Applying GHG-Pricing Programs In Western Organized Electricity Markets

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Introduction

Wholesale electricity markets in the Western U.S. have and will continue to play a critical role in enabling utilities to reduce costs and serve load reliably by accessing resource and load diversity. For states with clean energy standards (CES) or greenhouse gas (GHG) pricing programs, and for utilities with decarbonization goals, electricity markets are also expected to play a critical role in the transformation of the electric sector to renewable and non-emitting resources. As organized wholesale electricity markets develop and evolve, market design must support and reflect state policy frameworks and objectives. Ideally, state-specific policy implementation would also evolve in a manner that is consistent with efforts to enhance access to existing and potential future electricity markets.

While many state renewable portfolio standards (RPS) have been in place and implemented since the early 2000s, many Western state CES programs, in particular those that call for 100% clean energy or 100% zero-emissions, do not yet have implementation rules in place. With respect to GHG pricing programs, California's cap-and-trade program has been in place since 2013 and has existing frameworks that apply to bilateral markets, and all contract path-based deliveries. Washington's Climate Commitment Act, which is modeled after the California cap-and-trade program, will be implemented beginning January 2023 with rules very similar to those of the California program. As wholesale electricity markets evolve and state policies are implemented, there are a number of areas to consider with respect to where they intersect:

- The extent to which markets can play a role, beyond providing energy production and emissions data, in GHG tracking and accounting for purposes of state policy compliance;
- How the market dispatch and optimization can accurately price GHG without creating unintended consequences such as emissions leakage or inappropriate impacts to entities in states that have not adopted GHG-pricing policies; and
- Whether and how the market can enable demand to specify the types of energy resources it is willing to purchase from the market.

This paper addresses one aspect of how state environmental policies will interact with wholesale electricity markets—how to price GHG emissions in a regional market where only a subset of participating states has adopted GHG pricing policies. This paper *does not* address other significant aspects of how state policy implementation will interface with market policy including how states will verify compliance with clean energy standards for entities participating in an organized wholesale electricity market. However, the solution set forth here is designed to be simple, durable, and flexible enough to support the implementation of existing policy goals and objectives, while also accommodating future policy changes. At the same time, it is also critical to consider the limits in what a regional organized market can and should do with respect to the

implementation of state policy. While an organized market can and should incorporate price signals that are consistent with state policy programs and assist in the verification of reporting and potentially other policy elements, it should not be the role of the market operator to implement every unique aspect of each state's individual policy.

Furthermore, given the current and future importance of accounting frameworks in verifying state policy compliance, as well as increased federal scrutiny on environmental, social, and governance reporting, it is critical that market participants retain the ability to control the disposition of any non-power attributes associated with their supply, including both assets and long-term purchases. This is the case even where instruments conveying non-power attributes are not specifically traded or transferred in the market. Integrity in reporting depends in part on an entity's assurance that all non-power attributes associated with its instruments have been retained. If the emissions profile of a resource is considered a non-power attribute, the market-based assignment of a MWh from a non-emitting resource to a specific load could jeopardize the ability of the entity who holds the instrument to continue to claim those non-power attributes for compliance or voluntary programs. Any solution that requires the market operator to determine the assignment of specific resources to specific loads across the market footprint will face challenges and will not be durable. In addition, it is highly likely that incremental accounting systems will be needed, outside of the market, to determine whether states and entities have fulfilled decarbonization policy requirements. Robust regional dialogue on this topic should continue as markets and state policies evolve.

As noted, while the concepts in this paper may ultimately be more broadly applicable, it is focused on the current discussion in the West regarding the development of a regional day-ahead market, recognizing that such a market is currently being developed by both the California Independent System Operator (CAISO) and the Southwest Power Pool (SPP). The technical solution described herein can be adopted by either market operator and could satisfy the policy objectives of California and Washington to: 1) incorporate a cost to GHG emissions associated with energy that is imported to serve load in those states; 2) minimize emissions leakage; and 3) create long-term incentives for the development and use of non-emitting resources.

Broadly speaking, the solution articulated in this paper will divide the market into two zones: the GHG zone—where GHG emissions are priced; and outside the GHG zone—where GHG emissions are not priced. Each zone is made up of a combination of loads and resources not necessarily restricted by traditional balancing authority area (BAA) boundaries. As an initial matter, all loads and resources within the physical boundary of California and Washington (or other future state that adopts a GHG pricing policy) will be within a GHG zone.

