

April 4, 2014

Climate Change Program
California Air Resources Board
1001 I Street
Sacramento, CA 95814

**Re: Comments on Proposed Cap-and-Trade Regulations, 15-Day Changes
Resource Shuffling Safe Harbors — § 95852(b)**

Thank you for the opportunity to comment on the proposed carbon market regulations. Please incorporate by reference my previous comment letter from October 23, 2013,¹ and its attachments.²

Once again, I write to express serious concerns that the resource shuffling safe harbors will cause significant quantities of greenhouse gas emissions to leak out of California's carbon market. Since my last comment letter, significant leakage has already occurred via three major transactions that appear to be permissible under the safe harbor policy. As a result, between 30 and 60 million tons of CO₂ have already leaked or are imminently leaking out of California's market.

These new results demonstrate that the proposed regulations are inconsistent with clear statutory directives from California's climate law, AB 32. In addition, they underscore ARB's failure to analyze the environmental impacts of the proposed regulatory changes as required under the California Environmental Quality Act.

1. ARB's proposed resource shuffling safe harbors contradict the purpose and requirements of AB 32.

A. The safe harbors have already caused and will continue to cause resource shuffling, resulting in significant leakage of greenhouse gas emissions to neighboring states.

The proposed regulations are fundamentally inconsistent with California's climate policy objectives because the resource shuffling safe harbors have caused and will continue to cause significant leakage of greenhouse gases to other states. In plain English, this

¹ Danny Cullenward, Proposed Amendments to the California Cap-and-Trade Program (September 4, 2013 Proposed Regulation Order). Comment letter to the California Air Resources Board (Oct. 23, 2013), available at <http://www.arb.ca.gov/lispub/comm/bccommlog.php?listname=capandtrade13>.

² Danny Cullenward, Don't let accounting tricks dominate the carbon market. San Jose Mercury News op-ed (Oct. 21, 2013), available at http://mercurynews.com/opinion/ci_24354840/danny-cullenward-dont-let-accounting-tricks-dominate-carbon; Danny Cullenward and David Weiskopf, Resource Shuffling and the California Carbon Market. Stanford Law School ENRLP Working Paper (July 13, 2013), available at <http://law.stanford.edu/publications/resource-shuffling-and-the-california-carbon-market>.

means that the cap-and-trade market will not actually reduce greenhouse gas emissions as planned. To the extent that regulated parties in California rely on resource shuffling to comply with climate policy, the carbon market will produce the false appearance of emissions reductions. Put another way, resource shuffling means that the cap is no longer firm.

California’s climate law, AB 32, defines leakage as “a reduction in emissions of greenhouse gases within the state that is offset by an increase in emissions of greenhouse gases outside the state.”³ Under this definition, any reduction in emissions within California that is caused by the transfer of emissions liability outside the state constitutes leakage.

The risk of leakage is arguably greatest in the electricity sector, where the problem is known as resource shuffling. For example, consider a California utility that imports specified power from a coal power plant in Arizona. If the California utility sells its interest in that power plant to a party that is not a covered entity in California’s carbon market, the liability for those emissions will be transferred out of the State’s carbon market system. Suppose the California utility then acquires replacement power from a natural gas power plant; meanwhile, the coal plant continues to produce power for its new owner.

As a result of these transactions, the California utility would report a reduction in greenhouse gas emissions. At the same time, that reduction would be offset by an increase in emissions of greenhouse gases outside the state. Critically, there would be no change in net emissions to the atmosphere. The liability for the high-emitting resource would have merely been transferred out of California’s carbon market, allowing both the State and the covered entity to claim credit for emissions reductions that have not actually occurred.

Table 1: Resource Shuffling Example
(Using stylized greenhouse gas emissions units)

	California	Western State X	Total
Step 1	100	50	150
Step 2	50	100	150
Change	- 50	+ 50	0

Table 1 illustrates this example numerically. In the first step, the California utility owns a power plant and an out-of-state utility owns a natural gas power plant. For simplicity, assume the coal plant emits 100 units of greenhouse gases, whereas the natural gas plant emits 50 units of greenhouse gases; both produce the same amount of electricity and

³ Cal. Health & Safety Code § 38505(j).

are located outside of California. Because first deliverers of electricity are liable for the emissions associated with their imports,⁴ the California utility will initially report the coal power plant's emissions.

