

Tracking banking in the Western Climate Initiative cap-and-trade program

Executive Summary

We present a method for tracking the private bank of compliance instruments in the Western Climate Initiative (WCI) cap-and-trade program, drawing on official market data. Banking metrics allow policymakers and the public to track the extent to which independent analysts' concerns about allowance overallocation are manifesting in practice. Accordingly, we recommend that the California Air Resources Board (ARB) include a banking metric in its official cap-and-trade reporting, as the Board currently does for its Low Carbon Fuel Standard program.

Our metric indicates that the private bank is already quite large. Approximately 108 million compliance instruments were held in private accounts at the end of 2017, beyond what market participants need for the 2015-2017 compliance period. So long as annual program caps remain above actual covered emissions and quarterly auctions continue to sell out—conditions that have held true so far in 2018—the private bank will continue to grow.

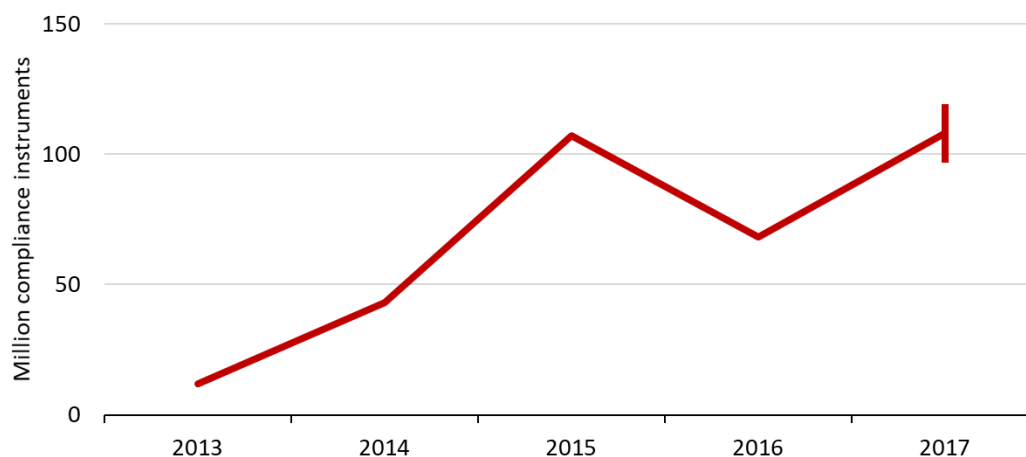
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Private bank of compliance instruments
(cumulative)



Our metric accounts for the fact that regulated emitters naturally seek to increase the number of compliance instruments they hold as a compliance deadline approaches. We measure only those instruments held in excess of outstanding compliance obligations, such that our banking metric is strictly independent from this natural market behavior.

In addition to tracking market health, banking metrics offer a basis for implementing program reforms that are conditional on market participants' observed behavior. In reaction to excess allowance supply conditions, the RGGI and EU ETS carbon markets recently enacted dynamic program adjustments that reduce allowance supplies on the basis of observed banking outcomes. One advantage of dynamic program adjustments, such as those implemented in RGGI and the EU ETS, is that they tighten markets only if undesirable conditions manifest in practice; if the balance of market supply and demand stays within a desired range, no action is taken.

Dynamic cap adjustments enable regulators to avoid significant delays associated with waiting for lagged data to be released before beginning a lengthy rulemaking process to address any problems revealed by those data. As a result, a cap-and-trade program with dynamic cap adjustments has a higher likelihood of delivering desired emission reductions compared to one with a multi-year gap between detection of any problems and the completion of a responsive rulemaking process.

Introduction

A key debate in California climate policy concerns cap-and-trade market overallocation—the extent to which the supply of compliance instruments exceeds demand. If market participants purchase and hold a large number of excess compliance instruments, regulated emitters could use these instruments in later years to comply with the cap-and-trade program such that emissions overshoot the declining program cap.¹ This outcome would

¹ See, e.g., Environmental Commissioner of Ontario, Ontario's Climate Act: From Plan to Progress – Appendix G: Technical Aspects of Oversupply in the WCI Market (Jan. 2018), <https://eco.on.ca/reports/2017-from-plan-to-progress/>; Legislative Analyst's Office, Cap-and-Trade Extension: Issues for Legislative Oversight (Dec. 2017), <http://lao.ca.gov/Publications/Report/3719>; Chris Busch, Oversupply Grows in the Western Climate Initiative Carbon Market, Energy Innovation Report (Dec. 2017), <http://energyinnovation.org/wp-content/uploads/2018/02/WCI-oversupply-grows->

undermine the cap-and-trade program's intended role as a backstop measure in the 2017 Scoping Plan, where it is assumed to "close the gap" between the emission reductions achieved by California's regulatory measures and the state's binding limit on 2030 greenhouse gas emissions.

