RAP Energy solutions for a changing world

International Experience with Market-Based Mechanisms for reduction of GHG emissions

Introduction and Summary

A recent RAP publication discusses a number of "key lessons" from international experience for countries designing market-based mechanisms for reduction of greenhouse gas emissions (GHGs).[1] The present paper builds on that earlier publication, provides more details on the international experience, and explains how that experience fits with the "key lessons". We tailor our discussion to reflect our understanding of the situation in China as the possibility of various market based mechanisms are considered there. We focus here on the existing examples of cap-and-trade style systems (also referred to as "permit schemes" in the earlier paper), namely those in New Zealand, the European Union, Tokyo, and the northeastern United States.[2] We also discuss California's planned cap-and-trade scheme.

The purpose here is not to provide an exhaustive description and analysis of each scheme; instead, we aim to highlight certain aspects of the international experience that we believe might be particularly important in the Chinese context.[3] Given the interest around the world in these types of policies, we hope this report might be useful in other countries as well.

Before we begin, it is worth making a few cautionary statements. First, our view is that market-based mechanisms such as cap and trade will, at best, represent only a modest part of any successful overall scheme to control a region or country's GHG emissions – in China or elsewhere. A robust portfolio of policies – which are beyond the scope of this paper to explain in detail – are needed to stimulate large scale exploitation of cost-effective energy efficiency opportunities, change the incentives for development faced by local decision-makers, facilitate a broad shift away from energy-intensive industry, and mobilize renewable resources. A single market mechanism will never achieve all of these goals. Second, governments that have experimented with market-based mechanisms have found that it is difficult to get all of the details right. There have been some positive developments, but there have also been many difficulties in design and implementation. As a result, existing mechanisms have made only modest steps toward reducing GHGs. China and other countries considering these types of

[1] http://raponline.org/docs/RAP%5FMarketBasedMechanismsandSupportingPoliciestoAchieveEE%5F2011%5F03%2Epdf

[2] The earlier paper also covered "white certificate" schemes (also known as energy efficiency certificate schemes).

[3] There are a number of international surveys available that discuss various market-based mechanisms at greater length. For example, see www.iea.org/papers/2010/ets_paper2010.pdf

mechanisms will probably learn more from the mistakes than the successes that have been seen to date.

Having noted the difficulties of design and implementation, we still believe that it is worth pushing ahead with market-based mechanisms, not least because they will be an aid in developing the institutional infrastructure needed to support broad GHG reduction goals. In particular, as has been the case in other countries, even an attempt that is not fully successful may lead to improved institutional capacity in the following areas:

- setting regional and national emissions targets;
- emissions MRV (monitoring, reporting and verification);
- dissemination of information on emissions and emissions reductions; and
- mobilizing capital for effective investment in energy efficiency.

This institutional capacity is useful, even if the market mechanism itself is not particularly successful.

With these overarching themes in mind, we turn to a review of the short list of key lessons that we draw from international experience. This list is modified from our previous paper to reflect our most recent thinking, as well as our current understanding of the fast-changing situation in China. Please see the original paper for more discussion and an explanation of terminology. Note that the implementation of a cap-and-trade scheme requires attention to many complex issues; this list is merely a selection of issues that we believe are particular important for policymakers in the early stages of planning a new scheme. [4]

1. **Cap design: A firm and ambitious cap is very important, but has been elusive in existing schemes to date.** The effectiveness of a cap-and-trade scheme flows from the government's firm restriction of the number of allowances. An allowance represents the right to emit a fixed amount of GHGs. The number of allowances issued by the government should reflect existing emissions less the reductions that decision makers are seeking to achieve. Each party subject to the scheme (ie, each potential emitter, sometimes referred to as "participants") must obtain and surrender allowances equivalent to the total quantity of its emissions. The total number of allowances issued should be determined by the government's goal for emissions reduction. Various designs that tie the number of allowances to other variables (such as expected production by emitting firms), or are open to ad hoc adjustment, will undermine the emissions reduction goal. Unfortunately, the existing international examples of cap and trade have all been disappointing with regard to the stringency of the cap, and as a result allowance prices have been low. Another important lesson for cap design is that good data on emissions is essential for setting an effective cap and should be collected early in the policymaking process. The EU ETS, in

[4] This list is not necessarily ordered by degree of importance.

particular, suffered from difficulties in its first phase due to poor initial data quality and uncertainty about how to set the cap. In contrast, the Tokyo scheme benefited from a forerunner program that – although unsuccessful at controlling emissions – established a good system for mandatory reporting of emissions. In a similar fashion, the Regional Greenhouse Gas Initiative (RGGI) program benefitted from data collection mechanisms established under an existing air pollution monitoring program administered by the US EPA.

2. **Coverage: Initially limiting the scheme to a particular sector (or sectors) is a good approach; remaining sectors may then be added gradually.** No government in the world has yet been successful in fully implementing a comprehensive market-based mechanism that covers all sectors, fuels and end-users — although New Zealand and California have plans to implement economy-wide coverage and the EU appears to be moving gradually in that direction.[5] There are several reasons to limit a cap-and-trade scheme to a relatively narrow sector during the early stages of implementation – ***and due to its carbon-intensity and relatively small number of emitters the power sector is a particularly good choice for initial implementation.*** First, such a limitation means fewer firms covered by the scheme and thus easier implementation of an MRV and enforcement regime (see point five, below). Second, inclusion of industrial sectors that produce internationally tradable goods often leads to political pressure from affected firms for protection from competitive disadvantage. In some places – notably the EU – this lobbying has led to decisions in favor of less ambitious caps and free allocation of allowances based on historical emissions, undermining the effectiveness of the cap-and-trade scheme. Third, starting with the power sector can offer policymakers, officials, and affected firms time to learn and adapt.

