CALIFORNIA MARKET DESIGN INSIGHT

from Andy Van Horn & Ed Remedios

In 2008, California and other states are planning to adopt regulatory frameworks to govern their future emissions of greenhouse gases. There are three potential cap and trade market designs for the electric power sector:

1) source-based,

2) load-based, and

3) first-seller/deliverer,

This article considers how well each cap and trade design would meet several basic objectives of environmental markets, including the capability to provide the incentives needed for the development, deployment and utilization of new and innovative technologies. An array of improved technologies will be essential to achieve significant reductions in the emissions of global greenhouse gases.

The Competing Proposals

In a source-based market electric generators that burn fossil fuels will be the affected sources or, in other words, the point of regulation. An affected source must comply with GHG regulations by acquiring and surrendering emissions allowances (EAs) for each ton of emissions. As the number of allowances issued declines over time, so will emissions. In a load-based regulatory approach the regulated entities that must comply are the Load Serving Entities (LSEs). LSEs are companies that generate or buy and then deliver electricity to their customers, i.e., the load, which are mostly electric utilities. In a first-seller/deliverer market, the regulated first-seller/deliverer is the entity that first sells or delivers electric power into the state where that power is subsequently sold to end-users.

Experience with cap and trade markets in the U.S., U.K. and Europe, tells us that these three market designs are likely to have *significantly different* effects on the development and deployment of new and cleaner technologies. In general, investments in improved and innovative technologies will be most likely to occur if the costs of GHG are clearly valued and internalized in the prices of the outputs or services provided by these technologies. Technologies suitable for global deployment will have greater opportunities for funding, demonstration and ultimate success than technologies developed to meet only localized market needs. Regional market design should encourage access to global markets by allowing verified "offset" projects that utilize new technologies and will move them more rapidly along their developmental learning curves.

Competitive markets should have many buyers and many sellers. The strengths and shortcomings of source-based markets have been tested in practice, while there are many shortcomings of the load-based approach that will make this market design more costly and not scalable up to multi-state or regional coverage levels. The first-seller/deliverer approach is a hybrid of these two market designs and is expected to have impacts falling in between the effects expected for the other two approaches.

The comparisons of each market design show that a load-based system would be more complex, costly and inaccurate than either a source-based or a first-seller market design. As a result, clearer market signals to buyers and sellers and increased incentives for technological innovation are more likely under the source-based and first-seller/deliverer market designs. Therefore, to comply with California's Assembly Bill No. 32 (AB 32) passed in 2006, we recommend that California and other western states adopt an integrated, source-based cap and trade system with broad enough geographic coverage to include most of the power sources now serving California and other western LSEs. As a second choice, which would incur unnecessary costs prior to the transition to a national cap and trade system, we recommend that California and other western states adopt a first-seller/deliverer market design with provisions for replacing it with a regional or national source-based system.

Objectives for GHG Cap and Trade Market Design

The primary objective for creating a GHG cap and trade market is to:

• Reduce regional GHG emissions to levels set by emission tonnage caps in an efficient and cost-effective manner.

In general, GHG reductions will occur, if a market design properly internalizes the costs of GHG emissions in the prices of goods and services. Entities under a cap and trade approach must pass along their compliance costs, so that all market participants (emitters, consumers and market intermediaries) receive proper price signals. Then emitters, intermediaries and consumers can select the most economically efficient products that include environment-related costs. Cap and trade provides emitters with an effective market mechanism to reduce their own GHG compliance costs by trading EAs when it is economic to do so. By reducing emissions to meet a cap regulated by EAs, products can become more cost-competitive and environmentally friendly. An effectively designed cap and trade market will internalize the costs of GHG and operate efficiently, while a failed U.S. or California market design could cause a global loss of confidence in emissions markets and global carbon reduction goals.

Comparison of Three Cap and Trade Market Designs

A multitude of decisions must be made by investors to create and commercialize new technologies and by consumers to adopt and bring them into widespread use. In the best case, emission regulations should encourage the adoption of better technologies, and, at worst, should not impede their adoption by masking

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the value of lower emitting technologies. The choice of market design will have important effects on technology investment and development. The table below summarizes the capability of each market design to achieve the important objectives listed in the first row.