The solution will enable resources that are physically external to the GHG zone to import their output to a GHG zone provided that the market participant communicates their intent to do so prior to the market optimization, and provided that specific regulatory criteria are met. An external resource that is imported into the GHG zone will be treated by the market optimization *as if* it was internal to the GHG zone from a dispatch, pricing, and settlement perspective: the resource will be dispatched at its resource-specific emissions rate and will receive the GHG price within the GHG zone. An external resource that does not indicate its intent to sell to the GHG zone on a resource-specific basis and meet the defined criteria will continue to sell its output in the non-GHG zone and will not be dispatched with a GHG emissions price.

In general, the impact of applying a price on GHG emissions in the GHG zone will raise prices in the GHG zone relative to the external area (where GHG costs are not included in market prices). Absent intervention, this price separation will naturally shift generation to lower-cost resources outside of the GHG zone that may be higher emitting, but whose GHG emissions are not considered by the market optimization. To prevent this shift to imports with higher emissions, or emissions "leakage," the solution will prevent transfers from the external area to the GHG zone unless a GHG toll price—representing a reasonable estimate of the GHG costs associated with the types of resource being used to support those transfers—is overcome. When such transfers to the GHG zone occur, these "unspecified" imports will be assigned a default emissions rate for reporting and compliance purposes.

As more fully articulated below, there are a number of areas of this proposal that require further discussion and input from state air regulators in California and Washington. A key element of the solution is to reduce instances of "backfill", where resources that would otherwise serve native load are identified as imported into the GHG zone and native load is instead determined to be met through market purchases of fossil-fueled resources. To support this objective, criteria will need to be developed to ensure that resource-specific imports into the GHG zone are appropriately validated, and these criteria should utilize existing approved mechanisms and be further developed in concert with state air regulators.

Another key aspect of the proposal is the role of the market operator to collect revenue, through the GHG toll applied to unspecified imports, for the purpose of purchasing and retiring allowances associated with unspecified imports into the GHG zone. Under this proposal, with respect to unspecified transfers, individual importers will not be identified; rather total transfers and associated emissions will be calculated, and associated revenue collected by the market operator. An entity or entities must be identified to be responsible for reporting these emissions and the purchase and retirement of associated allowances.

Given the complexity of incorporating single-state GHG pricing policies into a regional and interstate wholesale organized energy market, this solution attempts to preserve the benefits of

a wide footprint security-constrained economic dispatch as well as reflect state policy goals and objectives. While no solution is likely to be perfect, the below solution attempts to balance competing objectives to arrive at a solution that will work most effectively and simply and will be durable as both markets and state policy evolve over time.

I. A Properly Designed Organized Market Can Incorporate GHG-Pricing Program Provisions For Those Jurisdictions That Elect To Adopt One

The purpose of a GHG-pricing program is to reduce GHG emissions by imposing a cost on electricity generation located within the GHG-pricing program's footprint (hereinafter referred to as a "**GHG zone**") in proportion to the quantity of GHGs emitted. The GHG cost can be established through taxation (as in the case of British Columbia's carbon tax) or it can be the cost of acquiring the corresponding quantity of GHG allowances (as in the case of California's cap-and-trade program and Washington's forthcoming cap-and-invest program). For generating resources located within a GHG zone, the effect is to make low- or non-emitting resources relatively more economic than resources that emit high amounts of GHG emissions, creating incentives to shift electricity production to lower-emitting resources, and reduce total GHG emissions in the GHG zone. GHG-pricing programs may also adopt rules applicable to electricity imports into the GHG zone in order to prevent "leakage," which can occur if electricity production shifts from GHG-emitting generating resources located within a GHG zone to GHG-emitting generating resources located outside the GHG zone, where the same GHG-pricing program rules may not apply.

A properly designed and implemented regional day-ahead and real-time organized electricity market can support the GHG-pricing programs of the respective states and provinces, as well as the decisions of those states or provinces that do not implement a GHG-pricing program, to achieve the following:

Within A GHG Zone	Outside A GHG Zone
• **Include the cost of GHG emissions in the dispatch of generation** resources inside the GHG zone. • **Include the cost of GHG emissions associated with imports** into the GHG zone. • **Enable market access** for low- or non-emitting resources outside a GHG zone to compete to sell their low- or non-emitting output into a GHG zone. • **Ensure market prices in the GHG zone reflect the cost of GHG emissions**, encouraging low- and non-emitting resources to be developed and available when they provide greatest value.	• **Ensure the cost of GHG emissions are *not* included in the dispatch of generation** outside of GHG zones. • **Ensure the cost of GHG emissions are *not* included in transfers** that occur entirely outside of GHG zones. • **Ensure that market prices for electricity do *not* include costs of GHG emissions of resources outside the GHG zones**.

