

Cap-and-Trade: Five Implications for Transportation Planners

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ABSTRACT

This paper identifies five key implications for transportation planners of extending cap-and-trade for greenhouse gas emissions to the transportation sector, as envisaged in legislative and regulatory proposals in the U.S. Congress and the Western states and Canadian provinces. First, cap-and-trade would increase gasoline prices as refiners and fuel importers pass on the cost of carbon allowances; a \$30 per metric ton price of carbon allowances equates to 27 cents per gallon of gasoline. Second, transit, smart growth and other emission reduction projects may be eligible for billions of dollars in revenue from carbon allowance auctions. Third, as emissions would be constrained at the level of the cap, transportation projects would be unlikely to have any impact on aggregate emissions. Any environmental benefit of projects (reduced emissions) would be converted into an economic benefit (reduced carbon allowance prices and thus reduced compliance costs in other sectors). Fourth, the converse of this argument suggests a weakening of the potential to use the environmental review process to mitigate emissions from development projects. There may be an economic impact (higher carbon allowance prices), but not an environmental impact (emissions would be constrained at the level of the cap). Finally, extending cap-and-trade to the transportation sector eliminates the potential for revenue from the sale of offsets, as this would double count emission reductions.

INTRODUCTION

Cap-and-trade and other carbon trading programs may seem far removed from the central concerns of transportation planners. Typically, these initiatives focus on emissions from electricity generation and large industrial facilities. The latest generation of cap-and-trade proposals, however, would extend to the transportation sector, with a series of implications for planners' own efforts to reduce emissions. In particular, cap-and-trade brings the potential to increase the cost of driving and provide billions of dollars for transit and smart growth investment. At the same time, it affects the ability of transportation projects to achieve aggregate emission reductions.

Cap-and-trade is a centerpiece of many proposals to reduce greenhouse gas emissions in the United States. It is featured in various (as yet unsuccessful) bills in the U.S. Congress, including the Lieberman-Warner Climate Security Act which may form the basis for subsequent legislation; the draft scoping plan issued by the California Air Resources Board [1]; the Western Climate Initiative coalition of U.S. states and Canadian provinces; and the Regional Greenhouse Gas Initiative (RGGI) in the northeastern states.

These proposals would be far from the first to implement cap-and-trade. The Acid Rain Trading Program, often cited as the most successful example to date, was implemented in 1995 [2]; other emission trading programs include those for the phase-out of lead in gasoline, and the RECLAIM scheme for oxides of nitrogen and sulfur in Southern California [3]. For greenhouse gases, the European Emissions Trading Scheme (ETS) was implemented in 2005.

These earlier initiatives usually focused on stationary sources to the exclusion of the transportation sector. (Some exceptions include the phase-out of lead in gasoline and Mobile Source Emission Reduction Credits under the Clean Air Act.) In Europe, the ETS does not extend to transportation, but covers point sources in four main sectors: energy; iron and steel; minerals; and pulp and paper.

In contrast, most federal legislative proposals and the California draft scoping plan (although not RGGI) would include the transportation sector under the greenhouse gas emissions cap via an upstream design (defined in the following section). A similar approach is proposed in Australia [4]. This paper discusses the most significant impacts for transportation planners:

- i. Increased fuel prices;
- ii. Potential revenue for transit and other measures to reduce vehicle travel;
- iii. Conversion of emission reductions from an environmental to an economic benefit;
- iv. Complications in applying environmental review to greenhouse gas emissions; and
- v. Elimination of the potential for transportation offsets

These results are simple to derive from basic economic theory; therefore, this paper does not provide detailed analytic proofs or seek to extend the theoretical models. Rather, it aims to provide a synthesis and overview for transportation planners. The paper begins with a brief primer on cap-and-trade. It then discusses each of the five implications in turn.

Some of the implications – particularly higher gasoline prices and potential revenue – may be welcome news for transportation planners. Others, such as the conversion of environmental to economic benefits and the elimination of the potential for offsets, may be viewed less positively. However, much depends on the level at which the cap on aggregate

emissions is set. A loose cap may reduce the options available to transportation planners while bringing few emission reduction benefits, while a lower, more stringent cap would make the equation more attractive to planners intent on achieving emission reduction goals.