3. **Allocation of allowances: Auctioning of allowances is preferable to free allocation, both to raise revenue for energy efficiency investments and also to improve efficiency of the scheme.** Broadly speaking, governments administering cap-and-trade schemes generally make an initial distribution of allowances in some combination of the following two approaches: 1) by free allocation (sometimes called "gifting" or "grandfathering") – that is, by giving allowances away free of charge; and 2) by auction.[6] Auctioning has an important advantage: it raises revenue that can be used for socially beneficial purposes. In particular, these funds can be directed to fund "complementary" efficiency investment programs (see below). In other words, by providing allowances free of charge, the government is giving away valuable assets and passing up a source of revenue to fund complementary efficiency policies (see below). In addition, well-implemented auctions establish a price for emissions – which is particularly useful if there is no well-developed secondary market. Of existing international examples, so far only RGGI in the northeastern US has implemented

[5] Australia's proposed scheme (not discussed in this paper) may also have economy-wide scope.
[6] Our simplified discussion might be extended to include a third option, where the authorities allow purchase of allowances at a defined price, sometimes as a safety valve to an auction. This is the case in the US RGGI and New Zealand schemes.

substantial auctioning; however, the EU, Tokyo, and California appear to moving in the direction of greater auctioning.

4. **<u>Complementary policies</u>: Complementary policies supporting investment in energy efficiency are critical.** In the most basic textbook description, cap-and-trade programs rely on the *price mechanism* to stimulate energy savings: that is, prices rise until households and firms have sufficient incentive to implement the efficiency measures, fuel changes, or curtailment of energy use necessary to meet the overall cap. However, in practice, energy consumers are typically not very responsive to changes in prices and it takes large increases in price to stimulate modest investments in energy efficiency. Many consumers do not have access to capital to invest in alternatives or efficiency. Renters, in particular, have very short time horizons and high implied discount rates. In other words, relying on the price mechanism can be a blunt and traumatic way to encourage investment in energy efficiency. For this reason, we recommend pairing cap-and-trade schemes with programs that mobilize capital for direct, comprehensive investment in energy efficiency. These programs may be administered by government agencies, government-affiliated organizations, or grid companies. Again, the experience of RGGI in the northeastern US is a particularly useful example.

5. **<u>MRV, enforcement and related issues</u>: Managing emissions data and ensuring that required allowances are surrendered by emitters are at the heart of any cap-and-trade scheme.** Policymakers face the task of designing a regime, based on local conditions and institutional capacity, that includes:

    - *mandatory* self reporting and independent verification (usually by third parties) of actual emissions by firms covered by the scheme;
    - penalties for non-compliance, including substantial penalties (that significantly exceed the market cost of allowances) for emitters who fail to surrender required allowances;
    - a registry to track ownership of allowances; and
    - secondary market oversight and promotion of transparency in order to reduce price volatility.

    Work in most of these areas will have benefits beyond the scope of the market mechanism itself by helping to support other emissions-reduction policies.

The following sections briefly discuss each of the international case studies. We organize our comments in line with each of the five "key principles" above. Our goal is to illuminate the ways in which mistakes and successes in each case have led us to our current views.

Regional Greenhouse Gas Initiative (Northeastern US)

The Regional Greenhouse Gas Initiative (RGGI), launched in January 2009, covers ten states in the northeastern US – together representing about a fifth of the national economy. We see RGGI as a very good model along most of the dimensions discussed in the introduction. Above all, it has a laudable record of auctioning most allowances and, in turn, devoting the majority of that revenue to various state-run efficiency programs. In addition, the RGGI states pragmatically decided to limit the scheme – at least in its initial stages – to reducing power sector emissions. RGGI falls short, however, in terms of the cap: although the cap is reasonably firm, the level of the cap is not ambitious (that is, it is not sufficiently low). For this reason, RGGI has, to date, delivered only modest amounts of emissions reductions at best.

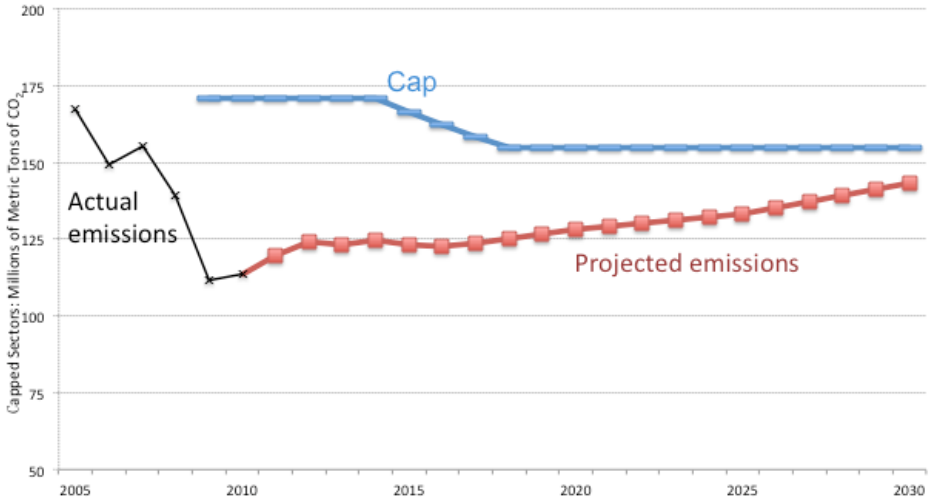
1. Cap design

RGGI's cap, designed in lengthy negotiations among the ten state governments, operates as a unified cap covering the entire region. It is framed in terms of a baseline corresponding to a level 4% above the actual average power sector emissions seen in 2000-2004 (approximately 171 million metric tonnes of CO2 per year).[7] Over the period between the launch of the program in January 2009 and December 2014, the cap is set to keep emissions at this baseline level. After the end of 2014, the cap is slated to be tightened by 2.5% per year so that it is 10% below the 171 million tonne baseline by the end of 2018. (See Figure.)