In contrast, a poorly designed organized market can undermine the effectiveness of a state's or a province's GHG-pricing program, and/or may improperly impose GHG costs in states or provinces that have not adopted any such program within their own jurisdiction.

In exploring how best to design an organized day-ahead and real-time market to support decisions by state and provincial regulators regarding GHG-pricing programs, the following goals are critical:

- **It is up to each state or province to determine whether to implement a GHG-pricing program.** The design of an organized electricity market must not have the effect, directly or indirectly, of encroaching upon the autonomy of each state or province to define the GHG-related programs and associated rules, if any, that shall apply in their jurisdiction.
- **The organized market design should reflect the policies of each state or province's GHG-pricing program**, while also recognizing that program policy design and implementation is the responsibility of the respective state or province. A well-designed GHG framework can also inform GHG policy choices and encourage harmonization of certain aspects of state or provincial GHG programs to enable improved market efficiencies, and improved environmental program outcomes.
- **The organized market design should anticipate that the number of states and provinces adopting GHG-pricing programs may increase**, and that all GHG-pricing programs will likely evolve over time. Designing flexibility into the organized market will reduce the need for significant changes to the organized market design each time there is a change to one or more GHG-pricing programs.

II. Principal Challenges To Incorporating GHG-Pricing Programs Into A Regional Organized Market

GHG-pricing programs generally seek to apply a GHG-related cost to two activities:

- The production of electricity by generation resources located within the GHG zone; and
- The import of electricity into the GHG zone.

Accurately applying GHG costs for generating resources located within a GHG zone is generally straightforward, requiring primarily that generators be able to include their resource-specific GHG costs as part of the offer prices submitted to the market operator.[1]

In contrast, applying GHG costs to imports into the GHG zone can be significantly more challenging because applying a GHG cost on a resource-specific basis requires identifying the source of the import and applying that cost to the portion of the source's output that will actually be imported. State reporting regimes have evolved to create two broad types of import activity:

[1] This may be submitted as a separate element of the offer price, or included with other applicable costs. Any market power mitigation rules must also recognize these GHG costs in any calculation of reference prices for generating units in jurisdictions with a GHG-pricing program.

specified and unspecified imports. The California and Washington GHG-pricing programs place a compliance obligation on the "first jurisdictional deliverer" or entity who imported electricity into the GHG zone. The importer is required to purchase and retire allowances based on the emissions content of the electricity imported. Emissions associated with imports are calculated based on whether the import is specified or unspecified:

Specified-source means a source that is permitted or required to be claimed under the GHG-pricing program as the source of electricity that was imported. Currently, specified source reporting requires the importer to have full or partial ownership in the facility or a written power contract to procure electricity generated by the facility or unit. Specified source imports are the result of specific generation resources located outside the GHG zone producing electricity and importing it into the GHG zone. Specified-source imports enable a resource-specific quantification of emissions associated with imported electricity and support state or provincial policy goals by incentivizing the building or contracting for non-emitting supply from generation projects located elsewhere in the western grid. Each GHG-pricing program will adopt its own definition for specified-source imports, but there are two important common required elements across current programs:

- Identification of the specific resource whose output is to be imported into the GHG zone, including generating technology and GHG emission rate (*i.e.,* $MTCO_2$/MWh); and
- Verification of the quantity of energy and emissions reported as imported.

In an organized market, specified-source imports can enable non-discriminatory access for non-emitting resources to import and sell their output into a GHG zone. This must be done in a manner that upholds each state's or province's requirements for specified-source imports, however. It can be counter-productive to the goals of a GHG-pricing program for an organized market to identify specified-source imports where there is no intention or arrangements for that output to be imported to serve load within a GHG zone: this mutes the accuracy of the price signal and can create leakage, as resources identified as imported into the GHG zone were actually used to serve native load in the external area.

