



Land Use & Natural Resources Committee

Item #14-12-7 Information

November 26, 2014

Agricultural Greenhouse Gas Emissions

Issue: What are the possible unintended impacts of greenhouse gas emissions regulations on agriculture processors?

Recommendation: None; this item is for information only.

Discussion: In Fall 2012, the SACOG Board visited food processing sites as part of a Rural Urban Connections Strategy (RUCS) tour focused on the Infrastructure of Agriculture. During the visit to Pacific Coast Producers (PCP) tomato processing facility in Woodland, questions arose about the effect of AB 32 on the agricultural industry and whether that facility could remain economically viable as costs to comply with AB 32 increase.

SACOG staff worked with PCP staff to undertake a study comparing greenhouse gas (GHG) emissions from the current PCP processing facility and related tomato production to emissions if that production was processed outside the region. The latter hypothetical scenario tested impacts if regulatory costs were to force PCP to close, but tomato production continued in Yolo County. The study also considered emissions changes in scenarios where tomato production was replaced with other crops or replaced with urbanization. This additional work helped provide relative measures of the emission savings from AB 32 regulations or the closure of PCP and how those savings could be offset by changes in land use activity.

Staff analyzed multiple scenarios for the study and will present the full range of results included in Attachment A. In the scenario of PCP closing and tomato production continuing, analysis showed that net emissions from transporting tomatoes to an AB 32-compliant processor outside the region are slightly greater (0.2%) than emissions from growing and processing those tomatoes in Yolo County. In scenarios where tomato production stops and land is fallowed, there was substantial increase in GHG emissions when that fallowed land is urbanized. For example, mixed density houses on 125 acres—only 0.4% of the 30,000 acres currently contracting to PCP—would emit GHGs equivalent to PCP's reductions per AB 32. These results show that small increments of urban development have significant impact on GHG emissions compared to the emissions from agriculture and food processing. Further, these findings are important because fallow agricultural acreage, particularly fallow acreage adjacent to established communities, is especially susceptible to urbanization when the viability of farm operations is compromised. Instability in the food system, such as the closure of a major processing facility, may negatively impact the profitability of farm operations.

This analysis reinforces actions proposed in ARB's Scoping Plan and the California Budget Act of 2014 that support the agricultural supply chain. Two related studies being conducted for the ARB include: estimating the economic multiplier of processing facilities, and the economic impact of agricultural processing leaving the state due to AB 32 costs. These studies are pending, but along with SACOG's work can support measures to ensure processing facilities' ability to remain competitive, encourage research and incentives for efficient farming practices, and incorporation of farmland conservation in land use planning. These studies can also help inform guidelines for allocation of cap-and-trade funds to the Affordable Housing and Sustainable Communities Program, which makes available funding for agricultural land protection.

Approved by:

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Attachment

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Inventory and Comparison of Agricultural and Urban Greenhouse Gas Emissions:
Scenario Analysis under Assembly Bill 32

Sacramento Area Council of Governments
September 2014

Research Questions

This analysis was undertaken to address concerns about meeting AB32 greenhouse gas (GHG) emissions reduction targets for Pacific Coast Producers (PCP), the last remaining tomato processing facility in the SACOG region. The issue was raised by management of PCP during a SACOG tour of their plant in 2012. PCP is concerned about the financial impact on their operation and their ability to remain competitive due to the cost of meeting the 20 percent GHG reduction target for their facility. PCP raised questions about the effectiveness of AB 32 regulations on food processors, particularly whether the GHG savings at PCP would be offset by added trucking to haul Yolo County tomatoes to other processors if PCP could not afford to remain in operation. As SACOG began to analyze this question, additional questions arose, including how emissions from tomato processing compare to other sectors of the agricultural industry, and how they compare to emissions from urbanized lands.

Methods

Staff created a methodology to quantify the transportation emissions from a processing tomato rotation (i.e., tomatoes are the main component of a farmer's crop rotation) on approximately 30,000 acres in Yolo County. These fields are contracted by PCP for tomato production, though other processing facilities in California could buy this product if PCP were to close. Staff used the SACSIM travel model to find mileage from individual fields to PCP. In the case of tomatoes being trucked outside of the region to processing facilities in Hollister, Lemoore, Los Banos, Modesto, and Williams, a combination of SACSIM and Google Maps was used to find mileage from the field to the processors. Staff then used EMFAC 2011 emissions data to find GHG emissions per mile for agricultural trucks. Multiplying mileage by emissions per mile resulted in the total transportation GHGs for the two scenarios: local tomato processing and tomato processing outside the SACOG region.