The looseness of the RGGI cap can be seen in Figure 1. The dotted line reflects the overall cap. Actual overall emissions for RGGI (the solid dark line) have so far been well below the cap. The downturn in actual emissions is partly due to the recession and partly to a decline in the relative price of natural gas compared to more emissions-intensive fuels.[8] According to the projections prepared by RGGI's implementing organization, emissions are still expected to be below the cap as far into the future as 2030. RGGI plans a comprehensive program review in 2012, and the cap level is expected to be the first issue to be addressed.

[7] Equal to 188 million short tons.
[8] Environment Northeast, May 2011, "RGGI Emissions Trends."

Figure 1: RGGI cap and projected emissions



Source: *RGGI Reference Case Results and Assumptions*, November 2010.

2. Coverage

By restricting the scheme to the power sector, and only regulating power plants larger in capacity than 25 MW, RGGI avoided the complications associated with designing a broader scheme. RGGI also ignores "leakage" from electricity imports over transmission interconnections to other regions. RGGI administrators only have to deal with about 200 plants covered by the scheme, which greatly simplifies the tasks of MRV and enforcement.

3. Allocation of allowances

To date, RGGI has by far the best auctioning record of any cap-in-trade scheme in the world. Over the first two years of the program, approximately 86% of allowances were sold through quarterly auctions (although this percentage varies by state, with some auctioning a much higher percentage).[9] However, although this percentage is admirable, the weak cap – and resulting low allowance prices – has meant lower auction revenue than would have been raised under a more ambitious regime.[10] The total auction for the two year period was $789 million, which is equal to about $8 per capita. Although this amount is not large relative to the size of the regional economy (it represents only about 0.01% of the region's annual GDP), it is significant compared to spending on energy efficiency. For example, per capita utility investment in energy efficiency was only about $11 (on average, across states) in 2009.

4. Complementary policies

[9] RGGI 2011, "INVESTMENT OF PROCEEDS FROM RGGI CO2 ALLOWANCES".

[10] Allowances to emit one tonne of CO2 consistently traded at less than $4 for the first two years of the program.

RGGI is an excellent example of "recycling" auction revenue into state and utility-run programs that investment in energy efficiency. Of the auction revenue mentioned above:

- 52% went to state and utility programs to improve energy efficiency;
- 11% to deploy renewable energy resources;
- 14% to assist low-income households; and
- 1% other GHG reduction programs.[11]

Again, these percentages vary by state. Some RGGI states have enacted legislation establishing a floor on the percentage of revenue from RGGI auctions that must be spent on energy efficiency. For example, Vermont requires 100% of proceeds be spent on energy efficiency. Unfortunately, RGGI state governments are currently experiencing mounting pressure – partly due to the economic downturn and weak tax revenues – to divert the funds raised from auctions to other uses.

5. **MRV, enforcement and related issues**

Due to the small number of regulated emitters, RGGI's requirements in this area are relatively straightforward. Nevertheless, regulatory officials spent considerable time on program design.[12]

A non-profit body, RGGI Inc., implements and supports the program, including maintenance of an online registry that records both allowance ownership and transaction prices.[13]

Under federal law, real-time emissions monitors are required by law in each regulated power plant; data is analyzed and verified by state and federal officials. The RGGI rules require regulated emitters to surrender allowances only at the end of each "control period". The first control period extends three years from the start of 2009 to the end of 2011. If at the end of the control period, an emitter fails to fully surrender required allowances, it will be fined an amount equal to three times the shortfall (and state governments may apply additional penalties).[14]

Secondary trading is conducted both over the counter (ie, bilateral trades outside of any market platform) and in a market operated by the Chicago Climate Futures Exchange which includes trading in futures contracts. The market is under the authority of the U.S. Commodity Futures

[11] RGGI 2011.
[12] The inclusion of a very limited offset option (less than 4% of compliance obligation) has added a considerable degree of complication (including the need for an offset MRV mechanism) but little benefit (it has so far been very lightly used due to low allowance prices). See http://www.rggi.org/market/offsets/verification
[13] https://rggi-coats.org/eats/rggi/
[14] http://www.rggi.org/market/tracking/data/compliance

Trading Commission; an independent consultancy is charged with monitoring for anti-competitive conduct.

European Union Emissions Trading Scheme

The European Union ETS has been in operation since 2005 and is the best known of the international examples discussed in this paper. There is a substantial body of literature about the EU ETS, offering a wealth of useful analysis for policymakers interested in cap-and-trade mechanisms.[15] The EU ETS has so far suffered from an unambitious cap – and has achieved, at most, only modest impact on emissions.[16] In addition, the ETS has allowed very little auctioning of allowances, with most being allocated free of charge to firms covered by the scheme. However, the EU is in the process of revising the ETS ahead of a new phase of operation scheduled to begin in 2013, and auctioning is expected to play a much larger role – with a significant fraction of revenues recycled into energy efficiency and GHG reduction investments.

1. Cap design:

The EU's overarching goal is to reduce GHG emissions to 20% below 1990 levels by 2020, with a view to collectively reducing community-wide emissions 60 to 80 % by 2050 compared to 1990.[17] The ETS is one part of the EU's effort to achieve this goal – and is intended to continue beyond 2020.[18]

The cap for the pilot period (2005-07), known as phase 1, was set loosely due to a rushed implementation schedule, limited data, lobbying by emitters, and overly-conservative estimates of abatement potential.[19] The cap for phase 2 (2008-12), has also been unambitious and may currently be higher than BAU.[20] This is partly due to the economic downturn, which pulled down BAU emissions. Despite the unambitious cap, prices have not fallen to zero (they traded in the range of 15-20 EUR per tonne during 2010) due to the regulations allowing banking: ie, allowances purchased in phase 2 may be surrendered to meet phase 3 commitments.

The EU ETS allows emitters to surrender JI and CDM credits purchased from areas outside of the EU (ie, "offsets"), limiting the downward pressure on emissions originating from within the EU.