Many independent analyses have concluded that the WCI market has a significant allowance overallocation problem. We find these independent analyses to be both credible and concerning, but we note that their projections are necessarily uncertain because they depend on future demand for allowances. Their accuracy can and should be measured over time by comparing projections of allowance overallocation against empirical metrics that track actual allowance banking in the WCI market.²

To that end, we adapt methods previously developed by ARB for tracking private banking behavior in the WCI market. We define private banking as the market-wide number of compliance instruments held in excess of compliance obligations at any given point in time. Our analysis shows that at the end of 2017, approximately 108 million compliance instruments were banked in private accounts.

The banking metric developed here can be tracked over time as new allowance auction and program compliance data are released. If the private bank continues to grow as projected, this would suggest that allowance overallocation concerns are indeed as serious as independent analysts have suggested; conversely, if the private bank holds steady or starts to decline, this would indicate that allowance overallocation concerns have been (at least partially) mitigated. So far, observable banking data are consistent with independent studies that project significantly higher allowance banking outcomes by the end of 2020.

We recommend that ARB include a banking metric in its official cap-and-trade data reporting. Banking metrics not only increase transparency in the operation of the cap-and-trade program, but also facilitate an opportunity

[February-update.pdf](#); Danny Cullenward & Andy Coghlan, Structural oversupply and credibility in California's carbon market, *Electricity Journal* 29: 7-14 (2016).

² The WCI market functionally includes only California and Québec. Ontario linked to the WCI market in January 2018 and participated in two quarterly auctions. Following its June 2018 elections, Ontario announced its intention to withdraw from the WCI market, stopped participating in joint auctions, and revoked its cap-and-trade regulation in July 2018.

for policymakers to design program reforms that adjust the supply of allowances in relation to observed banking behavior. As we and others have pointed out in the AB 398 implementation process, allowance overallocation conditions spurred both the Regional Greenhouse Gas Initiative (RGGI) and the European Union Emissions Trading System (EU ETS) to adopt data-driven strategies to manage the risks of market overallocation. Specifically, regulators in these jurisdictions have relied on metrics that track banking behavior to dynamically adjust program stringency.³

Estimating the private bank of compliance instruments

We define private banking as the difference between the number of compliance instruments currently held in private accounts and the number of compliance instruments needed to satisfy compliance entities' outstanding emission liabilities. Banking metrics are calculated at specific points in time. For example, the bank of compliance instruments as of the end of 2017 is the difference between the number of compliance instruments held in private accounts on December 31, 2017, and total compliance obligations that are still outstanding through that same point in time.⁴ Put another way, this represents compliance instruments held beyond those needed for the second compliance period's obligations (2015-2017).

We calculate the private bank as follows:

$$\textit{Private Bank}_t = \textit{Compliance Instruments}_t - \textit{Outstanding Obligations}_t$$

Where *Private Bank*_{*t*} is the bank of compliance instruments (including both allowances and offset credits) measured at the end of year *t*; *Compliance Instruments*_{*t*} is the number of compliance instruments held in private accounts at the end of the same year; and *Outstanding Obligations*_{*t*} is the compliance obligations incurred by regulated parties for cumulative emissions

³ Regional Greenhouse Gas Initiative (RGGI), more information available at <https://www.rggi.org/program-overview-and-design/elements>; European Union Emissions Trading System, "Market Stability Reserve," more information available at https://ec.europa.eu/clima/policies/ets/reform_en.

⁴ Compliance obligations are satisfied when emitters surrender compliance instruments, which are transferred from entities' private accounts to permanent retirement accounts. Compliance obligations that are still outstanding at a given point in time have not yet been satisfied by surrendering compliance instruments.

through the end of the same year that have not yet been satisfied by retiring compliance instruments.

We calculate that at the end of 2017, private entities had banked 108 (± 11) million excess compliance instruments. See Figure 1 and Table 1 for full results and see the Appendix for complete detail on the methods and data we use. A summary follows:

- **Compliance instruments:** We use ARB’s Compliance Instrument Reports (CIRs) to measure the number of compliance instruments held in private accounts.⁵ CIRs are released quarterly with data on private holdings of allowances and offsets by vintage year and account type, drawn directly from the WCI Compliance Instrument Tracking System Service (CITSS).⁶ In general, we use fourth quarter (Q4) CIRs to measure the number of compliance instruments held in private accounts at the end of a given year.

We limit the allowances included in this term to only those with vintage years equal to or less than the current year, t . Thus, our metric captures only those compliance instruments held in private accounts that can be used for compliance purposes in the same year for which the banking metric is calculated. We exclude all holdings of future year vintages—*e.g.*, those allowances purchased at advance auctions—until such time as they become current year vintages.

In addition to measuring allowances held in private accounts, we also include offsets because these credits can be used instead of allowances for compliance purposes, subject to quantitative limits.⁷ Including offsets implicitly assumes that the number held in private accounts does not exceed the cumulative limits imposed on their future use, which we believe is a reasonable assumption for the foreseeable future and which can be monitored going forward. For context, private accounts contained 47.5 million offset instruments at the end of 2017. Some of

⁵ ARB, Compliance Instrument Report, <https://www.arb.ca.gov/cc/capand-trade/complianceinstrumentreport.xlsx>.

⁶ WCI, Inc., Compliance Instrument Tracking System Service, <https://www.wci-citss.org/>.