This process was repeated for other crops besides processing tomatoes to allow for comparison of GHG emissions between cropping scenarios. The agricultural scenarios considered in this analysis are described in the table below.

Tomato Rotation	Processing Tomatoes Alfalfa Corn Field beans	Safflower Sunflower Wheat
General Field Crop Rotation	Alfalfa Corn Field Beans	Safflower Sunflower Wheat
Alfalfa Rotation	Alfalfa Corn	Safflower Sunflower

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	Field Beans	Wheat
Orchard Blend	Almonds	Olives
	Prunes	Walnuts

On-field GHG emissions were also included. On-field emissions were calculated from gasoline, diesel, fertilizer use and crop residue per UC Cooperative Extension's Cost & Return Studies and Jackson et al.'s 2012 article "Involving Local Agriculture in California's Climate Change Policy: an Inventory of Agricultural Greenhouse Gas Emissions in Yolo County"¹. This addition captured emissions from the time of planting up to the point that product reaches the processing facility. This gave an estimation of the greenhouse gas implications of agricultural decisions with only one remaining unknown, emissions from processing.

To estimate this missing factor, emissions from tomato processing were drawn from a recent publication by researchers at the University of California, Davis. Brodt et al. found in their 2013 article in *Food Policy*, "Comparing environmental impacts of regional and national-scale food supply chains: A case study of processed tomatoes", that processing emissions account for approximately twice as many GHG emissions as on-field operations. These data were unfortunately not available for other crops.

To further consider the relative magnitude of agricultural GHG emissions, agricultural scenarios were compared to three scenarios of urbanization. These scenarios varied in density, adjacency to existing communities and size. The GHG effects of these housing scenarios were calculated with Sketch7 travel model VMT estimations, EMFAC 2011 emissions data, and UrbanFootprint's housing emissions from heating, cooling, et cetera.

In addition to GHG emissions, the economic and fiscal impacts of these agricultural and urban scenarios were calculated. This was done with UC Davis Cooperative Extension's Cost & Return Studies for the agricultural scenarios, which gave costs and returns for the growers. Fiscal impacts of urbanization were calculated with SACOG's IMPACS tool, which estimates infrastructure and services needs and cost for urban development.

Results

SACOG's analysis found that increased trucking distances would not only negate the emissions reductions required by AB 32 and the California Air Resources Board's Scoping Plan, but net emissions would in fact very slightly increase (0.2%) over today's industry practice if tomatoes grown in Yolo County were to be transported out of the region for processing. This demonstrates that if the cost of compliance with AB 32 should make PCP uncompetitive and ultimately close, the emissions savings of the policy could likely be nullified and even slightly increase.

¹ Jackson, Louise, Van R. Haden, Allan D. Hollander, Hyunok Lee, Mark Lubell, Vishal K. Mehta, Toby O'Geen, Meredith Niles, Josh Perlman, David Purkey, William Salas, Dan Sumner, Mihaela Tomuta, Michael Dempsey, and Stephen M. Wheeler. 2012. *Adaptation Strategies for Agricultural Sustainability in Yolo County*, California. California Energy Commission. Publication number: CEC - 500 - 2012 - 032.

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PCP currently processes more than one third of processing tomatoes grown in Yolo County and closure of this market outlet could have repercussions in the supply chain. Possible scenarios given this instability could include growers shipping product to other processors with available capacity, leaving tomatoes out of their rotations if other processors cannot handle additional tonnage (resulting in a 47% decrease in annual net revenue), shifts to other crops entirely, or potentially the fallowing of fields. Given growers' loss in revenue from the lack of lucrative processing tomato contracts and high costs of recapitalizing for other crops (such as orchards), fallowing of fields is not an extreme scenario. Maintaining grower viability is important because fallow fields are particularly susceptible to urbanization, especially when these fields are adjacent to established communities.

With this in mind, the vast increase in GHG emissions between agricultural and urbanized acreage becomes even more pertinent when analyzing the impacts of climate policy on PCP.

Emissions reductions per Assembly Bill 32 and the California Air Resources Board's Scoping Plan would be approximately 7,000 tons of CO₂ per year at PCP. The following table puts these 7,000 tons in context of today's tomato processing industry and urbanization scenarios.