In the second step, the parties swap ownership interests in the two plants. As a result, the California utility reports a reduction in emissions that is offset by an increase in emissions outside the state, with no net change in emissions to the atmosphere. In this case, 50 units of greenhouse gas emissions have leaked out of California's system. Note that if this example involved a zero-carbon replacement resource (like nuclear or renewable energy) instead of natural gas, the leakage would be 100 units of greenhouse gas emissions.

1. The Safe Harbors Will Cause Significant Leakage.

Economists have repeatedly warned ARB that the proposed safe harbors effectively negate the prohibition on resource shuffling and will result in significant leakage. Previously, my colleague David Weiskopf and I estimated leakage impacts from resource shuffling of legacy coal power contracts, finding the potential for between 108 and 187 million tons of CO₂ through 2020.⁵ That view is consistent with what ARB's independent Emissions Market Assessment Committee ("EMAC") economists have estimated. For example, a June 2013 EMAC report found that the likely range of leakage impacts from resource shuffling would be between 120 and 360 million tons of CO₂ through 2020, including both legacy coal contract shuffling and other forms of resource shuffling.⁶ Another paper from University of California economists found that "even a modest weakening of the [rules and practices] targeted at limiting reshuffling will greatly undermine the strictness of the emissions cap through reshuffling."⁷

Under the proposed regulations, any transaction fitting a safe harbor is exempted from the prohibition on resource shuffling.⁸ In case there is any doubt about the breadth of the safe harbors and their impacts, I review two here, using the numbering in the proposed regulations:

⁴ Cal. Code Regs. tit 17, § 95852(b).

⁵ Cullenward and Weiskopf, *supra* note 2 at 27.

⁶ Severin Borenstein, James Bushnell, Frank A. Wolak, and Matthew Zarazoga-Watkins, Forecasting Supply and Demand Balance in California's Greenhouse Gas Cap and Trade Market. Draft EMAC report 1, 14 (June 12, 2013).

⁷ James Bushnell, Yihsu Chen, and Matthew Zaragoza-Watkins, Downstream Regulation of CO₂ Emissions in California's Electricity Sector. Energy Institute @ Haas Working Paper #236, at 4, *available at* http://ei.haas.berkeley.edu/pdf/working_papers/WP236.pdf. The specific measures referred to in this quote refer to the treatment of legacy coal power import contracts and the extent to which zero-greenhouse gas resources like hydroelectricity can be resource shuffled. *Id.* at 10.

⁸ Proposed regulations amending Cal. Code Regs. tit. 17, § 95852(b)(2)(A).

6. Electricity deliveries that substitute for deliveries that have been discontinued because of termination of a contract or divestiture of resources for reasons other than reducing a GHG compliance obligation.⁹
7. Electricity deliveries that are necessitated by early termination of a contract for, or full or partial divestment of, resources subject to the EPS rules.¹⁰

The sixth safe harbor exempts from the definition of resource shuffling any transaction motivated by any purpose except avoiding the compliance costs of California's carbon market. This provides countless options for avoiding the resource shuffling prohibition. For example, covered entities could plausibly justify nearly any resource shuffling transaction by citing complimentary objectives, like reducing local air pollution impacts from their power imports, minimizing costs, or even something so mundane as diversifying contractual counterparties. As a result, ARB would have serious trouble bringing any enforcement actions because defendant parties would always be able to claim a plausible complimentary motivation. At best, enforcement actions would face a difficult evidentiary question; at worst, a reviewing court could conclude that the safe harbor protects all transactions where any alternative rationale is present.

If the sixth safe harbor is unnecessarily vague, the seventh safe harbor offers an explicit loophole. It unambiguously exempts any transaction that involves divestment of resources subject to the EPS rules, referring to the emissions performance standard set by SB 1368. Presumably ARB's intent is to allow California entities to exit their interests in legacy coal contracts, which, as described above could result in more than 100 million tons of CO₂ leaking out of the market. As written, however, the safe harbor goes even further and provides an almost unlimited protection to all major utility power contracts.