CAP-AND-TRADE: A BRIEF PRIMER

There are two elements of a cap-and-trade system for greenhouse gas emissions (for a more complete introduction to cap-and-trade, see [3, 5]). The first element, the cap, provides an aggregate limit on emissions. The regulator issues a limited number of allowances (sometimes called permits) equivalent to the cap, and covered entities such as electricity generation plants must surrender one allowance back to the regulator for each unit of greenhouse gas emissions. Typically, one allowance gives a covered entity the right to emit one metric ton of carbon dioxide equivalent. Initially, regulators can give away allowances for free to emitters or other entities; auction them; or choose a hybrid of these two approaches.

The second element, the trade, provides the opportunity for emissions to be reduced to the level of the cap at the lowest cost. Assuming the cap is a binding constraint on emissions, the allowances gain scarcity value. If allowances are trading at \$30, then emitters will find it cheaper to implement any emission reduction measures that cost less than \$30 per metric ton. Thus, given heterogeneity in the cost of emissions reductions across the economy, some firms will find it cheaper to abate emissions, while others will find it cheaper to purchase permits. Trading maximizes economic efficiency through equalizing the marginal cost of emission reductions across the economy. This is a key advantage of a broad-based cap rather than more limited programs, as at least in theory it equalizes the marginal cost between sectors such as transportation and electricity generation.

Extending a cap-and-trade system to the transportation sector entails a fundamental decision on the point of regulation, i.e. the entities that are required to surrender carbon allowances based on emissions. Options include downstream trading based on individual households; a vehicle-manufacturer-based system; or the Municipal Mobility Manager, a local government-based system [6-8]. Most current proposals, however, opt for an upstream design. This would require refineries and fuel importers, or the entities that remit fuel taxes, to surrender carbon allowances equivalent to the carbon content of the fuel they sell. In effect, refineries would purchase allowances on behalf of the final emitters – households, freight carriers and other businesses. The analysis in this paper assumes an upstream design; conclusions may differ if another point of regulation is chosen.

Two of the main attractions of an upstream design for transportation are complete coverage and administrative simplicity. There are a limited number of refineries and fuel importers, and fuel deliveries are already closely tracked for taxation purposes. Upstream trading is a feature of much of the proposed cap-and-trade legislation in the U.S. Congress, including the Lieberman-Warner bill, which would have required covered facilities to surrender allowances based on the carbon content of fuel produced or imported. The Western Climate Initiative, which includes California, proposes a cap-and-trade system that would include an upstream cap for transportation from 2015. Including transportation was a recommendation of the California Market Advisory Committee [9], which concluded that this could augment vehicle efficiency and low-carbon fuels standards, and yield cost savings and liquidity benefits from a broader scope of cap-and-trade. And while the European Emissions Trading Scheme does not currently include transportation, there have been calls for its extension to the sector via an upstream cap [10, 11].

IMPLICATION 1: FUEL PRICES

Higher gasoline and diesel prices are the most direct implication of an upstream cap-and-trade system that covers transportation. As discussed above, refineries and fuel importers would need to purchase allowances equivalent to the carbon content of the fuel they sell. These costs would, at least to some extent, be passed onto the consumer. Indeed, complaints of the impact on gasoline prices on consumers have begun to be voiced, particularly in the context of federal legislation (for example, *The Hill*, May 19, 2008).

The impacts of higher fuel prices on travel behavior are well appreciated by transportation planners. The precise effect depends on the price elasticity of demand, i.e. how consumers respond to changes in price. Here, elasticity can be decomposed into two elements: the elasticity of vehicle travel (how fuel prices affect total vehicle miles traveled) and fuel consumption per vehicle (how fuel prices affect the choice of energy-efficient vehicles). In-depth reviews and meta-analyses are provided by several authors [12-15].

Several studies focus on short-run elasticities. Hughes et. al. [16] provide evidence that these have fallen in recent years due to behavioral and structural factors, such as the shift to auto-oriented land-use patterns. When assessing the impact of cap-and-trade, however, it is more instructive to examine long-run elasticities. It is reasonable to suggest that consumers will see any price increase as a permanent change rather than as a short-term effect of market volatility, and that they will adjust vehicle purchases and travel behavior accordingly.

Goodwin et. al. [14] find that the mean reported long-run price elasticity of fuel consumption is -0.64; for total vehicle kilometers, it is -0.29; and for fuel consumption per vehicle, it is -1.1. In other words, a 10% increase in fuel prices leads to a 6.4% overall reduction in fuel consumption, but most of this is achieved through great vehicle efficiency. Vehicle travel declines by 2.9% in response to the 10% price rise. Graham and Glaister (2002) present similar results, suggesting that long-run elasticities of fuel consumption lie between -0.6 and -0.8.