<u>125</u>	<u>Acres of mixed-density housing that emits equivalent GHGs to PCP's reductions per AB 32</u>
<u>602</u>	<u>Acres of mixed-density housing that emits equivalent GHGs to PCP</u>
<u>1,060</u>	<u>Acres of mixed-density housing that emits equivalent GHGs to current processing tomato industry in Yolo County</u>
<u>2,222</u>	<u>Acres of current processing tomato rotation that would not be contracted to PCP if it reduced throughput to meet AB 32 compliance</u>
<u>4,000</u>	<u>Acres of processing tomato fields currently contracting to PCP adjacent to existing communities</u>
<u>30,000</u>	<u>Total acres of processing tomato fields currently contracting to PCP</u>

Urbanizing only 4,000 acres of fields adjacent to established communities produced a 275% change in GHG emissions from the base case of 30,000 acres of a locally processed tomato rotation. When all 30,000 acres were converted to rural residential housing, GHG emissions rose by almost 700%. Yolo County, the jurisdiction analyzed in this case study, has strong agricultural conservation policies in its general plan which make these urbanization scenarios extremely unlikely; however, it is unique in its strict growth policies and such scenarios would be plausible in other agricultural counties around the state.

This calculation exposes the possible repercussions on GHG emissions that could come with instability in the food system due to AB 32. It indicates that while food processing emissions are required to be managed further, measures should also be taken to maintain the stability of regional food systems so that agricultural lands stay in agriculture. PCP's presence in the Sacramento Valley supports farm revenues and viability via contracts to growers for what is

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often the most profitable crop in their rotation. PCP offers a constant market for processing tomatoes, without which some growers will likely see reduced profits and some may stop farming altogether. Should processing tomatoes be exported outside the region or a grower sells land to development because of lost revenue, the benefits of AB 32 are quickly lost. However, these unintended consequences can be addressed through measures discussed below.

Policy Recommendations

California Air Resources Board's Scoping Plan—a central requirement of AB 32—calls for a reduction in agriculture sector GHG emissions, but also recommends actions that would address the concerns raised by this analysis. These actions are:

- Conduct research that identifies and quantifies the GHG emission reduction benefits of highly efficient farming practices, and provide incentives for farmers and ranchers to employ those practices
- Convene an interagency workgroup to engage local and regional land use planning agencies regarding incorporating farmland conservation in land use planning
- Strengthen technical assistance programs and financial incentives to help agricultural operators develop carbon plans and implement GHG emission reduction practices

Additionally, analyses are already underway to estimate the processing facility-level regulatory costs and benefits of AB 32 in order to inform short-term modifications to the policy. Externally conducted analysis is currently assessing the ability of the food processing facilities in the cap & trade program to remain competitive while incorporating the carbon price into their production processes.²

Furthermore, the California Budget Act of 2014 appropriates \$130 million of cap-and-trade revenue to develop and administer the Affordable Housing and Sustainable Communities Program (AHSC). Among other greenhouse gas reducing measures, this program provides funding eligible for “acquisition of easements or other approaches or tools that protect agricultural lands that are under pressure of being converted to nonagricultural uses, particularly those adjacent to areas most at risk of urban or suburban sprawl or those of special environmental significance.” This program supports the principles of the Sacramento Region Blueprint, Senate Bill 375 and its required Sustainable Communities Strategies (such as SACOG's MTP/SCS 2035) in that it encourages use of existing assets and infill development

SACOG staff is providing this analysis for consideration by the SACOG board to support these measures outlined by the Scoping Plan and the AHSC Program as they underpin the principles of the Sacramento Region Blueprint, Metropolitan Transportation Plan/Sustainable Communities Strategy 2035 and Rural-Urban Connections Strategy. The magnitude of emissions created by urbanization illustrates the benefits of maintaining existing agricultural

² California Air Resources Board First Update to the Climate Change Scoping Plan, “Chapter IV: Accomplishments and Next Steps. Key Recommended Actions for the Agriculture Sector”. May 15, 2014.

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lands for their lower carbon intensity and value to the food system. Policies and plans that use existing assets and promote compact development, such as local infill policies and regional Sustainable Communities Strategies, realize this efficiency in emissions by focusing urbanization within existing communities and preserving agricultural assets.

Further, pursuant SACOG's Rural-Urban Connections Strategy goal of enhancing rural economic viability and environmental sustainability, these measures should and do identify and address the potential sector instability posed by cap & trade conformity, recognize farmland as an asset to be conserved, as well as provide assistance and incentives for farmers to reduce on-field emissions. Should analyses find that cap-and-trade conformity make processing facilities uncompetitive, CARB should consider the use of cap-and-trade auction revenue to assist processing facilities, such as PCP, in financing the necessary retrofits to comply with AB 32 emissions standards. This provides the co-benefits of a strong regional food system and maximized emissions reductions from AB 32.