⁷ Current regulations specify a quantitative usage limit of 8% of a covered entity’s compliance obligation for each compliance period through 2020. Cal. Code Regs., title 19, § 95854(b). AB 398 lowers this usage limit to 4% for the years 2021-2025 and 6% for the years 2026-2030. Cal. Health & Safety Code § 38562(c)(2)(E) (as added by AB 398).

these offsets will be used to satisfy a portion of the outstanding compliance obligation for the 2015-2017 compliance period, substituting for allowances that would otherwise be used for compliance purposes. In contrast, the maximum cumulative allowable offset usage for 2018-2030 under existing program caps and usage limits would be 248 million instruments.⁸ This comparison indicates that even if none of the currently held offsets were used to satisfy outstanding compliance obligations, sufficient permission exists for them to be fully used in the future and therefore they should reasonably be considered part of the overall private bank of compliance instruments.

- **Outstanding obligations:** To calculate a running total of cap-and-trade compliance obligations for 2013-16, we use historical data on covered emissions for California and Quebec.⁹ We then subtract actual compliance submissions made in California and Quebec. As a result, we capture only those compliance obligations that have been incurred through the end of a given calendar year, t , but not yet satisfied by retiring allowances or offsets in a formal compliance submission.

Official data on covered emissions for 2017 have not yet been released for California or Quebec. We use an estimate of 2017 covered emissions for each jurisdiction from the Environmental Commissioner of Ontario (ECO)¹⁰ and calculate an illustrative uncertainty range of $\pm 3\%$ around ECO's central estimate to evaluate the sensitivity of our 2017 results.

We account for the distinction between compliance submission requirements in California and Quebec. In Quebec, 100% of a multi-year

⁸ The number of permissible offset credits depends on future emissions because the offsets limit is expressed as a percentage of those emissions. To calculate this figure, we take the offset usage limits in current regulations and in AB 398 and apply those limits to the annual cap-and-trade allowance budgets in current regulations. Other reasonable assumptions could be made here but the total permissible offset usage would still be significantly larger than the number of offsets held in private accounts.

⁹ Covered emissions data for California are from annual compliance reports; covered emissions for Quebec are from an annually updated report. See Appendix for details.

¹⁰ Environmental Commissioner of Ontario, Ontario's Climate Act: From Plan to Progress (Jan. 2018), <https://eco.on.ca/reports/2017-from-plan-to-progress/>.

compliance obligation is due the November after the end of the compliance period. In contrast, California has annual compliance obligations that are due the November following each program year. For all but the final year of a compliance period, entities have a compliance obligation for 30% of their annual covered emissions. For the final year of a multi-year compliance period, the remainder of compliance obligations come due (*i.e.*, up to 70% for each earlier year and 100% of the final period year). We rely on official regulatory data to track retirements of allowances and offsets pursuant to these compliance events.¹¹

- **Effect of Ontario’s withdrawal:** Our calculations are consistent with Ontario’s brief entry into and early departure from the WCI program. We do not include compliance instruments issued by the Ontario government, nor do we include compliance obligations under Ontario law. However, remaining market participants in California and Quebec currently hold a substantial number of Ontario allowances, which remain valid for compliance purposes in California and Quebec and therefore contribute to the private bank in 2018. As of Q2 2018, ARB reports that Ontario’s departure led to an increase in the supply of compliance instruments held in private accounts in California and Quebec by 13.2 million allowances.¹² Although we do not report results for 2018 and therefore do not capture these new developments, future updates to this banking metric will reflect the presence of Ontario allowances in private accounts of entities in California and Quebec. See the Appendix for additional technical details on how we accounted for Ontario’s entry and exit in the primary reporting data used to construct our banking metric.

¹¹ ARB, 2013 Compliance Obligation Summary; ARB, 2013-14 Compliance Report; ARB, 2015 Annual Compliance Obligation Summary; ARB, 2016 Annual Compliance Obligation Summary, available at <https://www.arb.ca.gov/cc/capandtrade/capandtrade.htm>; MDDELCC, Report on the 2013-2014 Compliance Period of the Québec Cap-and-Trade System for Greenhouse Gas Emissions Allowances (C&T system), <http://www.mddelcc.gouv.qc.ca/changements/carbone/documentation-en.htm#compliance>.

¹² Michael Mastrandrea, Danny Cullenward, and Mason Inman, Ontario’s exit exacerbates allowance overallocation in the Western Climate Initiative cap-and-trade program, Near Zero Research Note (July 16, 2018), <http://www.nearzero.org/wp/2018/07/16/ontarios-exit-exacerbates-allowance-overallocation-in-the-western-climate-initiative-cap-and-trade-program/>.