The upper bound of the impact on fuel prices is straightforward to calculate using the price of carbon allowances and the carbon content of a gallon of gasoline. The cost of the carbon allowance per gallon is as follows, where 44/12 converts from carbon into CO₂, and 1/1000000 converts from grams into metric tons:

$$\text{Allowance cost} = \text{Allowance price} \cdot \text{Gasoline carbon content} \cdot \frac{44}{12} \cdot \frac{1}{1000000}$$

(\$ per gallon) (\$ per metric ton/CO₂) (grams C per gallon)

The Code of Federal Regulations sets the carbon content of gasoline at 2,421 per gallon [17]. An allowance price of \$30 per metric ton (the lower end of estimates of carbon prices from the Lieberman-Warner proposal) therefore equates to 26.6 cents per gallon. Using a long-run price elasticity of -0.6 to -0.8 and assuming a gasoline price of \$4 per gallon, this translates into a price increase of 6.7% and a reduction in gasoline consumption of four to five percent.

This estimate should be considered an upper bound for four reasons. First, the carbon content of gasoline may decline over time. California, for example, has a low-carbon fuel standard, adopted by Executive Order No. S-01-07. This Order calls for a reduction in the carbon intensity of transportation fuels by 10% by 2020. Similar proposals exist in other states and at the federal level. Second, the reduction in demand may cause the price of crude oil and/or refined products to fall.

Third, the full cost of carbon allowances may not be passed onto consumers. The precise incidence between producers and consumers depends on several factors, including supply constraints and the level of competition. One study for the petroleum industry estimates that pass-through to consumers will range from 74% to 94%, depending on year, although these estimates are highly uncertain due to the level of international competition and other factors [18]. In aggregate, this study (which models all three effects) concludes that the proposed Lieberman-Warner cap-and-trade legislation (as of December 2007) would have reduced vehicle miles traveled by 3% in 2030 compared with the base case, and gasoline consumption by 10% [18].

The fourth reason is political rather than technical or economic in nature, and relates to a potential backlash against a perceived backdoor gas-tax increase. There may be pressure to cut taxes on gasoline sales by an equivalent amount in order to avoid any impact on gasoline prices. Indeed, this approach has been proposed in Australia, where a July 2008 Green Paper states that fuel taxes will be cut “on a cent for cent basis to offset the initial price impact on fuel” from an upstream cap. This “adjustment mechanism” would be reviewed after three years, once motorists have had an opportunity to plan for higher fuel prices, the Green Paper proposes [4: 16].

IMPLICATION 2: TRANSPORTATION FUNDING

One of the most controversial issues surrounding cap-and-trade programs has been the initial allocation of allowances. In particular, analysts have focused on the choice between auctioning allowances, in which case the revenue would usually flow to the government; and granting free allowances to emitters based on historical emissions or output. One of the main criticisms of the European ETS has been the granting of virtually all allowances for free, which in some cases resulted in windfall profits [19].

In principle, the initial allocation should not affect decisions on whether or not to reduce emissions; trading should ensure that the allowances flow to the highest-value uses [5, *Ch. 6*]. However, there are substantial distributional issues. As a result, many analysts prefer to auction as many allowances as possible, with the revenues used to lower existing distortionary taxes and/or fund new public spending programs.

Auctioning allowances creates the potential to channel revenue to transportation investments. One version of the proposed Lieberman-Warner bill would have granted 1% of allowance revenues in 2012 – rising to 2.75% by 2030 – to states, regional agencies and local governments for transit expansion and travel demand reduction (note that figures refer to the Manager’s Substitute amendment). This share of allowances would be worth \$1.0 billion (at \$17/metric ton) in 2012, and \$6.4 billion (at \$61/metric ton) in 2030 [allowance prices based on 20]. Further shares of allowance auction revenue would have been channeled to states for energy efficiency measures; to states that have led in reducing emissions; and for replacement of commercial vehicle fleets.

Ewing et. al. [21: 137] suggest that four uses of allowance revenues are particularly worthwhile: technical assistance for smart growth planning; tax credits for smart growth projects; transit, cycling and pedestrian infrastructure; and a National Infrastructure Bank to fund transit, public housing, water and other infrastructure needs in central cities and older suburbs. Other possibilities include the use of allowance revenue as an incentive for cities and regions to reduce emissions; at least part of the revenue could be allocated based on performance against emission reduction goals.

