International Carbon Action Partnership

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EMISSIONS TRADING AND ELECTRICITY SECTOR REGULATION

A conceptual framework for understanding interactions between carbon prices and electricity prices

- SUMMARY FOR POLICYMAKERS -

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Emissions trading systems (ETSs) as a cost-effective instrument for emissions control in the power sector are now being implemented or considered across a diverse set of jurisdictions. However, regulation in the power sector may impede or alter the functioning of an ETS. In this paper, we consider opportunities and constraints for abatement in diverse power-sector regulation settings, from liberalized markets to highly planned systems to better understand what role an ETS might play under differing regulatory structures, and furthermore, to understand the instances where regulation may create a barrier to abatement. Options to strengthen an ETS and overcome hurdles resulting from regulation are discussed.

For an ETS to achieve emission reductions at least cost, markets ideally must function freely. This requires the ETS allowance costs to be reflected in the price of carbon intensive goods and economic entities are able to adjust their economic operations and investment decisions accordingly. The ability of covered entities to pass through some of the allowance cost to consumers is also fundamental for triggering abatement along the value chain, recouping the costs of long-term low carbon investments and enhancing the credibility of future emission reduction targets.[1] Furthermore, to be fully effective, emissions markets must be designed in a way that encourages trade and price discovery to send a clear signal on the value of abatement.

This is the case for ETSs operating in liberalized electricity markets where customers are free to choose their electricity supplier. The unbundling of supply, generation, and networks ensures competition in wholesale and retail markets; generators are free to supply the market and independent regulators are assigned to monitor the market. These conditions, combined with some level of auctioning of allowances and the absence of other market distortions[2] generates a liquid allowance market, where a clear and credible allowance price signal emerges to drive cost-effective emission reductions.

[1] Throughout this paper, the term cost pass-through refers to the mechanism through which the allowance price is reflected in power prices and/or in carbon intensive goods.
2 Other distortions such as market power, myopia, and credibility may also be present. These have been dealt with well in the literature and as we would like to isolate the effects of electricity sector regulation, they have been excluded (see Hepburn et al. 2016; Koch et al. 2016; Edenhofer et al. 2017 and Hintermann 2010 for an overview).

In these markets, the allowance price drives economy wide abatement through a number of distinct levers. First, it makes low-carbon electricity generation more competitive, encouraging a shift away from fossil-based generation technologies toward low-carbon alternatives (production lever (clean dispatch)). Second, it increases the price of fossil fuel-based electricity, pushing consumers to more efficient electricity use or to purchase cleaner electricity products (consumption (industry and household levers)). Third, cleaner forms of electricity generation become relatively more profitable, incentivizing investments in low-carbon technologies and their development (investment lever). Fourth, high-carbon assets earn lower margins and are encouraged to shut down (decommissioning lever). Together, these channels provide a broad signal to invent new products, processes and technologies that use carbon more efficiently (innovation lever).

These abatement levers are represented in the conceptual framework in Figure E.S.1. The framework distinguishes between the drivers of short term static efficiency, which ensure least cost abatement options are taken up first, as well as those for dynamic efficiency, where the intertemporal costs of achieving long-term reduction targets are kept to a minimum. We apply this framework to understand the opportunities and constraints for abatement under different forms of electricity sector regulation. The effect of allocation and compensation decisions on carbon price pass-through and the resulting price signal is also considered.