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[15] For example, see Ellerman, A. Denny et al, *Pricing Carbon: The European Union Emissions Trading Scheme*, 2010.
[16] For discussion of the emissions reductions achieved during phase 1 of the ETS, see Ellerman, Chapter 6. Also see Sandbag "Cap or trap? How the EU-ETS risks locking in carbon emissions." www.sandbag.org.uk/site_media/pdfs/reports/caportrap.pdf
[17] Decision No. 406/2009/EC, paragraph 2.
[18] Under the 2009 "Effort-Sharing Decision" (ESD), effective in 2013, member states are required to achieve targets in sectors not covered by the ETS. The overall target under the ESD is to reduce GHG emissions in non-ETS sectors by about 10% from 2005 levels by 2020. See Decision No. 406/2009/EC of 23 April, 2009 at http://ec.europa.eu/clima/policies/effort/framework_en.htm
[19] Pollard, Vicky, "The EU Emissions Trading Scheme: lessons from experience" presentation delivered in Beijing, May 25, 2011.
[20] See Sandbag "Cap or Trap?"

In phase 2, offsets are limited to between 7 and 20% of each member state's cap, according to each state's National Allocation Plan (NAPs).[21] This fraction is expected to be reduced during phase 3.

For phase 3 (2013-20), the cap is slated to decrease by 1.74% per year, bringing the 2020 cap to 21% below the level of the 2005 cap.[22] However, because phase 2 credits can be banked into phase 3, the unambitious phase 2 cap may work to undermine phase 3.[23] Beyond 2020, an annual 1.74% reduction in the cap slated to continue indefinitely, with a review to occur no later than 2025.[24]

2. Coverage:

The EU ETS currently covers CO2 emissions from about 11,500 large emitters representing about half of all EU CO2 emissions (or 40% of all GHG emissions) – mainly electricity generators and energy-intensive industry.[25] In order to reduce the complexity of the scheme, small emitters (defined as facilities emitting less than 25,000 tonnes of CO2 annually) are generally not covered.[26]

The scheme is scheduled to expand in breadth to cover aviation in 2012 and the aluminum sector in 2013.[27] Non-CO2 GHGs will begin to be included with the beginning of phase 3 in 2013.[28] Unlike the New Zealand ETS, credits for sinks (such as forestry) are not permitted.[29]

3. Allocation of allowances:

To, date the EU ETS has been heavily biased toward free allocation of allowances to emitters, with little auctioning. Phase 1 saw no auctioning at all; only 3% of allowances were auctioned

[21] See http://europa.eu/rapid/pressReleasesAction.do?reference=IP/07/1614.
[22] The 2013 cap will be about 2 billion tonnes, which is 1.74% below the average annual total quantity of allowances issued over the 2008-12 period. http://www.decc.gov.uk/en/content/cms/emissions/eu_ets/phase_iii/phase_iii.aspx The EU has signaled willingness to further tighten the 2020 cap to 34% below 2005 levels if other countries also take stronger measures (IEA 2010, p 22).
[23] See Sandbag "Cap or Trap?"
[24] Pollard 2011.
[25] Pollard 2011. Also: http://ec.europa.eu/clima/faq/ets/index_en.htm
[26] However, to avoid a perverse incentive to build multiple small installations instead of one bigger one, multiple installations on the same site are considered as one, according to the so-called "aggregation clause". See http://ec.europa.eu/clima/documentation/ets/docs/guidance_interpretation_en.pdf
[27] International maritime emissions may also enter into the scheme in 2013. See Directive 2009/29/EC, paragraph 3.
[28] IEA 2010, "Reviewing Existing and Proposed Emissions Trading Systems."
[29] According to Pollard 2011, flights departing from EU airports will be covered; incoming flights will also be covered, unless the country of departure has "equivalent measures" in place.

under phase 2.[30] This giveaway of resources that could have been used for promoting EE has been a windfall for certain large firms covered by the scheme.

In phases 1 and 2, individual EU countries approached free allocation of allowances somewhat differently, according to individual National Allocation Plans. However, allocation is expected to be centralized in phase 3.[31]

In phase three, auctioning will become the "main method" for allocation of allowances, and the EU expects auctioning to be applied to about 50% of allowances issued over the five-year period.[32] Electricity generators will be required to buy necessary allowances (with some limited exceptions). However, firms exposed to competition from outside of the EU (notably, industry and aviation) will continue to receive substantial free allocation. Auctioning during phase 3 will be at least 50%, and is targeted to reach 100% by 2027.[33] The aviation sector is expected to get a large amount of allowances for free.[34]

An important lesson from the EU experience is that certain industries have been very effective at lobbying for free allocation. Many firms – particularly in the energy-intensive steel and cement sectors -- have obtained allocations of more certificates than needed to cover their own emissions, which are then sold in the secondary market.[35]

4. Complementary policies:

The EU has a range of complementary policies to achieve targets for energy efficiency and reduced emissions, operating at both the EU and national levels.[36] So far, however, the EU ETS lacks a dedicated recycling mechanism: the paucity of allowance auctioning to date (as described above) means there has been little scope for channeling revenues back into EE investments. Phase 3 is set to include a provision requiring that 50% of auction revenues must be invested (by member states) in energy efficiency and other GHG reduction measures, "mainly within the EU, but also in developing countries".[37]

5. MRV, enforcement and related issues:

[30] IEA 2010.
[31] Pollard 2011.
[32] http://ec.europa.eu/clima/faq/ets/auctioning_third_en.htm
[33] Pollard 2011 and IEA 2010.
[34] CTW 2011.
[35] Sandbag.
[36] See http://ec.europa.eu/news/energy/110622_en.htm
[37] Pollard 2011. http://ec.europa.eu/clima/faq/ets/auctioning_en.htm

The EU ETS Directive provides that the Commission is responsible for monitoring the functioning of the scheme and submitting an annual report to the European Parliament and Council. The Commission is also responsible for making legislative proposal for amendments to the scheme.[38]

The EU ETS Directive only establishes general rules for MRV. More detailed rules are established in the Monitoring and Reporting Guidelines (MRG).[39] Each covered firm must develop a monitoring plan in line with the MRG and follow the plan in its annual monitoring.