IMPLICATION 3: CONVERTS ENVIRONMENTAL INTO ECONOMIC BENEFITS

To many transportation planners, a more subtle implication of cap-and-trade is that it removes the potential of any measures to reduce aggregate emissions. While land-use, transit and demand management programs may have an effect on local emissions from transportation, these will be offset by increases elsewhere leaving aggregate greenhouse gas emissions unchanged.

This implication follows directly from the design of cap-and-trade. If cap-and-trade is effective in reducing emissions, the cap represents a binding constraint – i.e., emissions would have been higher in the absence of the cap. Any further reduction in transportation-sector emissions will then be countered by an increase in emissions elsewhere in the economy. As noted before, the cap applies across the economy in order to equalize the *marginal cost* of abatements across sectors, rather than ensuring that each sector undertakes a proportionate reduction.

To take a tangible example, suppose that the cap in a given year is 5,000 million metric tons, indicated by the dashed vertical line (Q_0) in the left panel of Figure 1 (not to scale). The initial demand curve is shown as line D_0 . Suppose a new rail system reduces emissions by 100,000 metric tons, thus shifting the demand curve in Figure 1 inward to D_1 . Aggregate emissions would not fall to 4,999.9 million metric tons (Q_1), as the regulator will have issued the same number of allowances (Q_0). Rather, demand and thus the allowance price will fall from p_0 to p_1 , and this lower price will lead to an increase in emissions elsewhere in the economy. The project would have to shift the demand curve to D_2 for there to be an impact on aggregate emissions; in this case, the cap is no longer binding and the allowance price is zero.

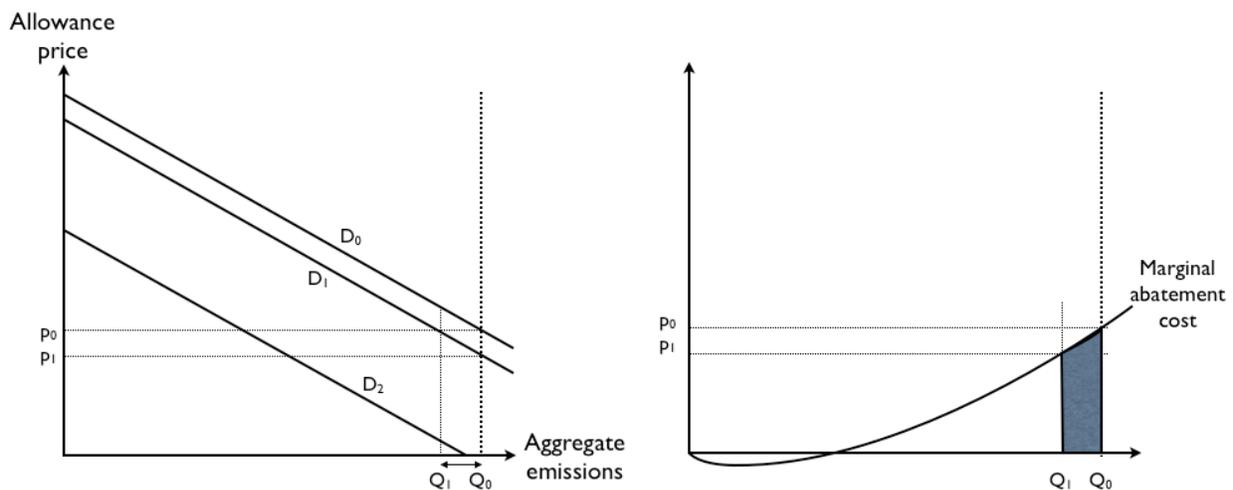


FIGURE 1 Impact of Transportation Emission Reductions Under Cap-and-Trade

This does *not* imply that there are no benefits from emission reductions from the hypothetical rail system. Rather, it means that the benefits are economic (reducing compliance costs elsewhere in the economy) rather than environmental (reducing aggregate emissions). The right panel of Figure 1 shows the marginal abatement cost curve, i.e. the cost to reduce each additional metric ton of greenhouse gas emissions. Rational firms will implement abatement measures until the marginal cost of these equals the allowance price. As the rail system means

that fewer reductions are required from the rest of the economy, the marginal cost of abatement and the market price of carbon allowances decline. Thus, the reduction in the carbon allowance price from p_0 to p_1 yields savings in other sectors of the economy equivalent to the shaded area in Figure 1. For example, if the allowance price falls from \$30 to \$28, an electricity generator may avoid implementing abatement measures that cost \$29 per metric ton.