By defining the seventh safe harbor by reference to any divestment of resources subject to the EPS rules, ARB would exempt any transaction involving both utilities and long-term baseload power contracts. Technically, the EPS applies to "load-serving entities" and "local publicly owned electric utilities."¹¹ The EPS prohibits "long-term financial commitments," which are defined as either "new ownership investment[s] in baseload generation or a new or renewed contract with a term of five or more years, which includes procurement of baseload generation."¹² Thus, the seventh safe harbor would even exempt any transaction involving a utility and a long-term baseload power contract or ownership interest; even divestment of natural gas facilities would be permissible.

As these examples demonstrate, the safe harbors effectively undo the prohibition on resource shuffling. Therefore, if the proposed regulations are adopted, covered entities in

⁹ *Id.* § 95852(b)(2)(A)(6).

¹⁰ *Id.* § (b)(2)(A)(7).

¹¹ Cal. Public Utilities Code §§ 8340(h)-(i).

¹² *Id.* § 8341(a) (the prohibition); *id.* § 8340(f) (the definition).

the electricity sector would be officially free to engage in transactions that would leak tens to hundreds of millions of tons of greenhouse gas emissions to neighboring states.

2. The Safe Harbors Have Already Caused Significant Leakage.

ARB will formally undermine its prohibition on resource shuffling if it adopts the proposed regulations. In practical terms, however, ARB already undermined the carbon market's integrity with its November 2012 informal guidance on resource shuffling.¹³ The current administrative process would simply codify the changed regime ARB introduced then, as that document lists the very same safe harbors proposed here.

It should come as no surprise, then, that several major resource shuffling transactions have already occurred. Because these transactions all involve or relate to baseload electricity contracts—specifically, divestment from legacy coal power contracts—they appear to be entirely permissible under the broad safe harbors as articulated in ARB's regulatory guidance document. The three transactions are described below, offering further indication of the environmental and economic impacts of ARB's proposed regulatory reforms.

- **Southern California Edison / Four Corners Units 4 & 5.**

At the end of December 2013, Southern California Edison completed the sale of its interests in the coal-fired Four Corners power plant in Arizona to APS, a utility based in Arizona.¹⁴ As a result of the transaction, SCE will report a reduction in emissions in the California carbon market because whatever replacement power SCE secures will have lower emissions than conventional coal power. In turn, the Arizona utility's emissions profile will increase. Thus, this transaction caused emissions to leak out of California's carbon market.

- **California Department of Water Resources / Reid Gardner Unit 4.**

Pursuant to its Climate Action Plan,¹⁵ the California Department of Water Resources terminated a contract with Reid Gardner Unit 4, a coal-fired facility in Nevada. DWR's original contract term ended in July 2013, at which point the Department elected not to renew the contract with the plant's owner, Nevada Power

¹³ California Air Resources Board, Cap-and-Trade Regulation Instructional Guidance, Appendix A: What is Resource Shuffling? (November 2012), *available at* http://www.arb.ca.gov/cc/capandtrade/guidance/appendix_a.pdf.

¹⁴ APS Press Release, APS completes purchase at Four Corners power plant (Dec. 31, 2013), *available at* <https://www.aps.com/en/ourcompany/news/latestnews/Pages/aps-completes-purchase-at-four-corners-power-plant.aspx>.

¹⁵ California Department of Water Resources, Climate Action Plan, Phase I: Greenhouse Gas Emissions Reduction Plan (May 2012). Note that terminating the Reid Gardner contract accounts for approximately 80% of the Department's planned emissions reductions. *Id.* at 10, Table S-1 (estimating that by 2020, DWR will have reduced 882,700 mtCO₂ per year by terminating the Reid Gardner, compared to 1,116,730 mtCO₂ per year from all measures combined).

Company. DWR will report a reduction in emissions in California, likely from using replacement power from the new natural gas-fired Lodi Energy Center in California.¹⁶ Nevada Power Company will continue to operate Reid Gardner Unit 4, resulting in an increase in emissions outside of California.¹⁷ Thus, this transaction caused emissions to leak out of California's carbon market.

- **Los Angeles Department of Water and Power / Navajo Generating Station.**

Earlier this year, the Los Angeles Department of Water and Power approved the purchase of a natural gas-fired power plant in Nevada called the Apex Power Plant. According to regulatory filings, this facility was purchased as part of LADWP's plan to divest its interest in the Arizona-based, coal-fired Navajo Generating Station in 2015, prior to the end of its contract term in 2019.