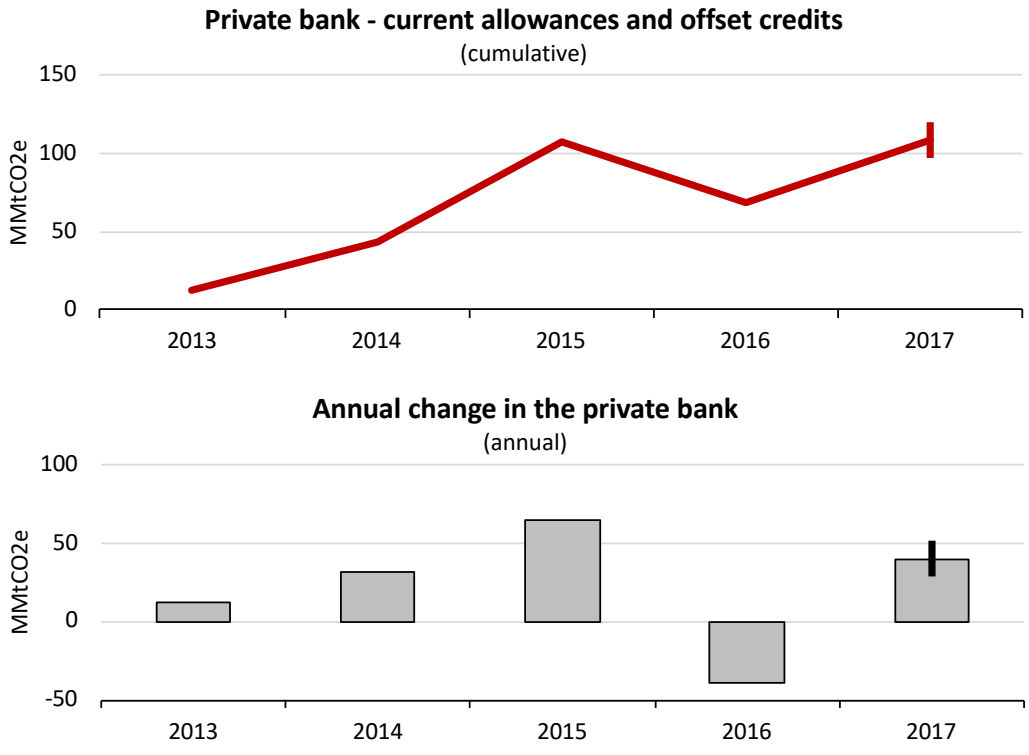


Figure 1. Private banking of excess compliance instruments. The top panel shows the running total of the number of compliance instruments banked in private accounts, calculated as the number of compliance instruments above and beyond the need to satisfy outstanding compliance obligations for covered emissions subject to the cap-and-trade program. The lower panel shows the annual change in the cumulative private banking metric. Data for 2017 in both panels include an uncertainty range reflecting the fact that 2017 emissions are projected, not officially reported.

Table 1: Banking metrics (million metric tons CO₂-equivalent, or MMtCO₂e)

	2013	2014	2015	2016	2017
Total private bank (cumulative)	11.9	43.1	107.1	68.3	108.1 (±11.3)
Annual change in the private bank	11.9	31.2	64.0	-38.7	39.7 (±11.3)
Covered emissions	163.4	164.4	397.9	382.4	375.6 (±11.3)
Outstanding compliance obligations	163.4	284.4	397.9	678.2	956.6 (±11.3)
Compliance instruments in private accounts	175.3	327.4	505.0	746.5	1,064.6

The annual change in our banking metric is related to the number of allowances and offsets introduced to the market each year. Figure 2 shows the supply of allowances and offsets introduced to private accounts by calendar year. Allowances are separated into direct allocations, current year auctions (including consignment allowance sales), and advance year auctions. When the supply of compliance instruments that passes into private accounts is greater than the covered emissions in a given year, the bank increases; conversely, in 2016, WCI auction sales collapsed, causing the banking metric to decline for that year.

Note that advance year allowances are excluded from our banking metric until their vintage year becomes current, as discussed further below.