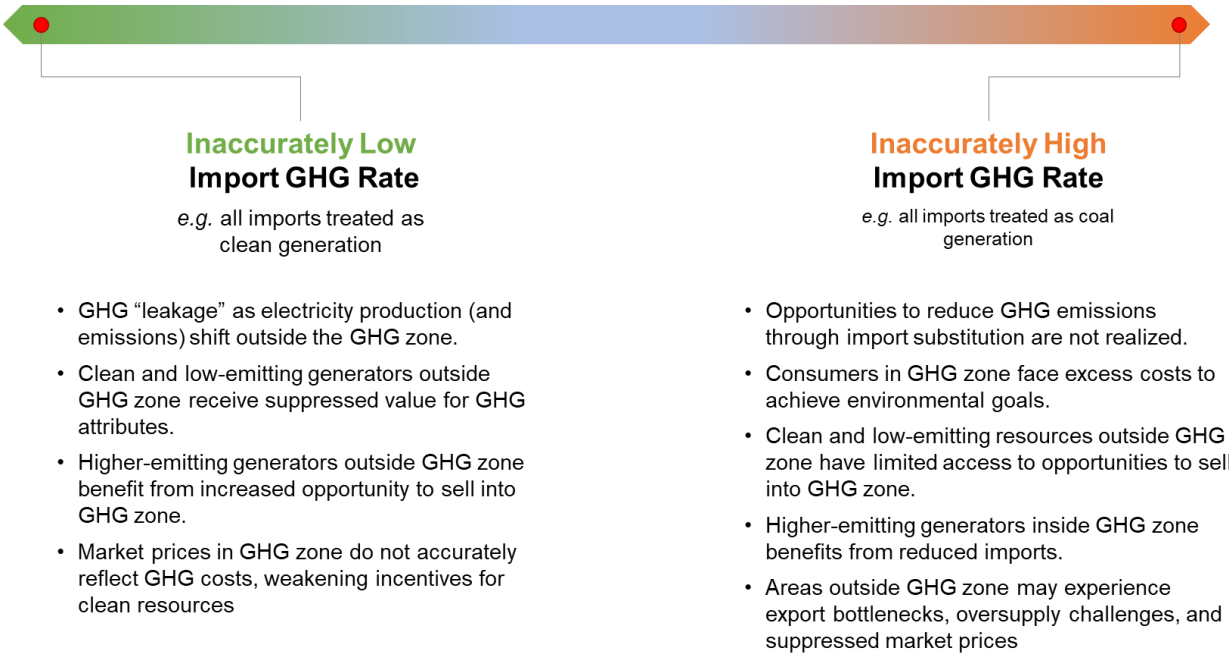
Unspecified Imports are imports into a GHG zone that do not satisfy the GHG-pricing program's requirements for specified-source imports (*i.e.*, where the source of the import cannot be identified). Unspecified imports from an area outside the GHG zone can generally be expected to represent aggregate generation in excess of that external area's own load[2], and cannot be accurately linked to any particular generation resource. The accurate application of these two

[2] And also excluding generation associated with specified-source imports out of the external non-GHG zone.

types of imports in the context of a regional day-ahead and real-time organized market presents important design challenges, discussed below.

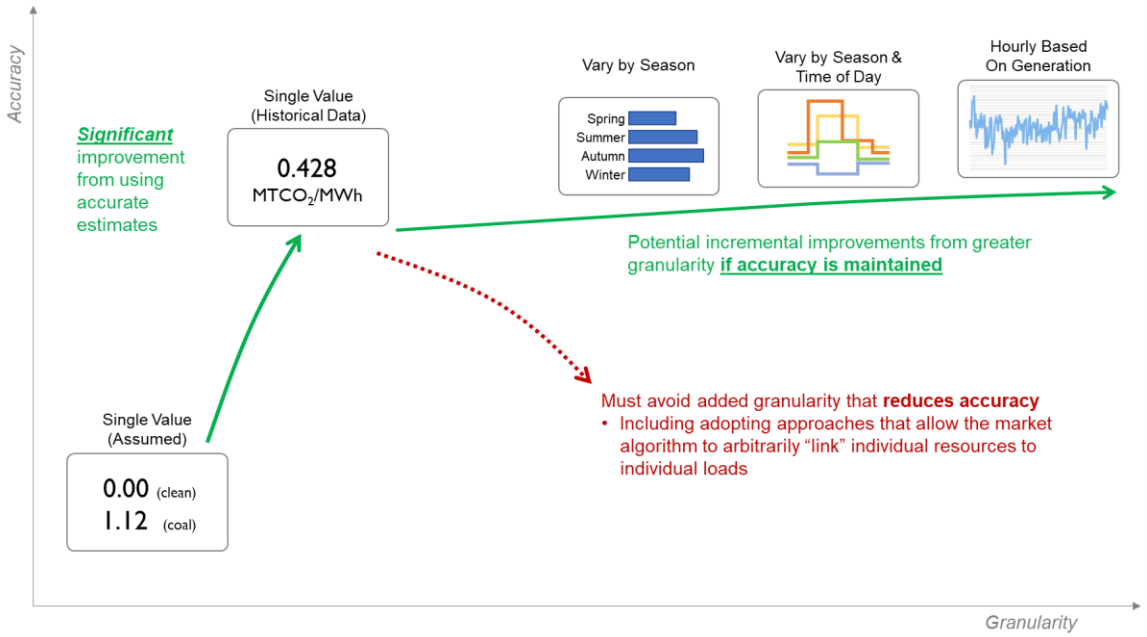
A. Challenge 1: Accurately Determining The Import GHG Rate