Because LADWP has not yet divested—and therefore cannot report emissions reductions within California—this transaction does not yet constitute resource shuffling. Nevertheless, it contains a candid and telling admission from LADWP. In a regulatory filing with the Los Angeles City Council, LADWP states that divesting from the Navajo Generating Station will reduce its CO₂ emissions liability, **“relieving LADWP from having to purchase emission credits to comply with the statewide cap and trade program.”**¹⁸

Indeed, this appears to be a textbook example of “a plan, scheme, or artifice to receive credit for emissions reductions that have not occurred”—the very definition of resource shuffling currently on the books.¹⁹ Yet it clearly fits within several of the safe harbors in the guidance document and for this reason would not violate the proposed regulatory amendments.²⁰

¹⁶ *Id.* at 58 (indicating that DWR has a 33.3% interest in the Lodi Energy Center and plans to use those imports to replace the lost deliveries from Reid Gardner). According to DWR, this facility is 16% more efficient than ARB's default unspecified emissions factor (361 vs. 428 mtCO₂e/GWh). *Id.*

¹⁷ Nevada recently passed SB 123, a law that requires Nevada Power Company to retire 300 MW of coal-fired capacity by the end of 2014, and an additional 250 MW by the end of 2017. This has generally been interpreted to mean closing Reid Gardner Units 1, 2, and 3 (each 100 MW) in 2014, and Reid Gardner Unit 4 (250 MW) in 2017. Leakage will continue until Reid Gardner Unit 4 retires.

¹⁸ Los Angeles Department of Water and Power, LADWP Board Approval Letter re: LADWP Apex Power Project Power Sales Agreement (PSA) No. BP 13-055 (Nov. 26, 2013), at 3, *available at* <http://cityclerk.lacity.org/lacityclerkconnect/index.cfm?fa=ccfi.viewrecord&cfnumber=13-1635>.

¹⁹ Cal. Code Regs., tit. 17, § 95802(a)(252).

²⁰ For example, LADWP cites several other motivating factors behind its decision to divest—such as the expectation of better prices from selling the coal contract early, and the intention to subsequently increase renewable energy and energy efficiency resources—and would therefore likely meet the sixth safe harbor conditions. LADWP, *supra* note 18 at 3. In any case, the transaction involves replacement power LADWP could argue “is necessitated by” divestment of a resource subject to the EPS rules, clearly satisfying the seventh safe harbor.

Once divestment from the Navajo Generating Station occurs as planned, LADWP will report a reduction in emissions within the California market. In turn, emissions outside the state will increase. Thus, LADWP's stated intention to shift the liability for its legacy coal resources to unregulated parties and report an emissions reduction due to its purchase of relatively clean replacement power indicates a firm intention to cause leakage.

These three transactions demonstrate that greenhouse gas emissions are already leaking out of California's carbon market at scale. As a result, between 30 and 60 million tons of CO₂ have leaked or are imminently leaking out of California's carbon market. Full calculations are presented in Tables 2 through 5, contained in the Appendix to this letter.

B. The safe harbors violate AB 32's clear requirement that ARB regulations minimize leakage. (Cal. Health & Safety Code § 38562(b)(8))

California's climate law speaks directly to this carbon market design issue. AB 32 requires that "to the extent feasible," ARB "shall ... minimize leakage."²¹ Here, the proposed regulations effectively undo the formal prohibition on resource shuffling. Because resource shuffling has caused and will continue to cause significant leakage of greenhouse gas emissions to other states, the proposed regulations do not minimize leakage.

A regulation that does not minimize leakage would be permissible under AB 32 only if there are no feasible alternatives. In this case, however, ARB has a wealth of alternative options. First, ARB could strike the proposed safe harbors and leave in place the original prohibition on resource shuffling in its regulations. Second, ARB could write new regulations that increase compliance flexibility while preventing leakage in cross-border electricity transactions. For example, ARB could require covered entities to retain emissions liability when shifting major electricity contracts to unregulated, out-of-state parties.²² Third, ARB could lower the overall cap under AB 32 to reflect observed and anticipated leakage, such that the net reduction after leakage meets the 2020 emissions target.