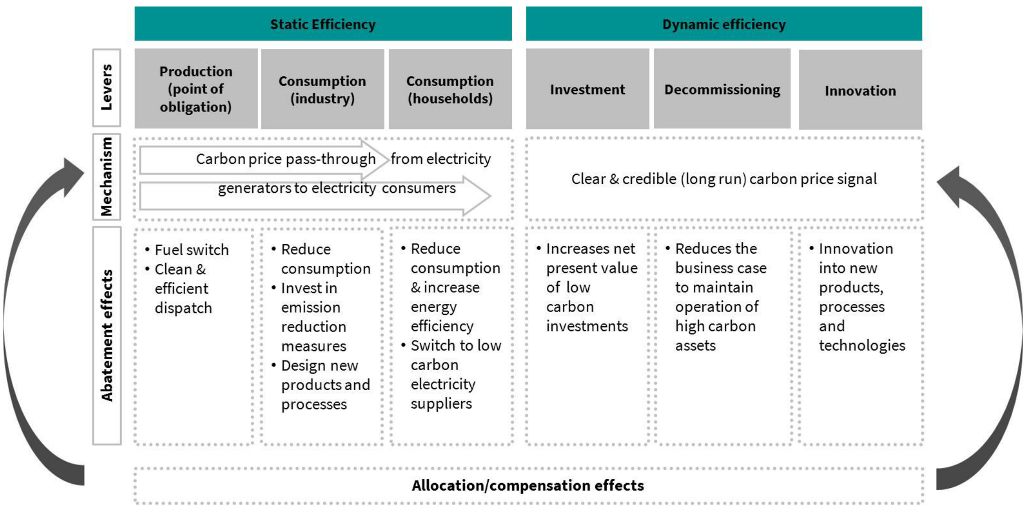

Figure E.S. 1: Framework for understanding interactions between power sector regulation and emissions trading

Emissions trading and electricity sector regulation

In practice different forms of electricity sector regulation interact with real-world ETSs in ways that may prevent or change how participants respond to the allowance price. In this report, four types of electricity sector regulation are assessed, which represent the spectrum from largely liberalized, competitive markets to heavily regulated, centrally planned systems.

1. Regulated retail prices: With the introduction of an ETS, the incentive for end consumers to reduce their emissions depends critically on the levels and structure of

electricity rates. In the best case, rate levels and structures reflect the marginal costs of generators (e.g. real time tariffs) and end consumers consider the carbon costs in their consumption choices. In the worst case, tariffs are set ad hoc by the regulator with little consideration of the underlying generation costs. In between, tariff structures that reflect average generation costs result in partially passing through cost to end consumers (e.g. single part tariff). Where little or no pass-through occurs, there is no incentive to reduce electricity consumption or switch to less carbon-intensive goods and services. However, as long as a functioning wholesale electricity market is in place, even with regulated retail prices, an ETS might still drive efficient dispatch decisions, generate low-carbon investments and drive high-carbon decommissioning.

2. Regulated wholesale prices: How wholesale markets are regulated and structured has a profound effect on the cost effectiveness of emissions trading. It affects dispatch decisions, price pass-through and resulting downstream effects as well as investment and decommissioning decisions. The tariff methodology and structure will also be important for how regulated power generators behave under an ETS. In the best case, tariffs are set against emission performance benchmarks (performance-based regulation) with allowances purchased at auction. In contrast, where prices are set ad hoc with little consideration for the underlying production costs, the carbon cost will not be reflected in production decisions or passed through to end consumers such that the desired changes in dispatch and downstream abatement from carbon pricing will not take place. Controls on upper and lower electricity prices may be important to provide predictability and avoid large price spikes. However, they also distort dispatching decisions and can limit profits and hence incentives for investment from new, low-carbon generators.

3. Planned investment: Governments can centrally plan the expansion of electricity infrastructure to achieve specific goals, such as service reliability, energy access/security, or environmental targets. To this end, in some jurisdictions, such investments are driven by yearly tenders based on the government's expectations of future capacity needs and the system operator may have the right to require old technologies to stay online as back up capacity. This type of regulation may impede the proper functioning of an ETS as investments are driven by government decisions rather than market signals as in liberalized markets. The greenhouse gas (GHG) impact of these investments could be positive or negative, depending on the objectives of the regulator.

4. Planned production: In a system with regulated power production, planning agencies instruct electricity dispatch based on predetermined technical, economic or political considerations/criteria. When electricity is dispatched following administrative instructions, operation no longer follows the least cost approach and investment decisions will not be driven by current and expected market prices. Electricity will not be dispatched according to least cost and cannot be altered by ETS allowance costs; therefore, the clean dispatch effect that the ETS is designed to deliver will not take place. Additionally, in an administratively dispatched system, the rate received by

each generator would generally be pre-established in purchase agreements and the wholesale prices do not reflect production costs, leaving little scope for cost pass-through. Investments are likely driven by contractual arrangements, rather than expected profits.