The approval of monitoring plans is done by the "competent authority" of the EU ETS in each member state.

Large emitters are required to monitor and report own emissions annually, with third party verification. Third-party verifiers are accredited by member states.[40]

Annual surrender of allowances is required, but allowances have been allocated for three-year "trading period" ("phase") at one time. Large fines (100 EUR per allowance) are applied for failure to surrender, which are significantly higher than the market price for allowances.

So far there have been separate registries administered by member states, but regulated by the EU and linked through an EU "hub"; in 2012 there will be a new single registry, maintained by the EU. As in New Zealand, registries record ownership but not transaction prices.[41]

Secondary trades include both OTC (through brokers) and market trading. Independent financial institutions have developed derivative products, such as futures, options and swaps.

New Zealand Emissions Trading Scheme

The New Zealand Emissions Trading Scheme (ETS) first took effect in January 2008 (but initially only applied to the forestry sector, a net "sink") and was amended in 2009. The scheme got underway in earnest in mid-2010 with the expansion of coverage to industry and transport. It is slated to eventually cover all sectors of the economy. It suffers from a lack of a firm cap and also does not have any auctioning or recycling mechanisms. However, it has established a modest price on emissions for the covered sectors, that fluctuates with the international market price for carbon units established under the Kyoto Protocol.[42] The scheme's MRV and enforcement policies are well designed.

1. Cap design

[38] http://ec.europa.eu/clima/news/docs/communication_en.pdf
[39] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:229:0001:0085:EN:PDF
[40] Pollard.
[41] Pollard.
[42] Ministry for the Environment, 2011, "Report on the New Zealand Emissions Trading Scheme." http://www.climatechange.govt.nz/emissions-trading-scheme/building/reports/ets-report/index.html

The New Zealand government has made clear national commitments to reduce GHGs: New Zealand agreed under the Kyoto Protocol to reduce its GHG emissions to 1990 levels, on average, for the period 2008-12, or pay for any surplus. In addition, the government has set a 2050 target for net GHG emissions at 50% below 1990 levels.[43]

However, the ETS itself unfortunately lacks a binding cap.[44] Under the current system, a number of allowances (known as "New Zealand emissions units") are allocated to each qualifying firm as a function of the (expected) output of the firm; there is no overall limit on the amount of allowances that are issued in a given year.[45] More specifically, firms that are rated "moderate or high" in energy intensity *and* trade-exposed are awarded free allowances in amounts that vary directly with each firm's expected output for the year.[46]

In addition, the ETS is linked to the international market for carbon units under Kyoto and will also eventually be linked to Australia's new scheme. Participants may surrender these units in lieu of the domestic allowances, in order to cover their own emissions.[47] In effect, the New Zealand scheme allows for unlimited offsets.

As a result of these features, the New Zealand ETS does not serve as a firm constraint on New Zealand's emissions. However, it has succeeded in introducing a price on emissions for the sectors that are covered so far, by linking to the international price of carbon.

2. **Coverage**

The New Zealand ETS broadly covers all sectors and all GHGs. However, sectors are entering the ETS very gradually, giving officials and affected firms time to adapt and modify the program:

- Forestry entered in January 2008. Forest owners earn allowances as their forests absorb carbon, but are required to surrender them when the trees are cut down.

- The industry sector, "stationary energy" sector (mainly fuel for non-renewable power sector), and "liquid fossil fuel" sector (mainly transport), altogether responsible for 45% of 2008 emissions, entered in July 2010.

- Agriculture (47% of 2008 emissions) is slated to enter in January 2015.

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[43] Ministry for the Environment, 2011.
[44] Geoff Bertram and Simon Terry, 2010, "The Carbon Challenge: New Zealand's Emissions Trading Scheme."
[45] Note on terminology: the ETS is not officially claimed to be a cap-and-trade scheme.
[46] http://www.climatechange.govt.nz/emissions-trading-scheme/participating/industry/allocation/how-it-works/
[47] During an initial "transition phase" that lasts until end-2012, covered participants need only submit half the required allowances (or "units"); ie, one unit for every two tonnes of emissions. Thereafter, New Zealand will adopt the convention of one allowance per tonne. In addition, during this transition period, covered participants have the choice of paying 25 NZD per tonne instead of surrendering allowances, effectively capping the price. See Ministry for the Environment, 2011.

The points of regulation are generally "upstream": eg, fuel producers and importers are generally required to surrender permits (as opposed to "downstream" end users). This means a smaller number of "mandatory participants", thus simplifying administration. As of mid-2011 there were only 96 mandatory participants.[48] These upstream mandatory participants pass on the cost (to varying degrees) of allowances to end-users.

New Zealand's decision to implement a relatively broad scheme (compared to RGGI) has led to some difficulties. In particular, the industrial sector poses a challenge because of the political pressure to protect exporters from the effect of the scheme – resulting in the "free allocation" noted above. Agriculture also poses political problems because of the large size of that sector relative to New Zealand's economy.

3. Allocation of allowances

To date, there has been no auctioning of allowances under the ETS and there are no definite plans to begin. By free allocation of allowances, the New Zealand government is essentially giving away rights to selected firms; revenues from sale of these rights might otherwise be used for promotion of energy efficiency (or other government objectives).

4. **Complementary policies**

Because there is not yet any auctioning of allowances, there is no scope for recycling of auction revenues back into energy efficiency. However, New Zealand does have a somewhat comprehensive portfolio of administered energy efficiency programs. These include grants for efficiency investments from New Zealand's Energy Efficiency and Conservation Authority; grants for low-income households for insulation and efficient water heating; and an Electricity Commission efficiency investment program that is funded by a levy on participants in the country's wholesale electricity market.[49] Taken as a whole, these programs are modestly funded; there is plenty of room to mobilize additional resources for energy efficiency in New Zealand – an ETS-linked revenue recycling scheme would be a good approach.