As these options demonstrate, ARB has a number of feasible alternatives—including doing nothing at all to the existing regulations. ARB's decision to nevertheless encourage leakage through the codification of safe harbors can only be described as arbitrary and capricious.

Because (1) the safe harbors have caused and will continue to cause significant leakage, and (2) ARB has a range of feasible alternatives, the proposed regulations do not minimize leakage as required by state law.

²¹ Cal. Health & Safety Code §§ 38562(b), (b)(8).

²² For a fully developed regulatory text implementing this approach, *see* Cullenward and Weiskopf, *supra* note 2, Appendices I & II.

C. The safe harbors violate AB 32's clear requirement that ARB regulations produce emissions reductions that are real, permanent, quantifiable, verifiable, and enforceable. (Cal. Health & Safety Code § 38562(d)(1))

By definition, leakage creates emissions reductions that are not real because when leakage occurs, the associated emissions reductions reported in California do not cause net emissions reductions to the atmosphere. Instead, they merely indicate the transfer of emissions liability to unregulated, out-of-state parties. Accordingly, the reported emissions reductions due to leakage are not real, permanent, accurately quantified, or verifiable. Even if ARB technically preserves its prohibition on resource shuffling, the safe harbors render it unenforceable. Thus, the safe harbors also violate AB 32's requirement that emissions reductions be "real, permanent, quantifiable, verifiable, and enforceable."²³

2. ARB's environmental analysis is legally insufficient because it fails to acknowledge the significant environmental harms caused by the safe harbors.

Although the proposed amendments are problematic enough on their own, ARB's failure to acknowledge the expected—and quite likely intended—consequences of its actions is all the more troubling. ARB's September 2013 Staff Report on the current proposed regulations contains an environmental analysis for the proposed regulations.²⁴ This analysis brazenly relies on misleading comparisons to avoid assessing the environmental impacts of the proposed regulatory changes. It must be updated to serve the most basic purposes of the California Environmental Quality Act ("CEQA"), which are to:

- (1) Inform governmental decision makers and the public about the potential, significant environmental effects of proposed activities.
- (2) Identify ways that environmental damage can be avoided or significantly reduced.
- (3) Prevent significant, avoidable damage to the environment by requiring changes in projects through the use of alternatives or mitigation measures when the governmental agency finds the changes to be feasible.
- (4) Disclose to the public the reasons why a governmental agency approved the project in the manner the agency chose if significant environmental effects are involved.²⁵

²³ Cal. Health & Safety Code § 38562(d)(1).

²⁴ California Air Resources Board, Proposed Amendments to the California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms, Staff Report: Initial Statement of Reasons 1, 44 (Sept. 4, 2013).

²⁵ Cal. Code Regs tit. 14, §§ 15002(a)(1)-(4).

Even as it implements major reforms that undermine the economic and environmental integrity of the carbon market, ARB nevertheless manages to stay silent on the expected environmental impacts. ARB's 2013 Staff Report falsely construes the proposed safe harbors as mere "clarifying language" that "would not affect the compliance responses available to [covered] entities from what was analyzed in the 2010 FED."²⁶ That reliance is misplaced because the 2010 FED analyzed a rulemaking that produced the original prohibition on resource shuffling, which did not include any safe harbors. In other words, ARB falsely claims that the current proposed safe harbors do not affect its prohibition on resource shuffling.

This is simply incorrect. The current regulation says only that "[r]esource shuffling is prohibited and is a violation of [Article 5 of the Cap-and-Trade Regulations]";²⁷ it says nothing about thirteen broad exemptions to this supposedly-preserved rule. As a result of the proposed safe harbor provisions, ARB's prohibition on resource shuffling will become an unenforceable formality. Between 30 and 60 million tons of CO₂ have leaked or are imminently leaking as a result, exceeding any reasonable threshold for significance under CEQA.²⁸ Because the proposed safe harbors would radically modify the carbon market regulations as they currently exist, CEQA requires ARB to conduct an analysis of the environmental impacts.²⁹

By claiming that it is not, in fact, changing its market rules, ARB suggests that adding multiple loopholes that undermine a critical market rule will have no environmental effect on the performance of its cap-and-trade market. Yet as my previous comment letter, ARB's own economic advisers (EMAC), and the observed resource shuffling transactions described in this letter show, the proposed regulatory changes have caused and will continue to cause significant leakage. In turn, this will lead to significant environmental consequences, as ARB put it when addressing leakage in its 2010 FED:

²⁶ California Air Resources Board, *supra* note 24 at 51 (citing California Air Resources Board, 2010 Cap and Trade Regulation, Appendix O: Functional Equivalent Document 1, 1 (Oct. 28, 2010)). ARB concludes its 2013 Staff Report analysis by stating that:

"Resource shuffling was disclosed as a prohibited activity in the 2010 Regulation as analyzed in the 2010 FED. Therefore, the potential for adverse impacts associated with the proposed clarifications to this definition fall within the scope and scale of those previously analyzed."

Id. at 59.

²⁷ Cal. Code Regs. tit. 17, § 95852(b)(2).

²⁸ *See* Cal. Code Regs. tit. 14, § 15064.4 (providing guidelines for determining the significance of impacts from greenhouse gases for the purposes of CEQA analysis).

²⁹ ARB could argue that the current regulatory proposal will have no significant changes to the status quo, but only if it acknowledges that the safe harbor regime is already in effect due to the November 2012 regulatory guidance document. Yet that admission would raise serious questions as to whether introduction of the regulatory guidance document constituted impermissible underground regulation that avoided the basic requirements of California administrative law, such as offering the public with formal notice and an opportunity to comment.

“If leakage occurs, the reductions in GHGs achieved by sources in California may be undone by a corresponding increase in emissions outside of California [Leakage] would likely lead to increased adverse environmental impacts outside of California, and would have negative effects on California’s economy.”³⁰

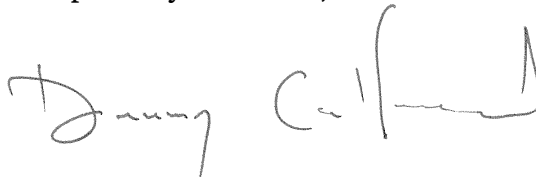
Because the resource shuffling safe harbors have caused and will continue to cause significant environmental consequences—impacts ARB has never acknowledged or analyzed—ARB has not satisfied the basic requirements of CEQA. To comply, ARB must assess the environmental consequences of its proposed safe harbor regulations and evaluate the feasibility of alternative approaches.

3. ARB can still pursue solutions, but must first acknowledge the problem.

Although the safe harbors have already created significant leakage, ARB can still act to fix the problem. There are at least two solutions. First, ARB could estimate the observed and anticipated leakage resulting from unfettered resource shuffling, and lower the overall cap such that the net emissions reductions meet the 2020 target. Alternatively, ARB could revoke the informal guidance on resource shuffling, implement new regulations that either restrict resource shuffling or price any leakage from cross-border electricity transactions, and adjust the cap to reflect the existing leakage observed to date.

Both solutions require ARB to acknowledge the impacts that have already happened and will continue to occur if left unchecked. Until that time, the credibility of the state’s carbon market will remain in question.

Respectfully submitted,



Danny Cullenward, JD, PhD
Philomathia Research Fellow
Berkeley Energy and Climate Institute
University of California, Berkeley
dcullenward@berkeley.edu

*My affiliation is for identification purposes only;
I am writing only in my individual capacity.*

³⁰ California Air Resources Board, 2010 Cap and Trade Regulation FED, supra note 26 at 378 (discussing leakage in the context of a CEQA evaluation of an alternative policy design that would employ border adjustments to goods and services imported to California).

Appendix — Calculating Observed Leakage

Calculating leakage from resource shuffling transactions requires information about the expected future production of both divested and replacement resources. If the precise pairwise replacement resource cannot be identified at the time of divestment, the leakage impacts can be bounded by the use of natural gas and zero-carbon replacement power benchmarks. Leakage will be highest if the replacement power is zero-carbon, and lower if natural gas is used; whatever mixture of replacement power supplies is used will fall in between these two benchmarks.

The first step in calculating leakage is to determine the period during which leakage will occur. This period begins when a covered entity divests from a high-emitting resource and ends at the earlier of (1) the end of the last carbon market compliance period in December 2020, or (2) when the high-emitting, divested resource retires. Leakage periods for the three transactions are shown in Table 2.