A related argument exists for renewable energy projects. Bird et. al. [22] suggest that under cap-and-trade, there would be little incentive for consumers and businesses to continue their voluntary purchases of renewable energy at premium prices, as there would be no impact on aggregate carbon emissions. Cap-and-trade would also restrict the ability of marketers to tout the environmental benefits of green power purchases.

The exception identified by Bird et. al. is if sales of green power are “bundled” with the retirement of carbon allowances. In other words, consumers would pay not only for the renewable energy, but also to take carbon allowances out of circulation and effectively reduce the emissions cap. This may be possible for local governments as well; indeed, in several proposals for federal legislation, a share of carbon allowances would be granted to local governments. As discussed above, however, this allocation of allowances is intended as a funding mechanism for transit, smart growth and other local projects. It would certainly be possible for a local government to retire them and thus reduce the level of the cap, but this would require foregoing the revenue associated with the sale.

What does the conversion of environmental benefits to economic ones imply for transportation planners? An economist may argue that there is no difference – the environmental benefit and the economic benefit are equivalent when converted to a dollar metric. However, there may be two main practical implications for planners – a potential reduction in political support for emission reductions, and changes to the way in which greenhouse gas reductions are treated in cost-benefit analysis.

Reducing Political Support?

In recent years, many planners have talked of climate change as an attention-grabber, helping to generate interest among the public and elected officials for transit, smart growth and demand management projects. Even though a project may already be cost-effective in terms of other goals, such as reducing criteria pollutants and travel times, climate change may have a “pile-on effect” that finally spurs implementation [23].

Cap-and-trade therefore raises the potential that this political enthusiasm may fade or disappear, if elected officials value the environmental benefits (emission reductions) but not the economic benefits. Given the constraints of local transportation funding, it is reasonable to presume that a county or regional agency may attach little or no value to reducing compliance costs for (say) electricity generators, given the competing demands for a limited pool of resources.

Indeed, if this effect is realized, one possibility is that transportation-sector emissions could actually increase under cap-and-trade. Figure 2 shows this graphically. Suppose that local governments and transit agencies plan to implement greenhouse gas reduction measures to achieve emissions of Q' . Further suppose that in the presence of the aggregate cap, they would abandon these measures, having other priorities for their limited resources. Then, if the allowance price were less than p' , transportation emissions would actually increase as a result of cap-and-trade (although aggregate emissions would remain unchanged at the level of the cap).

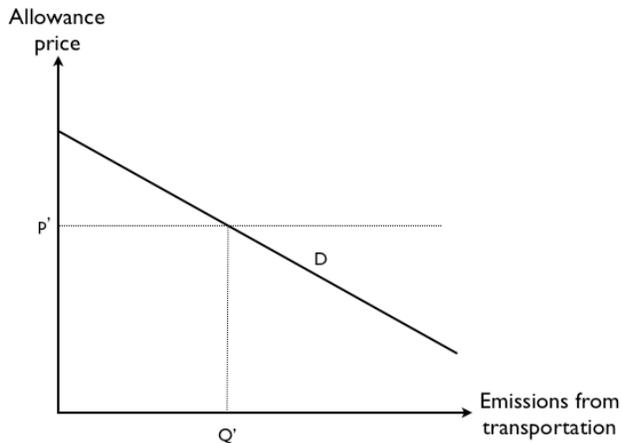


FIGURE 2 Cap-and-Trade and Increasing Transportation Emissions

Of course, this hypothesis is speculative at present; it is difficult to predict whether elected officials, planners and the public will make this inferential leap; and if they do, how they will respond. One possibility is that “emission reductions” are preserved as a convenient fiction in order to help support projects that have wider societal benefits, such as congestion relief and air quality improvements.

Valuation of Emission Reductions

A second implication of converting environmental to economic benefits suggests that planners should value carbon savings at no more than the market price of allowances. A transportation project that reduces emissions at a cost of \$50 per metric ton might be worth pursuing in the absence of cap-and-trade, if a community values emission reductions at this amount or more. However, it would not be an efficient investment in the presence of cap-and-trade and an allowance price of (say) \$30. In effect, the transportation sector would be paying \$50 to save \$30 elsewhere in the economy. (For simplicity, this example ignores co-benefits.)