The Goal: Clear Market Price Signals

In any competitive market, price signals are the basic driving forces that influence investment and operating decisions. Proper implementation and execution of a cap-and-trade system will send such price signals. Additionally, EAs need to be scarce enough to limit supply and warrant a price that is significant enough to encourage investments. Minimizing the price volatility of EAs will also encourage long-term investments.

Source-based market design

In this established market design, regulated emission sources are the entities that must comply with emission caps and, thus, affect market price signals by either buying or selling or banking allowances. GHG sources must comply by acquiring and surrendering the number of allowances needed to cover their emissions during a designated compliance period, e.g., over one year. Each source faces marginal compliance costs that equal its own marginal costs of reducing a ton of GHG or the price of purchasing a GHG EA in the allowance market, whichever is less.

The source-based design is the most straightforward and provides the clearest, most transparent and direct market signals. It also is the market design applied in successful emissions markets to date, such as

Comparison of Greenhouse Gas Market Designs- Source-based, Load-based and First-Seller/Deliverer

Objective: / Market Design:	Initiates clear market price signals for greenhouse gases (GHG)	Creates a uniform and stable GHG allowance price	Maintains the verified environmental integrity of emissions allowances (EAs)	Promotes research, development and demonstration (RD&D)	Provides incentives to purchase and use lower emitting technologies	Keeps monitoring, administration, and transaction costs low
Source-based	Changes supply curve: GHG EA costs internalized in kWh prices, allowing pass through of costs to all buyers, such as Load Serving Entities (LSEs). Markets can be linked globally.	Buyers will see internalized GHG price signals from those emitters covered by a cap. A uniform market clearing price will be created for EAs, and inter-regional trades will occur.	Source-based monitoring, tracking system and verification protocols provide ongoing integrity for EAs and certified emission reductions (CERs) at individual sources.	Sources must acquire sufficient GHG allowances to cover emissions and over time must find ways to reduce GHG. Regulated sources may fund some R&D, but will primarily own/buy new technologies.	Reducing costs of compliance with declining EA allocations over time provides incentives to develop, buy and operate improved lower-emitting technologies.	Systems and procedures are proven & tested. These costs should be reasonably low for sources that are already regulated for other emissions.
Load-based	Changes demand curve only from regulated buyers. Price signals to ratepayers and EA price signals from LSEs to power providers will be different.	Cap applies only to regulated LSEs - not to sources. Unregulated emitters might evade the cap by selling to unregulated LSEs elsewhere in the western region.	Imputed GHG from out-of-state (OOS) & system sources will lack environmental integrity. All EAs could be price discounted or not tradable OOS.	LSEs are not usually the direct buyers of improved GHG emitting technologies. Less incentive to fund R&D, since EA costs passed thru to ratepayers.	Unless they own emission sources, regulated LSEs are not likely purchasers of low emitting, supply-side technologies, but will buy from cleaner sources.	Very high administrative and tracking costs unless emissions from out-of-state are imputed. Cross-checks needed. Not fully MRTU compatible.
First-Seller/ Deliverer	First-deliverer sends market price signal to LSEs and to emitters. First-deliverer may be an emitter or a market intermediary.	In-state sources & first-deliverers would create a uniform EA price, but must compete with OOS power sources selling to buyers outside of capped region.	Hybrid compliance market. In-state EAs verifiable; out-of-state not tracked as accurately, resulting in discounted prices for all CA allowances.	If first-deliverer is an emitter, then EAs give some incentive to fund R&D and to buy innovative & new technologies. If it is a marketer/reseller, probably not.	If first-deliverer is an emitter, then declining EAs will provide some incentive. LSEs & others will prefer to buy power from cleaner plants.	High costs, since brokers will have difficulty forecasting their EA needs and tracking & allocating the GHG content of their power imports and resales.