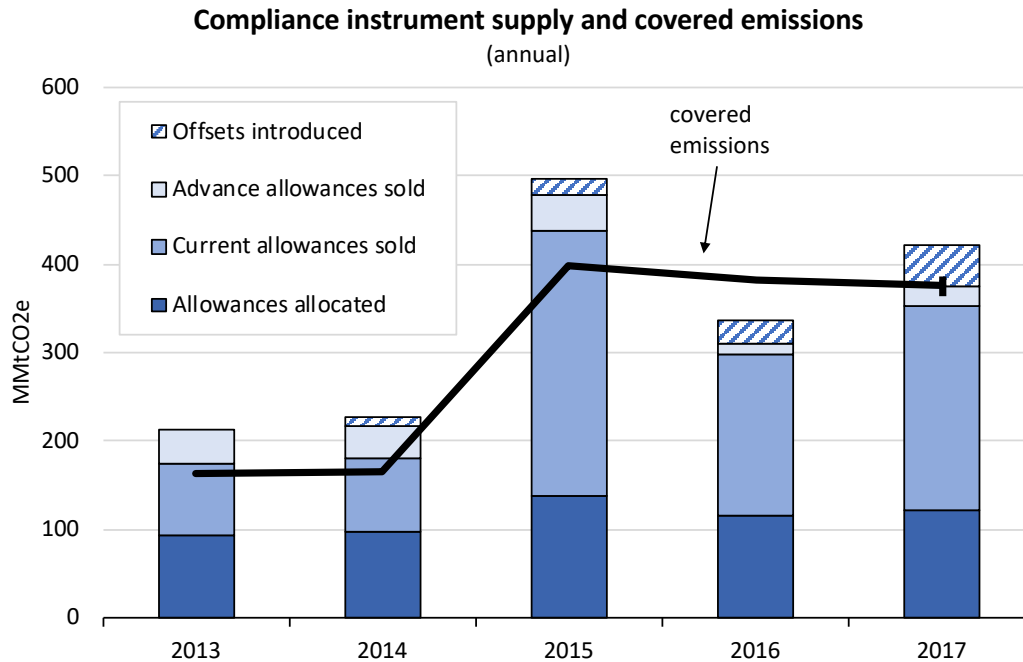


Figure 2. Annual compliance instrument supply and covered emissions. The bottom panel shows covered emissions compared against the number of instruments entering private accounts. When emissions are lower than the sum of the number of compliance instruments entering private accounts, there is a surplus and the bank increases. Covered emissions in 2013 and 2014 include electricity generators and large industrial facilities in California and Quebec. In 2015, covered emissions expanded to include fuel distributors. While total emissions instruments issued in 2016 exceeded covered emissions as in other years, several auctions failed to sell out; the unsold allowances are now being re-introduced at auction.

Additional allowance pools

In addition to the private bank of allowances tracked in the banking metric discussed above, three other pools of allowances are relevant in the context of evaluating overallocation and banking.

- **Advance auction sales:** WCI auctions include a “current auction” of allowances with the vintage of the current calendar year and a separate “advance auction” of a limited number of allowances with a vintage of three years in the future.¹³ For example, in 2014, quarterly auctions in

¹³ Current auctions also include the re-introduction of previously unsold allowances, which are sometimes of an earlier vintage year. See Mason Inman, Michael Mastrandrea, and Danny Cullenward, California’s “self-correct-

California and Quebec sold 84.8M vintage-2014 allowances at current auctions and 34.6M vintage-2017 allowances at advance auctions. All of these allowances were transferred into private accounts.

Although sales in advance auctions increase the number of allowances held in private accounts, these purchases are not necessarily an indication of growing market overallocation because they cannot be used for compliance obligations prior to their vintage year. Advance auction purchases can occur regardless of whether the market is oversupplied or undersupplied. Instead, purchases in advance auctions are primarily used as a hedge against future price increases and/or as an investment based on the prospect of rising allowance prices.

Accordingly, we exclude allowances purchased in advance auctions from our banking calculations until such time as allowances of the same vintage year are available in current auctions. Once time passes such that the vintage year of allowances purchased at advance auctions becomes current, these allowances contribute to the valid supply of compliance instruments and are therefore reflected in our banking metric. For example, the 34.6M vintage-2017 allowances sold at advance auctions in 2014 do not count towards the banking metric until the year 2017, at which point vintage-2017 allowances are “current” and therefore usable for compliance purposes arising from covered emissions through 2017.

By excluding allowances acquired at an advance auction from our private banking metric until such time as the banking metric’s year matches their vintage, we express no assumption or judgment about their eventual use. Accordingly, the number we report is a conservative estimate of the total market-wide private bank.

- **Unsold allowances:** In addition to allowances held in private accounts, government accounts hold a significant number of previously unsold allowances. In the 2016 and 2017 auctions, 143 million allowances owned by California or Quebec went unsold in current auctions and were transferred to temporary government accounts. Pursuant to

ing” cap-and-trade auction mechanism does not eliminate market overallocation, Near Zero Research Note (May 23, 2018), <http://www.near-zero.org/wp/2018/05/23/californias-self-correcting-cap-and-trade-auction-mechanism-does-not-eliminate-market-overallocation/>.

market rules, these previously unsold allowances are now being reintroduced for sale in current auctions.

California has a distinct market design that differs from Quebec's. If California's state-owned allowances remain unsold for more than 24 months, they are removed from the normal auction supply. Quebec's current regulations do not contain a similar stipulation. We calculate that this "self-correction" mechanism will help reduce the extent of overallocation in the WCI market, removing a minimum of 38 million allowances from the normal auction supply, if auctions continue to sell out, and as many as 52 million allowances, if the November 2018 auction does not sell out, but this will address only a fraction of the overallocation expected by 2020.¹⁴ (We note that overallocation estimates from Dr. Chris Busch accounted for allowances removed via this "self-correction" mechanism, under the assumption that current auctions would continue to sell out—which so far has proven true.)

Of the 143 million California- and Quebec-owned allowances that went unsold in 2016-2017, 60 million have already been reintroduced and sold at auction through August 2018 (including 16 million sold in November 2017). Those that were sold in 2017 are included in the private bank for 2017 and those that were sold in 2018 (or future years) will be included in future years' banking metrics. All told, an additional 75 to 89 million California and Quebec allowances that went unsold in 2016-2017 will likely be added to the private bank of 108 million measured as of the end of 2017, with the exact amount dependent on the outcomes of the next two quarterly auctions (Q4 2018 and Q1 2019). However, we stress that these expected sales are not included in the banking metric developed here, which incorporates only those sales that occurred by the end of 2017.