There is a wide range of estimates of the marginal social costs of greenhouse gas emissions. Nordhaus [24] puts them at \$30 per metric ton of CO₂, while toward the top of the range, Stern [25] puts the social cost of carbon at \$85 per metric ton. In the presence of an economy-wide carbon cap, these valuations of damage from greenhouse gas emissions (or conversely, the benefits of emission reductions) are highly relevant when deciding on the level of the cap, which in turn dictates the cost of the required reductions. These estimates are irrelevant, however, when making transportation planning decisions in the presence of a cap. As the benefit of emission reductions is economic, not environmental, they are properly valued by the marginal abatement costs in the economy as a whole. The value of carbon abatement is indicated by the market price for carbon, which equates to this marginal cost of abatement.

Put another way, different analysts may quite properly come to different conclusions about the valuation of reduced carbon emissions, depending on their evaluation of the environmental and human cost of climate change and choice of discount rate. Cap-and-trade, however, leaves no room for these heterogeneous valuations once the cap has been set.

Estimates of future carbon allowance prices vary depending on the precise design of the cap-and-trade system. The Energy Information Administration [20] provides one set of estimates of the impact of the Lieberman-Warner proposal; it projects allowance prices rising from \$30-

\$76 in 2020 to \$61-\$156 in 2030. (The wide range indicates different assumptions on the cost of reductions and on access to lower-cost offsets.) This uncertainty means that the principle – value emission reduction benefits at the prevailing market allowance price – is more difficult to implement in practice than it is to state in theory. For a project where emission reductions are expected over a multi-year period, planners would need to estimate the market price of carbon allowances in subsequent years, and hence the present value of the emission reduction benefits.

Does this imply that firms in other sectors might pay for the implementation of transportation abatement measures, in order to reduce the price of allowances and thus their compliance costs? In principle, it does. In practice, however, a single firm is unlikely to be a large enough purchaser of allowances to realize sufficient savings. The benefits would be widely spread over all allowance buyers, creating a classic collective action problem. Of course, the obvious solution to this is to channel allowance auction revenue to transportation-sector abatement projects, as discussed earlier in this paper.

Caveats: When Transportation Projects May Reduce Emissions

An important caveat must be made regarding the conclusion that transportation projects will have no impact on emissions. The assumption that aggregate emissions are fixed at the level of the cap may not hold, due to potential flexibility measures in a cap-and-trade program. Most of the following design features of cap-and-trade have been included in legislative proposals:

- **Safety Valve.** A safety valve sets a maximum price for carbon allowances (and thus compliance costs), through the regulator issuing an unlimited number of allowances at this maximum price. In effect, it converts cap-and-trade into a carbon tax at a predetermined price. A safety valve features in several of the legislative proposals in Congress. The significance here is that transportation abatement measures may have an impact on aggregate emissions, if they reduce the allowance price below the level of the safety valve. The converse of the safety valve – a price floor below which allowances would not be sold – has also been proposed. Transportation planning efforts could have an impact under this design if they reduce the allowance price to below the floor, causing allowances to be withheld by the regulator and aggregate emissions to be reduced.
- **Offsets.** Offsets are another flexibility mechanism included in many cap-and-trade proposals. They provide the opportunity to take advantage of lower-cost emission reductions outside the capped sectors, such as in forestry. Through reducing the demand for carbon allowances and thus their price, transportation abatement measures will tend to reduce the use of offsets. If all offsets represented real, additional and permanent emission reductions, then their use would have no impact on aggregate emissions. However, empirical evidence suggests that this is often not the case; many offsets are non-additional and would have been undertaken anyway [26]. Thus, reducing demand for offsets may help preserve the integrity of the cap and reduce aggregate emissions.
- **Political Will.** Many of the proposals for cap-and-trade set a declining trajectory for emissions, through lowering the cap over many years. There is nothing to prevent a future legislature from relaxing these caps, particularly if high allowance prices are perceived to be economically damaging. To the extent that they moderate allowance prices and preserve the political will to maintain (or tighten) the cap, therefore, transportation abatement measures may reduce aggregate emissions.

These flexibility mechanisms would mean that measures such as transit and smart growth planning could have an impact on overall emissions. However, the exact reduction would be even more difficult to predict, as it will be moderated by the carbon allowance market, i.e. the extent to which reductions in transportation-sector emissions affect demand for offsets or the invocation of a safety valve. Predicting the aggregate emission reductions from a particular project, then, would require not only an estimate of the impacts on vehicle travel and gasoline consumption (a severe enough challenge), but also an estimate of the shape of the demand and supply curves for carbon allowances.