Accurately determining the GHG emissions of electricity imports (referred to as the "**Import GHG Rate**") is of central importance to achieving the goals of a GHG-pricing program, as it will form the basis of any evaluation of the economic trade-off between importing electricity into the GHG zone instead of producing more of it within the GHG zone. An Import GHG Rate that is either inaccurately high or inaccurately low will limit the effectiveness of a GHG-pricing program, in different ways, as illustrated below:



Determining the Import GHG Rate for specified-source imports is generally straightforward, as it is the GHG emission rate of the specified generation resource(s) supporting those imports. The key task for an organized market is to verify that the applicable criteria established by a GHG-pricing program for specified-source imports have been satisfied, after which the market software can dispatch the specified generation resource based on its costs (including the cost of its GHG emissions, if any) in tandem with the scheduling of a corresponding quantity of specified-source imports into the GHG zone. In this manner, the cost of the specified-source imports into the GHG zone will accurately include the cost of the resources' GHG emissions, and can be directly evaluated against the cost of available generation located within the GHG zone (which also include GHG costs).

The Import GHG Rate for unspecified imports generally seeks to represent the rate applicable to the aggregate generation in the external area (outside the GHG zone) that is in excess of aggregate external load. The state or provincial bodies that have authority over a GHG-pricing program will specify how the Import GHG Rate for unspecified imports is determined. Existing GHG-pricing programs apply an Import GHG Rate based on historical information regarding the type of generation resource that tends to be marginal in a region, as this is the type of resource that would increase production if exports from that region increased. This calculation typically consists of a single value for a particular region, but calculations could also be developed that are specific to the time of day or to the month of the year. Conceptually, it may even be possible to calculate the Import GHG Rate for unspecified imports on a continuous basis, reflecting the specific mix of resources in use at a particular time.



A more finely-tuned calculation of Import GHG Rates will generally support more efficient import schedules, provided that the increased granularity does not compromise accuracy. For instance, a very granular calculation may inadvertently lead to circumstances where the Import GHG Rate for unspecified imports is inaccurately low due if it fails to recognize that production from energy-limited clean resources in one hour may lead to increased use of higher-emitting resources in a future hour. It should also be recognized that an inaccurately low unspecified Import GHG Rate is more problematic than one that is inaccurately high, as clean and low-emitting resources have the opportunity to deliver their output to a GHG zone as a specified-source import.

The risk of inaccuracy is magnified if the organized market optimization process goes beyond simply identifying the generation resource type that is the marginal producer in an hour, and is tasked with selectively "assigning" individual generation resources to imports into the GHG zone,

and applying the GHG emission rate of the "assigned" resources as the Import GHG Rate. This is problematic because, in an organized market, there is generally *no basis for any* presumption of a connection between an individual generation resource and any individual load. Rather, all generation offered into the market is simultaneously dispatched (at the busbar of each resource) to serve all load and all exports (subject to transmission and other constraints).

Enabling the market optimization to simply select the generation resource that is "deemed" as being the source of the imported electricity into the GHG zone would be arbitrary and inaccurate. And because the objective being pursued by typical organized market software is to minimize overall production costs, such an approach will utilize that latitude to choose whichever "links" minimize the quantity of GHG emissions that are associated with imports, regardless of whether such "links" are accurate or even plausible. This can result in the market software dispatching incremental output from an external GHG-emitting resource, while concurrently deeming the import to be from a clean resource that:

- Was committed to serve native load outside the GHG zone;
- Did not increase its output in the market; and/or
- Was not imported (or even able to be imported) to the GHG zone.

Such outcomes highlight the inherent tension between a GHG-pricing program's objective of *increasing* electricity prices to accurately reflect the cost of GHG emissions associated with serving load, and a market optimization's objective of *minimizing* production costs through all available means, including through an arbitrary and inaccurate selection of the generation resources associated with an import. For this reason, the organized market should be designed to simply *apply* specified-source import treatment to those imports that clearly and unambiguously meet the applicable criteria of the GHG-pricing program for specified-source imports. For all other imports, the organized market should be designed to treat the imports as unspecified, reflecting that the imported electricity is being delivered from a mix of external resources that cannot be accurately identified.