Next, the annual leakage rate can be estimated using historical and forecasted electricity production delivered to California purchasers, along with facility-level emissions rates. Here, a representative production level is calculated from recent and projected production as reported by utility and power purchasers to the California Energy Commission.³¹ The facility-level emissions rates are based on heat rates from the Velocity Suite Database (provided by the California Energy Commission) and fuel emission rates from the Energy Information Administration.³² Table 3 contains the representative electricity production and emissions rate data for each facility based on this information.

Representative annual emissions for the three facilities are shown in Table 4. These numbers reflect the representative electricity production scenario for each facility, with emissions rates calculated for three fuel scenarios. The coal scenario uses the facility-level emissions rate from Table 3. The natural gas scenario uses ARB's default emissions factor

³¹ California Energy Commission, Form S-2 for 2011 and 2013, *available at* http://energyalmanac.ca.gov/electricity/s-2_supply_forms_2011/ and http://energyalmanac.ca.gov/electricity/s-2_supply_forms_2013/.

Note: Data from 2009 and 2010 come from 2011 Form S-2 filings. Data from 2011 and 2012 come from 2013 Form S-2 filings. Data from 2014-2015 are utility-reported forecasts in 2013 Form S-2 filings.

Note: SCE did not report 2013 numbers for Four Corners in the Form S-2 filings; the reported forecasts for 2014 and 2015 were zero due to planned divestment.

Note: DWR divested from Reid Gardner in July 2013. 2013 data were excluded to avoid intra-annual variations in energy consumption due to the department's use of the power for the state water project.

³² Ventyx, Velocity Suite Database, *available at* <http://www.ventyx.com/en/enterprise/business-operations/business-products/velocity-suite>; United State Energy Information Administration, Voluntary Reporting of Greenhouse Gases Program, Fuel Carbon Dioxide Emissions Coefficients, *available at* <http://www.eia.doe.gov/oiaf/1605/coefficients.html>.

for unspecified power (0.428 tCO₂ per MWh),³³ which is representative of baseload natural gas power plants. The zero carbon scenario assumes zero emissions, which is representative of nuclear or renewable power plants.

Finally, Table 5 reports the plant-level leakage estimates. Leakage estimates are determined by multiplying the number of years of leakage by the annual leakage rate. In the case of natural gas replacement power, the annual leakage rate is the difference between the coal and natural gas scenarios in Table 4. In the case of zero-carbon replacement power, the annual leakage rate is the difference between the coal and zero-carbon scenarios in Table 4 (*i.e.*, the same as the coal scenario). If production at the divested high-emitting facility increases after divestment, actual leakage will be higher than is reported here. If production falls, actual leakage will be lower. Similarly, if the facility retires earlier than specified in Table 2, actual leakage will be lower.

Table 2: Leakage Periods for the Three Observed Transactions

Facility	Divestment	Retirement?	Leakage Period
Navajo Generating Station	December 2015	Not planned.	5 years
Four Corners Units 4 & 5	December 2013	Not planned.	7 years
Reid Gardner Unit 4	July 2013	December 2017	4.5 years

Table 3: Representative Facility-Level Data

Facility	Period	Average Output (GWh per year)	Emissions Rate (tCO ₂ per MWh)
Navajo Generating Station	2009 – 2015	3,906	1.02
Four Corners Units 4 & 5	2009 – 2012	5,143	0.97
Reid Gardner Unit 4	2009 – 2012	872	1.08

³³ Cal. Code Regs. tit. 17, § 95111(b).

Table 4: Representative Annual Emissions

Facility	Annual Emissions (million tons CO ₂ per year)		
	Coal	Natural Gas	Zero-Carbon
Navajo Generating Station	3.97	1.67	0
Four Corners Units 4 & 5	4.97	2.20	0
Reid Gardner Unit 4	0.94	0.37	0

Table 5: Leakage from Observed Transactions

Facility	Leakage (Million tons CO ₂ through 2020)	
	Natural Gas Replacement	Zero Carbon Replacement
Navajo Generating Station	11.5	19.9
Four Corners Units 4 & 5	19.4	34.8
Reid Gardner Unit 4	2.6	4.2
Total	33.5	58.9

Attachments

- Borenstein et al., EMAC Market Report (June 2013)
- Bushnell et al., Energy Institute @ Haas Working Paper #236 (January 2013)