IMPLICATION 4: ENVIRONMENTAL REVIEW

Environmental quality legislation has emerged as a new element of the policy toolkit to promote the implementation of emission reduction measures. Traditionally, environmental review has focused on impacts such as criteria pollutant emissions, endangered species, traffic congestion and historic resources. However, in several states, regulators have begun to require the analysis of greenhouse gas impacts as well [27].

In Massachusetts, for example, state-funded and large private projects subject to the Massachusetts Environmental Policy Act have been required to quantify and mitigate greenhouse gas emissions since October 2007. In King County, Washington, an executive order requires climate change to be considered in analysis under the State Environmental Policy Act.

The most extensive use of environmental review for greenhouse gas emissions has perhaps been under the California Environmental Quality Act (CEQA). Early lawsuits were filed by the Center for Biological Diversity and the Natural Resources Defense Council against the City of Banning and state Reclamation Board respectively. Subsequently, the state Attorney General began to file lawsuits against “lead agencies” (the public agencies with the primary responsibility for approvals) that failed to analyze potential climate change impacts in their environmental documents, most prominently against the County of San Bernardino. The Attorney General has also written to numerous lead agencies requesting consideration of climate change impacts in Environmental Impact Reports (EIRs) [28].

More recently, the process of considering greenhouse gas emissions impacts has become more formalized. The Attorney General has published and updated a list of mitigation measures that lead agencies could consider, including improvements to bicycle and transit facilities and Transportation Demand Management programs. Recent legislation (SB97) requires the Governor’s Office of Planning and Research (OPR) to develop regulatory guidelines on mitigating greenhouse gas emissions under CEQA by July 2009. OPR itself published a technical advisory in June 2008, which recommends that lead agencies make a good-faith effort to estimate CO₂ emissions from a project, determine whether they are significant and if so, mitigate them where feasible [29]. The Association of Environmental Professionals [28: 9] considers that the California Global Warming Solutions Act (AB32) creates a “compelling statutory basis for addressing significant adverse effects of [global climate change] in CEQA compliance.”

The legal basis for these lawsuits and guidance, however, rests on the premise that greenhouse gas emissions from a project do in fact constitute an environmental impact. This is a relatively simple argument to sustain in the absence of cap-and-trade; the argument usually boils down to whether or not this impact is significant. In the presence of a binding economy-wide cap, however, one might easily conclude that there is no environmental impact. While emissions from a particular project might increase, these would be offset by decreases elsewhere in the

economy. This is the converse of the argument presented in the section above; emissions may have an economic impact (they require increased abatement in other sectors), but not an environmental impact (aggregate emissions are constant). In California, CEQA guidelines explicitly state (§ 15131): “Economic or social effects of a project shall not be treated as significant effects on the environment.”

One potential precedent is provided by the RECLAIM cap-and-trade program for NO_x and SO_x in southern California. Despite the existence of a cap, these pollutants are still analyzed and mitigated through the environmental review process. Here, however, the impacts are local in nature – even if there is a fixed cap at the level of the region, increased local ambient concentrations of NO_x and SO_x would represent an environmental impact. Greenhouse gases, in contrast, are locally benign; only global concentrations are environmentally significant.

The flexibility mechanisms discussed in the section above, such as a safety valve and offsets, may mean that a project does have some environmental impact. Aggregate emissions may increase somewhat from, say, a highway widening or new subdivision. But as discussed above, emissions increases will be difficult to quantify, as they depend not only on the project characteristics but also the wider carbon market. Ultimately, the implications of cap-and-trade for environmental analysis and for using environmental law as a basis to require mitigation measures may need to be determined in the courts, but there is a good argument that aggregate impacts are less than significant. Of course, this argument applies to mitigation of emissions only; environmental impact reports may still need to analyze the adaptation implications of climate change, such as sea-level rise and wildfire risk.

IMPLICATION 5: OFFSETS

Offsets under a cap-and-trade program provide an opportunity to take advantage of lower-cost emission reduction opportunities from outside the capped sectors. Under the Clean Development Mechanism (CDM) of the Kyoto Protocol, for example, developed countries facing quantitative targets can purchase offsets from methane destruction, renewable energy and other projects in the developing world, as a partial alternative to reducing domestic emissions. There is also a strong market for voluntary offsets, driven partly by individuals and organizations wishing to reduce their “carbon footprint”.

