary services) not likely to be efficient <2030 or <2050.
- Of course many retrofitting actions, and some decarbonization of ancillary services, will be efficient.
- Note funding innovative demonstration projects may be expensive initially but hold the promise of substantially lowered costs by learning from the demonstrations
- To the extent that California governments mandate or try to encourage GHG-reducing actions, they have the responsibility to make sure they are recommending efficient ones.
  - Otherwise it causes the cost of reducing GHG emissions to be higher than necessary, jeopardizing the support of Californians for continuing along the emissions-reducing path, and discouraging by its costliness other jurisdictions from joining in this critical task.

III. Prices must equal social marginal cost in order to serve as good signals

- In workably competitive industries without major externalities, prices generally approximate social marginal cost and anyone can use them to compare alternatives and identify the least-cost choice
- Problems with prices arise in sectors that are not workably competitive.
  - One common market failure is the presence of substantial external effects, as when GHG emissions can be made with no cost or limit to the emitter.
  - Another common market failure is due to economies of scale that lead to natural monopoly. In natural monopolies, marginal costs and average costs diverge. Average cost pricing keeps the natural monopoly whole, but such prices are not good indicators of social costs.
  - The electricity sector has both of these conditions, and they cause problems in relying upon its prices for calculating the actual social cost of GHG reductions

IV. Four Critical Reasons why prices diverge sharply from social marginal cost and policies to fix them

- A. Expected Future GHG Allowance Prices are Unnecessarily Low and Deter Important LR GHG-Reducing Investments
  - Long-run investments consider likelihood of different allowance paths for as much as a 30-year period, to see if savings from emissions reductions will more than repay the upfront capital abatement costs.
  - No legislation ensures that CA GHG reductions will continue beyond 2020. Rational investors will reject in 2015-2020 many emissions-reducing LR investments that they would undertake if there was more certainty.
  - CARB could in its 2013 Scoping Plan suggest a process leading to legislative approval by 2015 of California GHG reduction goals for the 2021-2030 period.

IV. Four Critical Reasons (why prices need fixing) (cont.)

- B. GHG Allowance Prices, due to the global nature of the problem, need to become based increasingly on GHG reduction costs in a wider-than-California market
  - CA should give added weight to encouraging partnerships and linkages with other jurisdictions that have comparable policies and goals. These create new opportunities to reduce allowance costs and new opportunities for green entrepreneurs.
  - CARB seems alert to this, as evidenced by linkage with Quebec, WCI leadership and info-sharing partnership with Australia.
  - New federal GHG reduction initiative may enable many more state linkage possibilities (e.g. among state cap-trade programs that may be initiated)
  - By 2030, CA should achieve many more formal linkages

IV. Four Critical Reasons why prices need fixing (cont.)

- C. The Carbon Price Signal needs to be in Electricity Rates
  - The carbon price that is created through allowances should get translated properly as a cost component into the myriad of goods and services that it affects.
  - For electricity, SB695 essentially prevents this signal to the state's 10.2 million IOU residential customers.
    - Retail electricity distributors in 2013 will receive about $891 million in allowance proceeds to be used for the benefit of their ratepayers, about $87 per residence.
    - The CPUC wishes to raise volumetric electricity rates including residential rates by the allowance costs—providing the carbon price signal—and simultaneously compensate with twice-yearly dividend credits to the residential customers that will be the primary bearers of the allowance costs.
    - SB695 prevents the pass-through on Tiers 1 and 2 of the residential rate structure, even though these represent 64% of all residential kWhs
    - The SB695 restriction should be revisited by the legislature