While – as shown above – power sector regulation might inhibit the functioning of an ETS, also in such settings, an ETS can still play a role in decarbonization. An ETS signals that emission-intensive activities will play a declining role in future economic activity. A clearly defined emission reduction pathway provides predictability for economic actors, as it frames market expectations and sets a clear signal for necessary long-term investments (Eden et al. 2016). Where the power mix is dominated by a single generation source, such as coal, and the demand response to increasing electricity prices is low, investments in new clean generation will largely drive emission reductions. Hence, a strong medium-to long-term signal for clean investment can still encourage the broader decarbonization process, even when the current carbon price plays a reduced role in today's production and consumption decisions.

Options to strengthen the allowance price signal

Some of the above limitations can be overcome by well-considered emissions trading design.

Consignment auctions: In a system with consignment auctions, recipients of free allowances may be required to offer their allowances for auction, but in exchange receive the revenues of such sales (Burtraw and McCormack, 2016). This can increase market liquidity, help price discovery and market efficiency as well as market initialization in ETSs that are dominated by free allocation (Burtraw and McCormack, 2016). Consignment auctions could enhance the functioning of an ETS where prices are regulated or where regulatory barriers impede price discovery.

One example of this can be found in California, where consignment auctions are a feature of the California Cap-and-Trade Program. The California Cap-and-Trade Program administrator (the California Air Resources Board or CARB) allocates free allowances to electric utilities, including investor-owned utilities (IOUs), on behalf of electricity ratepayers to ensure that ratepayers do not experience sudden increases in their electricity bills associated with the Cap-and-Trade Program. The IOUs are required to consign their freely allocated allowances to auction and to utilize the value for the benefit of the electricity ratepayers. IOUs are subject to retail price regulation by the California Public Utilities Commission (CPUC) and the use of this value must be consistent with both CPUC and CARB requirements, and with the goals of the California Global Warming Solutions Act (AB 32), through methods that do not counteract the carbon price signal.

Coverage of indirect emissions: When electricity prices do not reflect the allowance price, for example with regulated wholesale prices, large consumers of electricity can be required to hold and surrender allowances for the indirect emissions from their electricity consumption. This extends the scope of the ETS to include large electricity consumers such as office buildings, hospitals and hotels. Electricity generators will face the carbon price when surrendering allowances for the emissions from electricity production. While the allowance price is not passed through to the electricity price, large consumers have an incentive to reduce emissions as they are required to surrender allowances for the emissions associated with their electricity consumption. Such an approach has been adopted under the Korean ETS as well as Chinese pilots where electricity prices are subject to various forms of government control.

Furthermore, the carbon prices created by an ETS could be used in the broader regulatory framework for the power sector.

Climate oriented dispatch: Where electricity production is regulated, administrative dispatch could prioritize low-carbon parameters (e.g., emission levels and fuel efficiency) and thus deliver a similar effect on dispatch that an ETS is designed to deliver. Instead of minimizing costs, under climate-oriented dispatch, the merit order would minimize environmental externalities, including CO_2 emissions and operators would be ranked by fuel efficiency or emissions levels. Energy Conservation Dispatch (ECD) was piloted in China where operators were ranked first by fuel efficiency and later by emissions level. A merit order was created based on GHG emissions and electricity from low-emitting generators dispatched before high-emitting ones.

Carbon Investment Board: In systems with regulated investments, governments could mandate that the planning body consider expected allowance prices when making investment decisions. For example, carbon costs could be included as additional charges or shadow prices in the cost-benefit analysis that governs investments. Including environmental “adders” to state funded investment decisions was common in the United States through the 1990s and is gaining increased attention as an option to include climate costs into electricity sector planning in the United States.

Pricing Committee: The committee could set and review retail prices in response to changes in allowance prices. In markets with wholesale price regulation, the pricing committee could set and review the rules for determining how wholesale prices reflect carbon costs. The committee could either operate as an independent body with complete autonomy over decision making or follow pre-established rules.

Consumption charge: A consumption charge could be introduced to facilitate downstream abatement, even when pre-existing regulations might prohibit explicit retail or wholesale price pass-through. This charge would represent the ETS allowance price and the carbon intensity of the electricity consumed. Such an approach was applied to price emissions from synthetic GHG under the now repealed Australian Carbon Pricing Mechanism.