5. **MRV, enforcement and related issues**

The New Zealand ETS has a comprehensive MRV and enforcement regime. The ETS includes 1) measures to ensure that free allocations of allowances go to recipients that are qualified under the ETS legislation; and 2) measures to ensure that emitters surrender adequate allowances. Note that the first of these two is a drain on the time and energy of regulators that would not be necessary if allowances were distributed by auction instead of free allocation.

[48] Ministry for the Environment, 2011.
[49] For more information on New Zealand's energy efficiency policies, see www.ieej.or.jp/aperc/PREE/PREE_New_Zealand.pdf

The Ministry for the Environment conducts selective audits to promote compliance on both fronts. If emitters are caught failing to surrender required allowances on time, the offenders must provide the required allowances plus a plus $30 penalty per allowance (i.e., per tonne; effectively more than doubling the price per tonne at current market price levels). Legislation specifies that the government may recover these penalties in the same way as any tax debt.

The Ministry for the Environment is also charged as the "Inventory Agency", responsible for producing annual estimates of the country's human-induced emissions and removals by sinks. Emitters are responsible for self-reporting, which is enforced through audits and substantial penalties for non-compliance (separate from the penalties for failure to surrender, mentioned above).[50]

The government operates an online registry that keeps track of the ownership of allowances (NZUs), but does not record prices or trades.[51] There is no officially-supported trading platform and trades are not closely monitored or regulated. As a result, there is some concern about the possibility of the emergence of market power.

Tokyo Cap-and-Trade Scheme

The Tokyo Metropolitan Government initiated a mandatory cap-and-trade program in April 2010. The Tokyo authorities see the plan as a way to motivate covered entities – specifically buildings and industrial facilities – to achieve facility-specific emission reduction plans. Indeed, the scheme requires many large facilities (owners and tenants) to develop and detailed plans and submit them for publication. In this sense, Tokyo's approach is somewhat different than the other schemes discussed in this paper, which typically do not require individual facilities to submit plans. The inclusion of this unique site-specific planning process perhaps can be seen as a strength of the Tokyo scheme, by backing up market incentives with targeted regulation that is similar in spirit to the "complementary policies" discussed elsewhere in this paper. Unfortunately, this has been paired with free allocation of permits to the covered firms; the Tokyo scheme does not have any scope for auctioning of permits – although some auctioning may be introduced after 2014. The Tokyo scheme is well-grounded on the data collection system established in by a forerunner program and has the advantage of starting small, focusing on a fairly narrow sector, allowing the authorities the opportunity to learn and adjust the scheme before expanding it to other sectors.[52]

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[50] Failure to provide required information to inventory agency carries substantial fines (on conviction by a court): $5000 for an individual or $300,000 for a corporation.

[51] http://www.eur.govt.nz

[52] The discussion in this section draws mainly on the following documents: Nishida, Yuko and Ying Hua "Motivating stakeholders to deliver change: Tokyo's cap and trade program" *Building Research & Information* (2011) 39(5), 518–533; Tokyo Metropolitan Government, Bureau of the Environment, "Tokyo Cap-and-Trade Program: Japan's first mandatory emissions trading scheme" March 2010.

1. Cap design:

Tokyo's overarching goal is to achieve a reduction in GHG emissions to 25% below 2000 levels by 2020. The cap-and-trade scheme calls for a reduction in capped-sector (see below for details on coverage) CO2 emissions by 6% relative to 2007 during the first "compliance period", running from 2010 to 2014. It is difficult to assess how ambitious this first compliance period cap is. Weak economic growth is likely putting downward pressure on emissions (as in the other cases described in this paper) so that the cap may not be as tight as originally intended. Details for the second period (2015-19) will not be confirmed until 2014, but are expected to entail a total reduction of 17% below the 2007 base year.

The program allows for three types of offsets: 1) emission reductions from small and midsize facilities within the Tokyo area (ie, facilities that are not covered by the cap-and-trade scheme); 2) renewable energy certificates (from within Japan); and 3), emission reductions outside the Tokyo area. Only the third type is limited (to 1/3 of the obligation reduction). Unlimited offsets can be problematic because they can dramatically reduce the incentives to reduce emissions within the geographical area covered by the scheme (in this case, Tokyo) and can thus undermine the cap.

Tokyo's current mandatory scheme is built on the foundation of a voluntary scheme that ran from 2002-07. Although this early scheme, because of its voluntary nature, failed to give real incentives to firms and thus failed to directly bring about substantial emissions reductions, it provided an extremely valuable foundation for the mandatory scheme by requiring reporting of emissions and submission of reduction plans; by 2007, the Tokyo authorities had a very good database of emissions by facilities in the Tokyo area that was extremely useful in the design of the new cap.

2. Coverage:

Tokyo also differs somewhat from other schemes discussed in this paper in terms of "point of regulation": it targets "downstream" instead of "upstream" energy use. The scheme covers large buildings (both commercial and non-commercial) and large industrial facilities – specifically, buildings and facilities with annual energy consumption of 1,500 kiloliters or more in crude oil equivalent. In total, there are 1,300 facilities (1,100 commercial/ institutional buildings and 200 industrial facilities) that exceed this level of consumption, representing 40% of total CO2 emissions from the commercial and industrial sectors – or about 20% of Tokyo's overall CO2 emissions. This decision to start the program with a focus on a particular slice of the Tokyo economy seems like a good approach, simplifying the administrative challenges during the initial stages of implementation.

3. Allocation of allowances:

The Tokyo scheme currently does not include any auctioning; instead, all permits are gifted to recipients. The free allocations are set in terms of "obligation reduction" (ranging from 6% to 8% over the first period) for various types of facilities.