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Comparison of Greenhouse Gas Market Designs- Source-based, Load-based and First-Seller/Deliverer *continued*

Objective: / Market Design:	Minimizes overall costs of compliance	Enhances Environmental Justice (EJ)	Keeps basic rules & functions simple and enforceable	Avoids unintended consequences	Enables timely transition to a regional or national cap and trade system & is scalable in size	Satisfies requirements under California Assembly Bill: AB 32
Source-based	Provides greatest source diversity and EA trading opportunities to reduce overall compliance costs. Most easily linked to & consistent with RGGI* and EU ETS* designs.	Provides some incentive to develop new technologies & to replace existing higher emitting urban plants. Thus, should be EJ preference, but is not now.	Scalable up in size. Source specific rules and incentives to comply are the simplest. GHG emitted is easier to measure, track, verify and enforce.	Will internalize GHG costs most efficiently, leading to fewer market surprises and fewer "gaming" opportunities and better compliance with declining emissions caps.	Used for today's successful SO2, NOx & EU ETS GHG cap and trade programs. Will likely be the U.S. national system. Transition would be easiest. Global trading also viable.	Yes, but only if most states in Western Electric Coordinating Council (WECC) selling power to CA adopt source-based reporting standards and a GHG cap.
Load-based	Highest in costs due to fewer LSEs, fewer verified EAs and fewer trades plus high admin costs. Some market power concerns. Not easily linked to RGGI or EU ETS or nation.	Could lead to earlier replacement of urban plants than costly command & control regulation. But existing plants will remain longer than under source-based cap & trade design.	Not scalable up in size to WECC or nation, due to exponential growth in # of transactions as more LSEs are included. Imputed GHG not verifiable – a ton may not be a ton.	Will encourage "contract shuffling" and "contract squabbling" and discourage power imports to CA utilities, possibly causing higher CA and WECC prices, as in 2000-2001.	Not scalable up in size to cover a multi-state region. Not easily transferable to a source-based system. Wasted time, effort and money, when a national system is adopted.	Yes, but only on an imputed index basis, due to need to impute GHG emissions from imported power to each state, which can not be tracked accurately or cross-verified.
First-Seller/ Deliverer	Will be higher in cost than a source-based system, but lower in cost than a load-based design.	All three cap and trade market designs are more likely to replace urban plants than more costly command & control GHG regs.	Similar in many respects to a source-based design but with difficulties for out-of-state first-deliverers selling imported power.	Marketers and out-of-state power plants may choose to sell to buyers in unregulated states, causing higher CA prices.	First-deliverer compliance systems and procedures will be more easily transferable than would a load-based system.	Yes, on an index basis, but only if all first-sellers/ deliverers can accurately verify & allocate GHG emissions to each transaction.

**RGGI = Regional Greenhouse Gas Initiative, states in the U.S. northeast starting a source-based GHG market in 2009. EU ETS = European*

the U.S. markets for sulfur dioxide (SO2) and nitrogen oxides (NOx) and the European Union Emissions Trading Scheme (EU ETS) for GHG. A source-based cap and trade market works best for large geographic areas encompassing many sources with a range of costs to control or reduce their emissions.

Load-based market design

This market design was proposed, because the electricity purchases of investor-owned electric utilities (IOUs), which are the predominant Load-Serving Entities (LSEs), are regulated by state public utility commissions (PUCs). If it is authorized to do so by state law, a state can create an allowance system, issue a limited number of allowances and require its regulated LSEs to surrender allowances associated with the GHG content of their power purchases and generation. In this market design LSEs, not emissions sources, are the originators of price signals. Since power generators do not need to acquire any allowances, generators will not embed allowance prices in their power sales prices.

The GHG price signal sent from individual regulated LSEs to electric generators that are not under contract may be partially or fully avoided by those generators selling to unregulated LSEs and to market brokers. Unlike a source-based market where the allowance price will provide an incentive for all GHG emitting generators to reduce their emissions, the LSE's market signal

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in a load-based market will not provide inframarginal generators with an incentive to reduce their GHG emissions. In addition, today's price responsive practices in power markets, including exchanges and purchases of ancillary services, may have to be artificially modified, in order to reflect the load-based price of allowances.

As in the other market designs, the downstream GHG price signal to consumers will be controlled by public utility commissions that devise different rate schedules for specific customer classes.