The importance of companion policies

Regardless of the specific “type” of regulation, governments are likely to continue to have a strong role in the electricity sector. This might be through direct control of investments or through setting technology-specific targets, performance targets, phasing out emission-intensive technologies or supporting innovation in low-carbon alternatives. These policies will be guided by more than just emission reduction considerations and can either support the ETS to overcome barriers from existing regulation or in some cases erode the efficiency of the system. Therefore, it is critical that regulators consider the effects of these “companion policies” on the allowance market.

Companion policies can play differing roles in the electricity sector. Some companion policies work in concert with an ETS and can be applied to hurdle some of the regulatory barriers that have been discussed above or even improve the functioning of liberalized electricity markets (complementary policies). Other companion policies target the same sectors and sources as an ETS but operate independently from the ETS (overlapping polices). Finally, some policies can work directly against the incentives that an ETS is intended to deliver (countervailing policies).

Where an ETS interacts with power sector regulation, it is important to understand where barriers exist, how much mitigation potential will be lost and which policies can target these areas of the economy. Three areas are important in this regard, including: (i) policy coordination and planning; (ii) building adjustment measures into ETS design; and (iii) strengthening commitment to long-term targets.

Policy coordination and planning: Reliable and methodologically sound approaches to estimate the impact of companion policies on emissions from the electricity sector allows policymakers to take better account of policy interactions when designing and reviewing their ETSs.

Building adjustment mechanisms into an ETS: Where companion policies overlap with an ETS, adjustment measures can improve the functioning of the market and help ensure the additionality of overlapping policies. Adjustment measures can either come in the form of stability mechanisms that adjust the quantity of allowances auctioned based on price or quantity thresholds or by directly adjusting the cap to reflect companion policy induced changes in allowance demand.

Long-term targets as guardrails: Where an ETS is embedded within a clear and credible long-term policy architecture, the short-term impact of companion policies will have less relevance for long-term investment decisions. At the same time, pre-defined periods in an ETS can provide a structured and transparent timeline for reviews and interventions to take account of companion policies.

Conclusions

While power sector regulation can have many goals, different types of regulation can remove or dampen the mitigation signal an ETS delivers. An ETS can still be effective under different forms of power sector regulation, however, in designing, implementing and reviewing an ETS, it is important to understand where barriers exist, how much mitigation potential will be lost and what mitigation will be achieved by other policies in the policy mix.

To the extent that end customers are shielded from the allowance price through retail price regulation, abatement opportunities in the residential sector will be lost. It is then an empirical question as to how much mitigation potential will be foregone that must be considered against the policy goals of retail price regulation. Consignment auctions, pricing committees, and for large consumers, coverage of indirect emissions represent design options that allow an ETS to co-exist with retail price regulation. Furthermore, companion policies that improve information and target residential energy efficiency could be combined with an ETS that operates with retail price regulation.

A competitive wholesale market for electricity seems especially important for coordination of a low-carbon electricity sector. Competitive wholesale electricity markets ensure the allowance price is reflected in dispatch decisions, incentivizing investments in low-carbon technologies and closing high-carbon generators. There are little alternatives to the coordination and incentive role that markets can play in delivering low-carbon electricity. This role will become even more salient in the face of an increasing number of small-scale distributed renewable generators, associated with a growing share of small-scale renewable capacity.

Where an ETS is introduced within the context of a regulated wholesale electricity market, the regulation is likely to affect dispatch decisions, price pass-through and resulting downstream effects as well as investment and decommissioning decisions. Design options that look to ensure the carbon price signal reaches generation as well as consumption decisions are important. The coverage of indirect emissions has shown some promise in this regard; however, the effectiveness and broader applicability of this design option demands further attention.

A clear and credible carbon price signal creates a business case to invest in low-carbon generators and close high-carbon ageing assets. That said, electricity sector investment is rarely purely market driven and companion policies will likely continue to shape the structure of the electricity sector even where well-functioning carbon markets are present. The impact of these overlapping policies must be explicitly considered in the policy planning and coordination process, the design of the ETS, and the way in which long-term targets are set and communicated.

Disclaimer

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