4. Complementary policies:

Like California, the Tokyo cap-and-trade scheme is framed in the context of an overall comprehensive plan for reduction of GHGs, issued in 2007.[53] This is a very useful approach, helping policymakers, energy consumers and other stakeholders approach emissions reduction in an integrated fashion. However, there is no direct recycling of revenue into complementary policies because all allowances are issued free of charge; the cap-and-trade scheme unfortunately does not yet allow for auctioning.

5. MRV, enforcement and related issues:

As in the EU and California cases, covered facilities are required to self-report emissions; the reports are then verified by third party auditors. The Tokyo Metropolitan Government designates and licenses these third-party organizations.

Facilities that fail to surrender adequate allowances/offsets are subject to fines. However, compared to other schemes discussed in this paper, the fine for failure to surrender adequate permits is fairly low: only 1.3 times the cost of rectifying the shortfall.[54]

Perhaps because the metropolitan government sees the scheme largely as means for guiding individual facilities toward planned emissions targets (rather than a "market mechanism" for searching for the least-cost available energy savings), secondary trades have been almost non-existent to date, partly because the metropolitan government only launched a registry in June 2011; however, one trade in 2010 was at a very high price: 142 USD per tonne.[55]

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[53] Available in English: http://www.kankyo.metro.tokyo.jp/climate/attachement/tokyo-climate-change-strategy_2007.6.1.pdf

[54] Nishida and Hua 2011, p. 524. Note that, due to legal and cultural considerations in Japan, authorities expect that compliance should not be problematic: even though the fines are low compared to other international examples, participants are likely to be motivated by fear of public disclosure of non-compliance. The concept of the cost of rectifying the shortfall has yet to be fully specified.

[55] Nishida, Yuko and Ying Hua "Motivating stakeholders to deliver change: Tokyo's cap and trade program" *Building Research & Information* (2011) 39(5), 518–533.

California cap-and-trade scheme

California's cap-and-trade plan, to be implemented beginning in 2012 under the rubric of the state legislation AB 32 (Assembly Bill 32; also known as "The Global Warming Solutions Act of 2006") is part of a broader set of emission-reduction policies. We focus here on the cap-and-trade scheme, but with reference to the AB32 framework. Overall, the scheme is impressive, though much of the hard work is targeted for later years; the program incorporates a fairly soft start, with only the electricity and industrial sectors covered until 2015. Many implementation details, particularly for the transport sector, have yet to be finalized.

One of the California scheme's strengths is that it has been designed and presented as part of an overall package of policies, including strengthened codes and standards for transportation and buildings, energy efficiency investment programs run by electric utility companies, expansion of renewable electricity generation, and reduction of coal-fired generation. In fact, the cap-and-trade scheme itself is only intended to achieve about 20% of California's targeted overall emissions reductions.

1. Cap design:

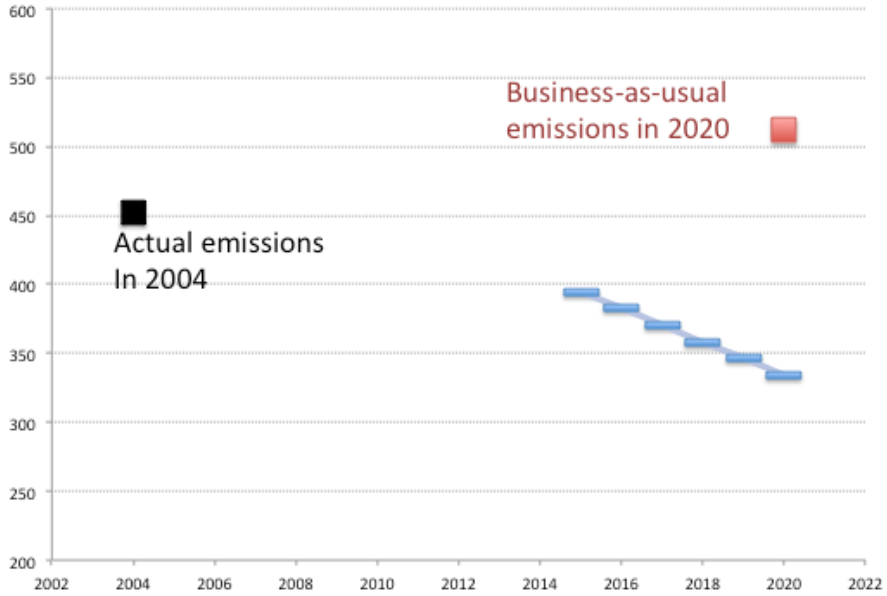
California's overarching goal, spelled out in AB 32, is to reduce California's GHG emissions to 1990 levels, ie 427 million metric tons (MMT) per year, by 2020. In addition, Executive Order S-3-05 calls for 80% reduction below 1990 levels by 2050 (although this is not a firm target). According to a 2008 scoping plan released by the California Air Resources Board, the lead agency for AB 32 implementation, 2020 emissions would reach 596 MMT/year under business as usual (that is, if AB 32 were not implemented). So, reaching the 2020 goal will require a 169 MMT/year (about 30%) reduction from BAU. The cap for the sectors covered by the cap-and-trade scheme (see more below) is set at 334 MMT/year for 2020.[56] At the outset, the cap is to be set broadly in line with BAU emissions; in the years up to 2020, the cap will steadily tighten to reach this 2020 goal (see Figure).[57] The scoping plan says BAU for the capped sectors would reach about 510 MMT/year in 2020 under BAU.

[56] Proposed regulation, October 2010 (adopted in December 2010).

[57] Due to administrative and political considerations affecting the launch of the program, the first compliance period has been shortened to two years from three -- but the targets have not been relaxed and will still be achieved in the same timeframe.

The program is may be linked with a number of other US, Canadian, and possibly Mexican areas, under the Western Climate Initiative. The scheme contains scope for substantial offsets, broadly similar in scope to the EU ETS. Offsets are allowed for up to 8% of compliance obligation; if allowance prices exceed a defined range, the allowable offset percentage increases.