IV. Four Critical Reasons (why prices need fixing)

- D. Retail electricity prices are far from marginal costs, apart from the treatment of GHG allowances
  - The retail electricity distributor is a natural monopoly with substantial fixed costs. This means that marginal cost (MC) is below average cost (AC).
  - Most common practice to ignore efficiency and price at AC.
  - But very big differences in MC of service both by time of day and by season (often >10x). ($MC_{peak} > AC > MC_{offpeak}$)
  - Many California residences under its tiered system face rates of $.30-.40 per kWh even in the middle of the night, when the marginal social cost of that electricity is generally below $.05 per kWh.
  - There is a further magnification of this problem because GHG emissions per kWh also vary enormously over time of day as well as seasonally, and it is critical to have prices that reflect or signal these differences.
    - Two independent studies [McCarthy and Yang (2010), Zivin, Kotchen and Mansur (2012)] find that marginal GHG emissions caused by California electricity demand were generally 25-35% greater during peak hours than during offpeak hours

Consequences of Retail Electricity Prices Unrelated to Marginal Costs

- Vehicle electrification is an important method for achieving California's GHG reduction goals, but this is certainly not going to happen under current electricity rates that make such electrification 6-8 times more expensive than it should be.
- Demand response participation, end-user storage, and grid supply from distributed generation (e.g. solar) all are inadequately low for the same basic reason: the asymmetry between retail and wholesale prices gives end users too little incentive to participate in these options.
  - The advent of the "smart grid" is making it easier and easier as a technological matter for customers to participate in these GHG-reducing activities, but they need incentive as well.
  - If customers faced peak-period rates, they would be more interested in
    - conserving during this period and joining demand response programs.
    - storage batteries to "tank up" in the offpeak and use the batteries to avoid peak charges. These could be free-standing or in appliances (like in EVs).
    - solar installations that generate excess electricity during the peak—with marginal-cost based net metering rates
- The pricing part of the solution to all of these issues is widespread time-varying rates.
- There are many options for making this transition gradually.
  - Connecticut: makes time-varying rates mandatory for all.
  - Change the default rate to be time-varying, and close the traditional time-invariant rate to any new customers.

My preference for a new rate design: HOOP electricity pricing

- HOOP: Household On and Off Peak pricing: volumetric rates at time-varying marginal costs, fixed costs raised by graduated annual connection charges.
- Graduated fees are similar to the all-fixed-cost cellular phone pricing observed in the market
- Difference is that in electricity only about 30% of costs are fixed (raised by the graduated fees) with 70% raised by volumetric marginal-cost based rates.
- Options could include standard TOU, critical peak pricing, and real-time pricing

Cellular Phone and HOOP Electricity Pricing Compared

AT&T Actual*		Electric Utility**	Peak 2-7 30¢ Offpeak 5¢
Size (Minutes/Month)	Monthly Fee	Size (Annual kWh)	Monthly Fee
450	59.99	2000	5.23
900	79.99	4000	11.09
1350	99.99	6000	17.48
2000	119.99	8000	24.52
4000	169.99	10,000	32.15
6000	219.99	12,000	39.13

*AT&T Nation with Canada Plans as of 7/19/13
**Calculations in Friedman “Consumer-Friendly and Environmentally-Sound Electricity Rates for the Twenty-First Century” at http://gsppi.berkeley.edu/faculty/lfriedman/lee-s-friedman

V. Summary of Recommendations

- (1) the state should confirm a credible commitment by 2015 to the continued reduction of GHG emissions beyond 2020, with specific goals for the 2020-2030 period, so that CA investors will be (more) willing to make large long-run investments that reduce emissions
- (2) the state should give more emphasis during 2015-2030 to expanding partnerships and linkages with other jurisdictions adopting comparable GHG-reduction goals and policies
- (3) the carbon price signal from GHG allowances should be made visible to retail electricity customers, with compensation for the cost increase through dividend credits
- (4) there must be much more widespread use of time-varying retail electricity rates based on marginal costs.

Thanks!

- This presentation is based upon the report by Lee S. Friedman “Electricity Pricing and Electrification for Efficient Greenhouse Gas Reductions.” Done in collaboration with the California Council on Science and Technology and Next 10, it is available at: http://next10.org/sparking-ca
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