Finally, Pacific Coast Producers can work with state and local agencies to identify any potential cost-effective methods to reduce emissions at its plant, particularly should it be eligible for cap & trade revenue. Agencies should be able to identify areas of processing and canning with significant energy use, leakages, and technologies to address them.

Further Research

Processing tomatoes were the highest emitter in this analysis; however, processing emissions were not available for crops other than tomatoes, which is a gap in information that skews the results. The magnitude of this gap is unknown and requires further research; however, tomato processing is the largest emitter in the food processing industry.³

Trends among the agricultural scenarios showed that there is substantial potential for emissions reductions and economic viability in orchard rotations. Further research into the lifecycle emissions of crop production is needed to gauge the magnitude of this potential, but research indicates that orchards may be net sinks of carbon dioxide.⁴

³ California Air Resources Board "California Cap on Greenhouse Gas Emissions and Market-Based Mechanisms, Appendix A: Additions and Amendments to Product-Based Benchmarks in the Cap-and-Trade Regulation", March 2014.

arb.ca.gov/regact/2013/capandtrade13/2appabenchmarks.pdf

⁴ Kendall et al. "A life cycle assessment of energy use and greenhouse gas emissions in Almond Production". Forthcoming.

Future GHG Emissions Scenarios by Land Use

	Agricultural Scenarios				Housing Scenarios		
	Tomato Rotation (base case)	Tomato Rotation (no PCP)	General Field Crop Rotation	Orchard Blend	Mixed-density housing near established communities (20,000 HH on 4,000 acres)	Large-lot SF residential near established communities (8,000 HH on 4,000 acres)	Convert all fields to rural residential housing (28,300 HH on 28,300 acres)
Total VMT (miles per year) ¹	545,000	5,447,000	220,000	190,000	347,300,000	139,600,000	730,000,000
Transportation CO ₂ (Average; tons per year) ²	850	8,000	300	300	160,000	65,000	340,000
On-Field CO ₂ (tons per year) ³	25,000	25,000	11,000	18,000	71,000	37,000	130,000
Tomato Processing & Canning CO ₂ (tons per year) ⁴	36,000	29,000	not included	not included	n/a	n/a	n/a
Total CO₂ (tons per year)	61,850	62,000	11,300	18,300	231,000	102,000	470,000
Per Unit CO₂ (tons per year)					12	13	17
Per Acre CO₂ (tons per year)	2.2	2.2	0.4	0.6	58	25	17
% Change from Base Case	--	0.2%	-82%	-70%	273%	65%	660%
Amortized Costs over 25-year Horizon	Growers' Costs & Returns				Public Costs & Returns		
Establishment/Capital Costs (per year)	\$2,250,882	\$2,250,882	\$1,860,000	\$13,200,000	\$9,500,000	\$3,100,000	\$34,000,000
Operational & Maintenance Costs (per year)	\$46,000,000	\$46,000,000	\$22,900,000	\$100,700,000	\$16,000,000	\$4,000,000	\$24,000,000
Total Costs (per year)	\$48,000,000	\$48,000,000	\$24,700,000	\$113,900,000	\$25,800,000	\$6,800,000	\$58,000,000
Revenue (per year)	\$57,400,000	\$57,400,000	\$29,700,000	\$156,000,000	\$26,000,000	\$6,080,000	\$41,000,000
Net Revenue (per year)	\$9,500,000	\$9,500,000	\$5,000,000	\$43,000,000	\$56,500	-\$705,000	-\$17,100,000
% Change from Base Case	--	--	-47%	353%	-99%	-107%	-280%
Water Usage (gallons)	50,000	50,000	30,000	90,000	5,000	1,100	7,000
Labor (hours)	440,000	440,000	150,000	720,000	0	0	0

Citations:

¹ VMT from field to processor from SACSIM; urban VMT from Sketch7

² CO₂ emissions per mile from EMFAC 2011

³ "On-Field" GHG emissions for housing scenarios account for electricity and natural gas usage in the household; they do not account for water transmission

⁴ Processing CO₂ estimated from Brodt, Kramer, Kendall & Feenstra's "Comparing environmental impacts of regional and national-scale food supply chains: A case study of processed tomatoes," Food Policy, Volume 42, October 2013.

Note: Housing Scenarios 1 & 2 only account for VMT and emissions on the 4,000 acres converted; they do not account for the other 24,000 acres that presumably stay in agriculture production