Potential transportation offsets include transit infrastructure, smart growth planning and fuel switching [30]. However, the sector has faced numerous challenges, most significantly in gaining approval for the methodologies to quantify emission reductions from a given transportation project. Transportation methodologies have tended to be more complex than in other sectors, and they have been hampered by difficulties in estimating baseline emissions – i.e., what emissions would have been in the absence of the offset project. As of June 2008, transportation accounted for just 7 out of 3,498 projects in the CDM pipeline, and 0.15% of the 6.2 billion metric tons of emission reductions projected from the CDM by 2020 [31]. Transportation accounted for just one out of the 109 large-scale methodologies approved, plus one for biofuels that is not transport-specific.

Nevertheless, there has been considerable interest in developing methodologies for transportation offsets. Ewing et. al. [21] advocate for smart growth to be considered as a potential category of offsets. The California Climate Action Registry is considering developing offset protocols for Bus Rapid Transit, fuel switching in transit vehicles and truck stop electrification (CCAR, personal communication). The New York Metropolitan Transportation

Authority, meanwhile, approved a \$776,000 contract in May 2008, part of which will examine the potential for transportation offsets (*AM New York*, June 2, 2008).

Cap-and-trade that extends to the transportation sector, however, would preclude any domestic transportation-sector offsets due to double counting. To see this, note that any transportation offset, by definition, must reduce the demand for gasoline or diesel fuel. A Bus Rapid Transit project that seeks to qualify as an offset would already have had these emission reductions counted, as refineries and fuel importers would need to surrender fewer carbon allowances. The same goes for smart growth development, more fuel-efficient vehicles, or any other project that reduces gasoline demand. (Biofuels may be an exception, as any emission reductions would be outside the capped sectors through carbon sequestration in agriculture.)

Put another way, emissions from the capped sectors remain at the level of the cap, regardless of how many BRT or smart growth projects are implemented (assuming the cap is binding). Allowing these projects to qualify as offsets, then, would in effect inflate the cap, as offset credits could be submitted in place of regular emissions allowances. By definition, offsets consist of emission reductions outside the capped sectors.

The potential of transportation offsets may well be limited by the methodological problems noted above, and it is unclear whether any significant revenue would be generated for transportation agencies. Implementing cap-and-trade for the transportation sector, however, would rule out offsets altogether.

CONCLUSION

Many economists advocate a broad-based cap-and-trade system covering transportation on the grounds of efficiency. The California Market Advisory Committee [9: 35] states: “By broadening the scope of the program, including the transport sector creates more emissions-reduction opportunities and thereby lowers the costs of meeting a given emissions cap.” This approach can also increase liquidity, provide a consistent price signal across all sectors and avoid market distortions, the Committee adds. Stavins [32: 18] argues that an economy-wide cap increases flexibility: “By drawing from a broader, more diverse set of emission reduction opportunities, an economy-wide cap reduces the risk of unexpectedly high emission reduction costs much like a mutual fund reduces investment risk through diversification.

The challenge with cap-and-trade in the transportation sector is that these price signals would apply solely to motorists, and indirectly (through vehicle and fuel purchases) to vehicle manufacturers and fuel refiners. Under the standard upstream trading design, there would be no price signal to local governments to make appropriate investments in transit, non-motorized transportation and other measures to reduce greenhouse gases.

Cap-and-trade for transportation would certainly help in efforts to reduce vehicle travel and improve fuel economy, through increasing the price of gasoline. It also offers the potential to channel significant funding to transportation agencies through the auctioning of emission allowances. At the same time, however, it deprives these agencies of perhaps one of their main motivations to implement emission reduction measures. Existing efforts are largely driven by the preferences of elected officials and staff, i.e. their desire to reduce emissions. By converting the environmental benefit (reduced emissions) into an economic benefit (reduced compliance costs, with emissions constant at the level of the cap), cap-and-trade would not alter the economic desirability of implementing these measures to reduce emissions, but it may alter the priority of these measures for local decision-makers.

This paper does not argue that extending cap-and-trade to the transportation sector is undesirable. Indeed, there are numerous broader benefits to be gained from doing so – most importantly, providing greater certainty of meeting a given emissions target. If transportation is outside the cap, decision-makers need to estimate the reductions that would be achieved from policies such as fuel economy standards, and set the cap for other sectors accordingly. The European experience suggests that this process can often go awry, with unrealistic assumptions for transportation used to justify a higher cap for other sectors. If cap-and-trade is extended to transportation, however, planners should be aware of its perhaps unforeseen implications

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