B. Challenge 2: Selecting Which Region(s) Receive The Output Of Each Resource

Entities that sell and deliver the output of clean and low-emitting resources have a range of geographic regions, each with potentially one or more different environmental programs, where their generation can be imported and the associated clean attributes can be applied. This includes committing clean and low-emitting output under renewable portfolio standards, clean energy standards, and product content disclosures, in addition to GHG-pricing programs. These entities need to ensure that the totality of their commitments to the different environmental programs do not overcommit their clean or low-emitting supply volumes. For instance, a seller may have determined that it is able to commit 1,000 GWh of its clean supply to an environmental

program in another region over the course of a particular year, and still meet its annual obligations to its source region. That seller may be unable to successfully meet its commitments in its source region if (1) it is required to sell *all* of the output of its resource as clean or low-emitting supply whenever its makes sales in another region; or (2) it will not know until after the fact how much of the output was determined to be committed to that other region's environmental program as clean or low-emitting supply.

For many entities, their clean supply consists of energy-limited resources whose output must be efficiently allocated over a timeframe of days, months, and seasons (or longer). An organized market, in contrast, schedules and dispatches resources one interval (*e.g.,* one hour) at a time. And while some organized markets attempt to incorporate certain energy limitations over time, these constraints are generally limited to 24 hours or less. In other words, not only will a regional organized market lack comprehensive visibility of all of the different programs that an entity may participate in (or the obligations they have already entered into), organized markets simply lack a framework to attempt to optimize a limited quantity of clean supply over the more relevant timeframes of the applicable environmental programs.

For this reason, each seller in an organized market must have the ability *for it to determine* the quantity—if any—of output that it will commit to being delivered as a specified-source import to another region. This "seller autonomy" approach may raise similar questions to those raised in other forums related to GHG-pricing programs about whether a seller of clean or low-emitting supply could engage in deliberate and unaccounted for "backfilling" of its clean resources with emitting supply that increases GHG emissions elsewhere in the region. For example:

- An integrated utility could deliver all of its clean resource output to a GHG zone, requiring it to purchase unspecified supply to serve its own load in the same hour; or

- An integrated utility could deplete its energy-limited storage hydro resource to meet its own load and deliver additional output to a GHG zone, requiring it to purchase unspecified supply in a future period to serve its own load.

These concerns are valid, but are not unique to the application of GHG-pricing programs in the context of organized markets, nor are they unique to a "seller autonomy" approach to deciding when and where clean or low-emitting supply is delivered. Rather, these concerns apply to all designs and approaches to applying GHG-pricing programs to electricity markets, and are best addressed through potential enhancements to the requirements for specified-source imports, if and when such enhancements are determined necessary by the regulators governing the applicable GHG-pricing program.

C. Challenge 3: Verifying That The Output Of The Specified-Source Was The Electricity That Was Imported

GHG-pricing programs have required that specified-source imports not only identify a generating resource, but also that the output of that resource be imported into the GHG zone. Demonstrating that the import of that specified-source electricity actually occurred requires that import verification rules be developed and administered by the state air regulator.

To date, GHG pricing program rules[3] in California and Washington include requirements for physically scheduled imports in the bilateral markets (including the use of the CAISO's intertie bidding framework), as well as separate provisions related to resources that are algorithmically "deemed" by CAISO to be imported through the CAISO's Western Energy Imbalance Market (WEIM)[4]. It is likely that GHG program rules will continue to evolve as new markets are developed in the west.

While it is important to recognize that GHG program rules may be developed or updated to reflect future organized market structures used to arrange imports, GHG design choices for a future regional day-ahead market must be made with the objective of accurately and faithfully upholding GHG program requirements, including developing a credible approach for validating specified-source imports.

Outside of organized markets, the industry standard mechanism for communicating the information necessary to demonstrate energy delivery, including the import of electricity into a specific region, is the use of e-Tags. E-Tags provide a validated source of the key details demonstrating direct delivery, including the identified generation resource, the load being served by the delivery, and the transmission path and transmission service arrangements enabling delivery from the resource to the load. Importantly, the information in an e-Tag must be validated by the applicable entities associated with the delivery. In particular, each transmission service provider on the delivery path will confirm that transmission service was, indeed, reserved and scheduled as specified on the e-Tag.