Figure 2: California's cap-and-trade emissions trajectory (MMT, capped sectors)



Note: During 2012-14 a cap is to be applied to a subset of sectors; it is not shown here.
Source: Calif. Air Resources Board: *Climate Change Scoping Plan*, 2008; *Proposed Regulation to Implement Cap-and-Trade Program,* 2009.

2. <u>Coverage</u>:

The California cap-and-trade scheme is very broad, aiming to cover 85% of emissions. Certain aspects of forestry, agriculture, and minor "fugitive" emissions are not part of the capped sectors (but are the subject of complementary policies to reduce emissions in those sectors). However, like the New Zealand scheme, sectors are to be phased in gradually:

- Electricity and industry program begins in 2012;
- Natural gas and transportation begins in 2015.

Like in other schemes, concern about the competitiveness (and lobbying by emitters and consumer advocates) has led policymakers to adopt a large degree of free allocation, particularly for the electricity sector. In this way California has faced a larger challenge than the RGGI states, which were able to sidestep much of this free allocation debate by only capping emissions from the power sector.

Under the California scheme, electricity sector emissions are capped regardless of whether the electricity is generated in state or out of state. The "first deliverer" of power into the California grid is responsible for securing allowances for the associated emissions.[58]

3. Allocation of allowances:

The plan is to first proceed with a large fraction of free allocation to electric utilities. Some of these utilities will then be required to auction the allowances. Over time, the California system will gradually move toward more and more auctioning of allowances, primarily associated with transportation sector emissions. The inclusion of free allocation in the scheme is partly due to concerns about the competitiveness of in-state industry (ie, "leakage" concerns). Many of the fine details of allocation have yet to be finalized. For the industry sector, allocation of allowances will be related to each emitter's industrial output, with an adjustment based on the relative efficiency of each emitter's production (ie, all emitters will receive allowances based on the emissions of the most efficient plants in their category; less efficient plants will have to compete to buy allowances in the auctions or secondary market).[59] Independent electricity generators will not receive any free allocations, even in the early stages of the program.

4. Complementary policies:

The California cap-and-trade scheme is well integrated with complementary policies. In particular, it was crafted from the beginning as part of a broad portfolio of policies designed to accompany AB 32.[60] California is already a leader in many aspects of low-carbon policy; the AB 32 implementation and planning process aims to strengthen and integrates these commitments.

The suite of legislation accompanying AB32 includes:

- Vehicle emissions standards and fuel standards.
- Strengthened building codes and appliance standards; programs for retrofits of existing buildings.
- Strengthened electricity utility programs for EE (analogous to the new DSM mandate for Chinese grid companies to achieve energy efficiency investments).
- Expansion of existing energy efficiency programs and standards.
- A requirement that 33% of electricity generation is from renewable resources by 2020.
- Fees on water use and high-global warming potential gasses.
- Prohibition of new coal-fired power generation facilities.
- Phase-out of existing coal generation unless the emission levels can be halved.

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[58] California Air Resources Board, "Proposed Regulation to Implement the California Cap-and-Trade Program , Part 1, Vol 1, Staff Report: Initial Statement of Reasons," October 28, 2010.
[59] http://www.arb.ca.gov/regact/2010/capandtrade10/candtappb.pdf
[60] http://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm

The proposed regulations includes scope for a significant degree of recycling of cap-and-trade auction revenues. Although the approach is somewhat more complex than in the RGGI case, the overall effect is similar: revenues from auctions will be used to fund utility (gridco) run investments in energy efficiency.[61]

Perhaps what is most important about the California suite of policies is that the lion's share of required emission reductions is expected to come from complementary policies, not from the cap-and-trade mechanisms. According to CARB estimates, only about 20% of the distance between BAU and the overarching 2020 goal is expected to be from the cap-and-trade mechanism itself.[62]

5. MRV, enforcement and related issues:

CARB is charged with continued monitoring of the program, as well as design and implementation of any necessary revisions. The program's regulations call for establishment of a registry overseen by CARB, but details have yet to be worked out. Offsets are being managed under a separate registry, administered by a California non-profit, the California Climate Action Registry.

MRV under the California program will be a significant challenge due to the broad coverage of the program. CARB's implementation rules call for annual self reporting of emissions. Large emitters (defined as those with greater than 25,000 metric tonnes CO2e annual emissions), of which there are currently about 800,[63] will be required to undergo third-party verification. The remaining small emitters covered by the scheme will not be subject to third-party verification, but will be subject to an audit program. The majority of small emitters utilize natural gas, and their emissions will be covered in the cap applicable to the natural gas industry, under regulations expected to be developed prior to the 2015 effective date of regulation for that sector. CARB will accredit third-party verification organizations.

Like RGGI, the scheme rules require allowances to be surrendered in line with three-year compliance periods. However, unlike RGGI, emitters must surrender at least 30% of their annual compliance obligation during the first two years – a provision that California officials hope will reduce the risk of non-compliance.

Penalties are substantial for failure to surrender allowances on time: if an emitter is caught, it will be required to surrender additional allowances equal to four times the amount of excess

[61] The proposed regulations also call for some auction revenue to be used for consumer rebates in order to lessen the impact of the cap-and-trade scheme on retail prices. See Proposed regulations, p.II-29-32. www.arb.ca.gov/regact/2010/capandtrade10/capisor.pdf

[62] The Scoping Plan estimates that 112 MMT out of 147 MMT in required reductions will come from policies other than the cap-and-trade scheme.

[63] Scoping Plan, P. 108

emissions (that is, equal to four times the amount that it failed to cover).[64] There are also strict enforcement provisions covering failure to obtain third-party verification and failure to comply with regulations regarding offsets.

Allowances (and offsets) can be fully banked across compliance periods.

[64] Proposed regulations, p.II-23.