- **Reserve accounts:** For the period 2013 through 2030, current regulations set aside an additional 213 million allowances in two government accounts: California's APCR and Quebec's reserve. These allowances will become available if allowance prices rise significantly above current levels, and/or if ARB re-allocates a portion of these allowances into so-called price containment points or other accounts accessible at

¹⁴ *Id.*

lower prices in the post-2020 market design currently under development in California.¹⁵ Because market prices remain close to the price floor, these allowances have not been purchased to date and therefore are not counted in the banking metric presented here. If any of these allowances are purchased in the future, however, they would show up in the CIRs and therefore be counted in future years' banking metrics.

Estimates of banking in other emissions trading systems

Three non-WCI emissions trading systems illustrate how policymakers can observe banking and use data-driven strategies to manage the risks of market overallocation.

We first consider the Regional Greenhouse Gas Initiative (RGGI), a cap-and-trade program that applies to electricity sector emissions in nine states in the eastern United States. RGGI has recognized that it has repeatedly experienced a large overallocation of allowances, leading to a large private bank of allowances.¹⁶

To account for the negative consequences of allowance overallocation, RGGI has already implemented two one-time adjustments that lower the system's emissions cap for future years. RGGI participants have also agreed on a third intervention to lower the cap, to be implemented over the period 2021-2025. The third adjustment of the cap is tied directly to the calculated size of the bank of allowances after satisfying compliance obligations for the current compliance period, 2018-2020, following this equation:¹⁷

$$\textit{Banked allowances} = \textit{allowances in private accounts} - \textit{emissions}$$

For *allowances in private accounts*, RGGI considers allowances of vintages up to the end of the current compliance period (*i.e.*, up to the end of 2020).

¹⁵ Danny Cullenward, Mason Inman, and Michael Mastrandrea, Implementing AB 398: ARB's initial post-2020 market design and "allowance pool" concepts, Near Zero Research Note (Mar. 16, 2018), <http://www.near-zero.org/wp/2018/03/16/implementing-ab-398-arbs-initial-post-2020-market-design-and-allowance-pool-concepts/>.

¹⁶ RGGI, *supra* note 3.

¹⁷ Regional Greenhouse Gas Initiative (RGGI), Model Rule 2017 (Dec. 19, 2017), https://www.rggi.org/sites/default/files/Uploads/Program-Review/12-19-2017/Model_Rule_2017_12_19.pdf.

For *emissions*, RGGI counts all covered emissions in the system for the current compliance period (2018-2020). Thus, the program features a dynamic cap adjustment based on the extent to which market participants voluntarily bank extra allowances into future market periods.

Second, the European Union recently implemented a Market Stability Reserve (MSR) to increase the stringency of its carbon market, known as the EU ETS. Like the WCI and RGGI programs, the EU ETS has experienced a significant market overallocation problem. Because the EU ETS lacks a price floor, however, carbon prices had remained low for several years, falling between approximately \$5 to \$10 per tCO₂e despite Europe's climate policy ambitions. To address this challenge, the EU climate regulator created the MSR, which dynamically updates the supply of allowances based on market banking behavior. If there are more than 833 million allowances in circulation, market regulators will withdraw allowances and thereby reduce supply; in contrast, if market circulation shrinks to less than 400 million allowances, the regulator will add additional allowances to increase supply.¹⁸ Since the MSR was implemented, EU ETS prices have recovered and, as of August 2018, now exceed prices in the WCI market.¹⁹

Third, California's own Low Carbon Fuel Standard (LCFS) features a market-based system of emissions reduction credits. ARB's LCFS Data Dashboard shows the number of emissions deficits (compliance obligations) and credits issued, along with the cumulative bank of credits in each quarter (see panel 3 of the online dashboard). ARB calculated that the bank was 9.8 million credits at the end of 2017 (the latest data available at the time of writing); this banked quantity is nearly as large as the annual compliance obligation in 2017, 10.0 million credits.²⁰ We believe ARB could take a similar approach to analyzing the supply and demand balance for credits in the statewide cap-and-trade program for greenhouse gases. In-

¹⁸ Torbjørn Jenovaker and Jørgen Wettstad, Ratcheting Up Carbon Trade: The Politics of Reforming EU Emissions Trading (2017), *Global Environmental Politics* 17(2): 105-124.

¹⁹ Sandbag, EU ETS Carbon Price Viewer, <https://sandbag.org.uk/carbon-price-viewer/>.

²⁰ ARB, Low Carbon Fuel Standard Data Dashboard (version as of April 25, 2018), <https://www.arb.ca.gov/fuels/lcfs/dashboard/dashboard.htm>.

deed, ARB has previously considered banking metrics similar to the concept proposed here.²¹

As these examples show, both ARB and other leading climate regulators have successfully tracked banking behavior in emissions trading programs around the world. The RGGI and EU ETS examples also indicate how a metric of observed banking behavior can be used to inform program stringency via dynamically adjusted program caps.