In the context of an organized market, electricity produced by a generator outside the GHG zone is generally sold to the market at the generator's busbar. While a generator's output—together with the output of other generators—can contribute towards *unspecified* imports into a GHG zone, a seller that has made no arrangements to import the output of that resource into a GHG zone should not be treated as a specified-source import. Whether a regional organized market

[3] https://www.arb.ca.gov/cc/reporting/ghg-rep/ghg-rep-power/epe-faqs_2021.pdf?_ga=2.211686226.611494132.1652364749-571543123.1652364749;

https://ecology.wa.gov/DOE/files/53/533eec8a-faf6-4a2e-afce-278d404caad6.pdf

[4] Concerns related to the accuracy of algorithmic "deeming" are further discussed in Section II A.

design uses e-Tags or some alternative approach, the mechanism to communicate the information necessary to support the specified-source import must be sufficiently robust to provide objective verification that the import of the output of the specified source has indeed occurred. This raises some important implementation questions:

1. How can we best ensure that a feasible path existed to deliver the output of the specified-source generator to the GHG zone?
2. How can we best ensure that the amount of aggregate specified-source deliveries to a GHG zone on a particular path does not exceed the transfer capability of that path?
3. What transmission arrangements should be necessary, if any, for an entity to be able to claim that its specified-source deliveries to a GHG zone are the ones that should be accepted when there are more deliveries than can be accommodated?
4. Are there other mechanisms that should be considered, such as contractual requirements, or verification of non-emitting surplus?

III. Proposed Design

The proposed design seeks to enable the organized market to efficiently dispatch generation resources and determine accurate market prices that are fully consistent with the GHG-pricing program, if any, adopted by the respective state or jurisdiction. This objective includes maximizing participation in the organized market by all resources (*i.e.,* avoiding a design that requires a clean resource to transact outside the organized market in order to realize the value of its clean attributes).

The proposed design enables any generation resource that is the source of a specified-source import to a GHG zone to inform the market operator in advance. Under a market design that supports base schedules, this functionality can be leveraged to enable participants to communicate their intent to deliver their resource to the GHG zone and to provide the necessary information to validate the specified-source import. To the extent base scheduling functionality is not supported, another technical solution will be required to allow entities to communicate this information. Resources associated with specified-source imports will be dispatched in tandem with a corresponding quantity of imports scheduled into the identified GHG zone; these resources will receive an energy price that includes the GHG Price of the GHG zone, and will be responsible for reporting and compliance under the applicable GHG-pricing program.

All other generation resources will be dispatched and compensated at the market price at their generation interconnection point, or node. Aggregate generation in excess of aggregate load in the external non-GHG zone may be imported into a GHG zone as unspecified import, based on an unspecified import "toll."

A. Specified-Source Import Proposal For A Day-Ahead Market

1. Advance Communication of Specified Source Imports

A generation resource that is the source of a specified-source import into a GHG zone will inform the market operator in advance using base schedule functionality or other technical approach. This communication must include the information necessary to support the specified-source import, such as:[5]

- Identified generation resource;
- GHG emission rate for the resource ($MTCO_2$/MWh);
- Identified GHG zone to which the generation output will be delivered;
- Valid physical delivery path, including, for each segment: the TSP, POD, POR, transmission reservations / AREF, transmission allocation (MW), and expected energy profile (MW); and
- Additional information as may be required by the applicable GHG-pricing program.

This information is required regardless of whether the specified generation source submits economic offers to the market or whether it submits a self-scheduled output quantity. This establishes the *maximum* quantity of specified-source imports from the generator to the GHG zone, but lower quantities resulting either from resource availability (*e.g.,* wind output) or economic dispatch are accommodated by the market operator updating the energy profile.

Each generation resource supporting a specified-source import to a GHG zone must also be validated by the applicable transmission service provider(s) to verify the import. One way this validation can be provided is through the use of e-Tags, where an e-Tag containing the same information referenced above would be required to be submitted and approved by the applicable transmission service providers by the end of the preschedule window (*e.g.*, 3 p.m.), and be maintained through real-time.

2. Offer Submission, Dispatch And Settlement

A generation resource that is identified as the source of a specified-source import into a GHG zone will include the cost of any compliance obligation with the GHG-pricing program in its offer price. It is not necessary for the GHG-related price to be offered separately from other

[5] Base schedules are anticipated to have additional applications requiring the delivery of identified generation to identified loads or locations. The present discussion is limited to the use of base schedules in the context of implementing GHG-pricing programs.

components of the resource offer price, since the resource will be economically dispatched only in the context of delivering to the GHG zone.[6]

The market will optimize the dispatch of the specified resource in tandem with scheduling of specified-source imports into the identified GHG zone. That is, any change to the quantity of the specified-source import requires an equivalent change in the output from the identified generation resource.

A generation resource associated with a specified-source import will be compensated based on the locational-marginal price ("**LMP**") at its individual generator location, plus the GHG Price in the GHG zone being served by the specified-source import, as discussed further below.[7]

3. Reporting And GHG-Pricing Program Compliance

For all specified-source imports, the market operator will record the final delivered quantity that results from the market optimization. These records will enable consistent communicating and reporting of:

- The total quantity (MWh) of specified-source imports into each GHG zone in each interval;
- The total quantity of GHG emissions (MT) associated with specified-source imports into each GHG zone in each interval; and
- The individual generation resource(s) that engaged in specified-source imports into each GHG zone, and their respective import volume (MWh) and GHG emissions (MT).