First-seller/deliverer market design

The first-seller/deliverer approach is a hybrid approach, depending on whether an emissions source is located inside or outside of California. The EA price signal for sources within California will be source-based. For sources outside California, the compliance responsibility lies with the first-deliverer of the power to a California location or entity. As the size of a regulated first-seller/deliverer market increases, so that most potential sources are included, allowance prices and electricity market signals should be similar to a source-based system, but with the difficulties of tracking and compliance placed on the first-seller/deliverer. These difficulties will grow in complexity as more generators sell into a first-seller's supply portfolio

Simplicity of Rules and Ease of Enforcement

A workable market design will require a system for enforcement, including penalties for emissions exceeding the allowances surrendered and for faulty measurement or misreporting emissions. Under a source-based market design the generator/emissions source will be responsible for measurement, reporting and allowance compliance. With a load-based or a first-seller/deliver market design, the LSE or the seller/deliver would likely have contractual arrangements that ensured they would not be held responsible for violations by the generator. Generators would still need to measure and report emissions content to market intermediaries, which would then pass on this data to the LSE or the first-deliverer. The compliance burden on sources to allocate emissions during each hour and then track them through the grid will be more difficult than providing quarterly reports of hourly emissions, as is done now. The assignment and verification of emissions is far simpler under a source-based approach. Certainly, enforcement would be easiest and transaction costs would be lowest with a source-based market design.

As experience has demonstrated, over-regulated markets are prone to unintended consequences, since the desire to control market outcomes can lead to undesirable effects. California has only to look back to the years 2000 and 2001 to realize that poor regulatory designs can have serious adverse effects, leading to consequences that may have been foreseeable, but were certainly unintended.

In a load-based market the difficulties of measuring, allocating, tracking, aggregating and verifying emissions for power sold to LSEs would grow exponentially as more and more LSEs and transactions are included. In the California Independent Systems Operator (CAISO) control area alone, there are 15,000 transactions per hour with 99 load schedules and 800 to 1,000 custody exchanges per hour between market participants. The CA ISO is one of 34 control areas in the western grid. A load-based approach cannot be practically scaled up to regional or national levels. In contrast, a source-based approach can be scaled up, since the responsibilities lie with each regulated source. Currently, all major proposals for U.S. national cap and trade legislation rely on a source-based market design.

Conclusions

In a longer version of this paper available on the VHC website, we discuss the capabilities of each market design to achieve each of the following important market objectives:

- Clear market price signals,
- Uniform and stable GHG allowance prices,
- Verified environmental integrity,
- Sufficient incentives for RD&D, purchase and use of improved technologies,
- Minimized monitoring, administrative, transaction and overall costs of compliance,
- Enhancement of environmental justice goals,
- Simplicity of rules and ease of enforcement,
- Acceptable magnitude and likelihood of unintended consequences,
- Scalable in size and enables a timely transition to a large regional or national market,

Overall, a regulated source-based market is more likely to achieve the above objectives than the other two market design options. With respect to technology incentives, the comparisons show that a source-based market with its clearer valuation of competitive allowance prices and its better internalization of costs in market prices would provide better incentives for the development and application of new technologies than either a first-seller/deliverer approach or a load-based design. In turn, a first-seller/deliverer approach is preferable to a load-based approach.

Several reasons why a source-based market design should be preferred are:

1) A source-based market design is simpler, and its implementation will have lower costs and lead to faster implementation.

2) Source-based emission reductions can be more accurately tracked and verified. In any case the responsibility for monitoring and accurate reporting will be placed on emissions sources, even if a load-based market design is adopted.

3) The environmental integrity of emissions allowances is greater in a source-based market than in a first-seller/deliverer market, which in turn, is higher than in a load-based market.

4) Incentives to purchase and utilize improved, lower emitting technologies will be greater under a source-based approach than under either the load-based or the first-seller deliverer approaches, and

5) The transition to a national source-based cap and trade market will be easier, faster and less costly, if states adopt a compatible source-based approach.

Editors Note: *Andy Van Horn and Ed Remedios have been engaged in California and national electricity market issues for many decades and are experts in electricity, natural gas and emissions markets and regulations. This article is extracted from a longer paper entitled "A Comparison of Three Cap and Trade Market Designs and Incentives for New Technologies to Reduce Greenhouse Gases." It is available on Van Horn Consulting's website: www.vhcenergy.com under Selected Documents and Example Working Papers. Andy can be contacted at andy.vanhorn@vhcenergy.com.*