Conclusion

We develop a method for tracking the private bank of compliance instruments in the WCI cap-and-trade program. Our metric indicates that there is a large bank of compliance instruments—approximately 108 million instruments at the end of 2017. So long as program caps remain far above covered emissions and auctions continue to sell out—conditions that have held true in 2018—the private bank will continue to grow.

Observed banking behavior suggests that market participants consider purchasing allowances beyond their immediate compliance needs to be a sound investment—either sufficiently valuable in relation to the rising floor price, as a financially attractive option with a rate of return similar to or better to other opportunities they have, or perhaps as a hedging strategy that reduces exposure to potentially higher compliance costs in the program’s later years. Given that the auction floor price is mandated to rise 5% per year plus inflation, allowance banking provides a relatively low-risk if modest return, with the potential for substantially higher returns when overallocation conditions diminish and market prices rise.

Banking provides important contributions to the cap-and-trade program’s performance. Some non-compliance entities provide liquidity to the market—for example, allowing compliance entities that are not bidders on the primary market to obtain allowances on the secondary market, and also facilitating futures trading that would not be possible without sophisticated intermediaries. However, excess banking across the entire market can lead

²¹ ARB, Updated Economic Analysis of California’s Climate Change Scoping Plan (Mar. 24, 2010) at 30, https://www.arb.ca.gov/cc/scopingplan/economics-sp/updated-analysis/updated_sp_analysis.pdf.

to artificially low prices and enable higher emissions in later years that put California's climate goals at risk.

As shown in this report, banking outcomes can be tracked objectively using public market data. Furthermore, these metrics could easily be integrated into ARB's official market reporting. In turn, official reporting would enable a number of important improvements to cap-and-trade program governance. For example, a banking metric would measure the extent to which concerns about allowance overallocation manifest in practice. Whether or not the bank of allowances will grow to the levels projected by independent analysts is, at its core, an empirical question that will be revealed in time.

Nevertheless, we caution that a pure "wait and see" approach is unlikely to detect the full extent of overallocation in time to make appropriate interventions. Instead of waiting for lagged data releases to indicate a problem that has already manifested, and then initiating processes to address the problem, policymakers could consider anticipatory reforms that apply only if banking metrics reach predetermined thresholds. Recent advances in the RGGI and the EU ETS markets offer examples of how this principle can be applied in practice. This type of reform has the distinct advantage of enabling policymakers to cut years of lag from the data reporting and rulemaking process, increasing the odds that a cap-and-trade program delivers on desired emission reductions.

Appendix: Method for calculating banked compliance instruments

We define the private bank as follows:

$$\text{Private Bank}_t = \text{Compliance Instruments}_t - \text{Outstanding Obligations}_t$$

Where *Private Bank_t* is the bank of compliance instruments measured at the end of year *t*; *Compliance Instruments_t* is the number of compliance instruments held in private accounts at the end of the same year; and *Outstanding Obligations_t* is the compliance obligations incurred by regulated parties for cumulative emissions through the end of the same year that have not yet been satisfied by retiring compliance instruments.

Below we describe our full methodology for calculating banked compliance instruments. For more details on data sources, including links to online data sources, see the accompanying spreadsheet, which is posted on our website.

- **Compliance instruments:** We use ARB's fourth quarter (Q4) Compliance Instrument Reports (CIRs) to directly observe private holding of offsets and allowances for most years in our banking metric.²² There are two exceptions. First, ARB did not report CIRs in 2013, so we used data on allowance allocation²³ and auction sales²⁴ for both California and Quebec for this year. Second, the CIR for Q4 2017 includes Ontario's allowances and required further adjustment, as described below.
- **Outstanding obligations:** Outstanding compliance obligations are defined as the total compliance obligations incurred up to a given date minus all compliance submissions up to that same date.

²² ARB, *supra* note 5.

²³ ARB, Public Data on Allowance Allocation, <https://www.arb.ca.gov/cc/capandtrade/allowanceallocation/publicallocation.htm>; MDDELCC, Le marché du carbone, Documentation: Allocation gratuite d'unités d'émission, <http://www.mddelcc.gouv.qc.ca/changements/carbone/documentation.htm#allocation>.

²⁴ Data for auctions that included California and any linked jurisdictions are available at <https://www.arb.ca.gov/cc/capandtrade/auction/auction.htm>; data for Quebec-only auctions are available at <http://www.mddelcc.gouv.qc.ca/changements/carbone/avis-resultats-en.htm>.

Total compliance obligations are based on official government summaries of the emissions subject to the cap-and-trade program in California²⁵ and Quebec.²⁶ We use the primary data that ARB and MDDELCC use to define legal compliance obligations under their respective cap-and-trade program regulations for the years 2013 through 2016, and a projection of emissions in 2017, as discussed below.

Compliance submissions are required every year in California and following the end of multi-year compliance periods in Quebec. We used official data on the number of allowances and offsets submitted in each compliance event.

By distinguishing between satisfied and outstanding compliance obligations, our metric accounts for the natural “stockpiling” behavior observed in the market as major compliance deadlines approach. This feature is essential because entities will tend to increase their holdings of compliance instruments toward the end of multi-year compliance periods, when the bulk of the multi-year compliance obligation comes due in the following November. Again, our metric fully accounts for this dynamic and measures only the compliance instruments held in excess of outstanding compliance obligations.

- **Projected emissions in 2017:** Because our banking metric uses official data on covered emissions, but official data are lagged by nearly a year, it is necessary to estimate 2017 emissions in order to calculate the banking metric for 2017. We use estimates of 2017 covered emissions

²⁵ California covered emissions are drawn from annual compliance reports. We use these data, rather than annual reported emissions from the Mandatory Greenhouse Gas Emissions Reporting (MRR) regulations, because the compliance reports address actual calculated compliance obligations and sometimes differ slightly from MRR reported emissions. For example, if ARB were to determine that a covered entity under-reported emissions in its MRR submission, a later edition of MRR data would include a revised value for their emissions for that year. If the revision were less than 5%, however, that entity would not be obligated to surrender additional compliance instruments (per Cal. Code Regs., tit. 19, § 95858), leading to a small difference between revised MRR emissions and aggregate compliance obligations for that year. We use the annual compliance reports because the banking metric tracks the number of compliance instruments held in private accounts relative to outstanding compliance obligations, not relative to actual emissions.

²⁶ Quebec covered emissions are from the MDDELCC report titled “Émissions de gaz à effet de serre déclarées et vérifiées des établissements visés par le RSPEDE,” at <http://www.mddelcc.gouv.qc.ca/changements/carbone/etablisements-SPEDE.pdf>.

from the 2018 Environmental Commissioner of Ontario (ECO) report on the WCI market.²⁷ ECO assumed that from 2016 to 2017, California covered emissions will decline 1.9% and Quebec covered emissions will decline 1.0%. We adopt ECO's estimate as our central estimate for projected 2017 emissions and include an error range of $\pm 3\%$ around this projection to illustrate the sensitivity of our metric to uncertainty about 2017 covered emissions.

The uncertainty range in our banking metric (108M \pm 11M compliance instruments at the end of 2017) reflects the underlying uncertainty in projected emissions. Once official data are released for 2017 covered emissions in California and Quebec, we will update our calculations and our estimate of banking through the end of 2017. That official reporting will soon be followed by Q4 2018 CIR data that will allow us to estimate a banking metric for 2018, based on a new projection for 2018 covered emissions in California and Quebec.

We emphasize that any projection of emissions could be used in this banking metric. None of the participating WCI governments generates an official projection, so we were forced to use an independent estimate. We believe that the ECO report offers a credible basis for projecting emissions that occurred in 2017, but anyone who prefers a different estimate can readily substitute that number into our calculations to generate a different banking estimate for the year 2017.

- **Adjustment for Ontario in Q4 2017:** CIRs describe the state of the WCI market several days after the end of their eponymous quarter. As a result, the Q4 2017 CIR measures private holdings in early January 2018, not the end of December 2017. At that point Ontario had joined the WCI program and the compliance instruments held by Ontario entities were included in the WCI-wide CITSS accounting data in the CIR. However, Ontario and the California-Quebec markets were not linked in 2017, so we could not use the Q4 2017 CIR data to measure WCI-wide allowance banking at the end of December 2017. Instead, we used the Q3 2017 CIR to observe private holdings of offsets and allowances as of the end of Q3 2017.

To then estimate what allowance holdings the Q4 2017 CIR would have reported if it had excluded Ontario allowances, we added the Q4

²⁷ ECO, *supra* note 10.

2017 current auction sales of California and Quebec allowances and subtracted the number of allowances submitted to ARB at the November 2017 compliance event.

We note that this is a one-time adjustment to the methods employed in our metric. Beginning with the Q2 2018 CIR, ARB is once again reporting compliance instrument holdings for California and Quebec entities only, consistent with Ontario's withdrawal from the WCI cap-and-trade program. Thus, for the banking metric in 2018 and in future years, no further adjustments will be needed, as the Q4 CIRs will directly measure the appropriate data once again.²⁸

Although this modification was necessary to estimate privately held allowances at the end of 2017, we retained the use of the Q4 2017 CIR to observe the number of offsets held in the California-Quebec market on the assumption that very few offset credits would have traded hands in the first few days of 2018. (California issues the vast majority of the offsets credits in the WCI program and Ontario has not issued any to date.) If this assumption proves incorrect and Ontario entities were in fact holding a substantial number of the offsets reported in private accounts in the Q4 2017 CIR, any error will manifest only in the 2017 banking metric because future years' banking metrics will be based on accurate holdings reported in future years' Q4 CIRs.

²⁸ Similar adjustments can be made if Ontario or other jurisdictions join the WCI program in the future.

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About Near Zero

Near Zero is a non-profit environmental research organization based at the Carnegie Institution for Science on the Stanford University campus. Near Zero provides credible, impartial, and actionable assessment with the goal of cutting greenhouse gas emissions to near zero. This research note is for informational purposes only and does not constitute investment advice.

Data used in this research note are available at our website.

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