The market participant associated with a specified-source import of electricity from a generation resource will generally be responsible for reporting and complying with the requirements of the applicable GHG-pricing program. For instance, the market participant will be responsible for reporting the quantity of the import, and the GHG emissions associated with the import, based on the emission rate of the identified generation resource. The net GHG-related compensation for a specified-source import is therefore the GHG Price that is paid to the resource through the market settlement process less the cost of any GHG allowances or GHG tax on the GHG emissions of the resource. Section III.C, below, provides an illustrative example of the market settlements and GHG-related responsibilities for specified-source imports.

[6] There may be other reasons why the GHG cost component may be submitted separately from other elements of the offer, but it is not necessary in order to implement the aspects of the proposed design related to GHG-pricing programs.

[7] In addition, the transmission capability associated with the delivery may receive congestion revenue; this is addressed as a separate component of the market proposal.

B. Unspecified Import Proposal

Generation resources not identified on a specific basis will deliver, sell, and be compensated for their output at their individual generation interconnection point. Aggregate generation in excess of aggregate load in an external non-GHG zone can still be imported into a GHG zone, as an unspecified import that is not associated with any particular generation resource.

4. Scheduling Of Unspecified Imports

The GHG emissions associated with an unspecified import are determined by the Import GHG Rate established by the GHG-pricing program. By multiplying this Import GHG Rate by the cost of GHG allowances or by the value of a GHG tax on each ton of GHG emissions, the market software can calculate a surcharge or "toll" for scheduling unspecified imports. The total cost paid by the GHG zone for unspecified imports is therefore the cost of energy in the non-GHG zone plus the "toll". Unspecified imports will only be scheduled when the market price of electricity inside the GHG zone (which includes GHG costs) is higher than the market price of electricity in the non-GHG zone (which does not include GHG costs) by at least as much as the "toll." This concept is illustrated in the examples below:

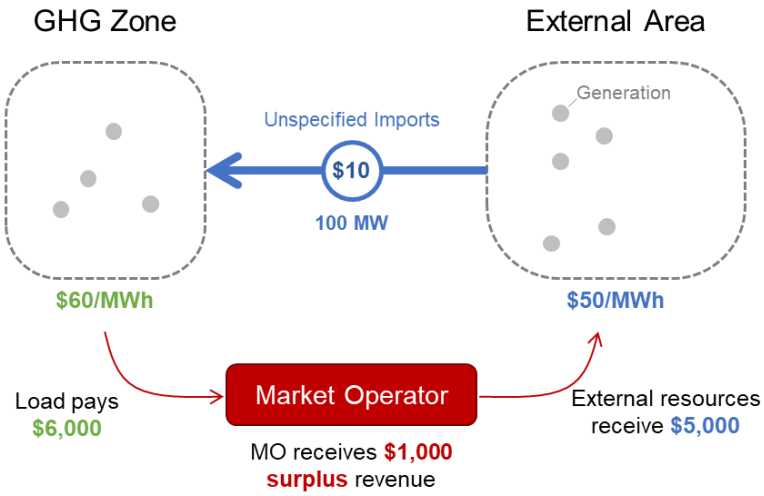
- **The cost of unspecified imports into the GHG Zone is $60/MWh**
  - the cost of electricity in the External Area ($50/MWh) *plus*
  - the $10/MWh "toll", for a total of $60/MWh.
- This is **more than the market price of electricity** in the GHG Zone, which is $55/MWh.
- Therefore, **unspecified imports are not scheduled** by the market software.

- **The cost of unspecified imports into the GHG Zone is $60/MWh**, as in the first example.
- But in this example, the market **price of electricity in the GHG Zone is $60/MWh**.
- Therefore, **unspecified imports <u>are</u> scheduled** by the market software.

5. Compensation, Reporting And Compliance

Since unspecified imports are not associated with any specific generation resources, there is no GHG-related market compensation paid to generation resources in the non-GHG zone. This means that the price charged by the market operator to the GHG zone for the unspecified import will necessarily be higher than the price paid by the market operator to generation resources in

the non-GHG zone. This is the expected outcome with any GHG-pricing program, and results in market settlements that collect surplus revenues, as illustrated below. The amount of this surplus is the "toll" multiplied by the quantity of unspecified imports subject to that "toll."



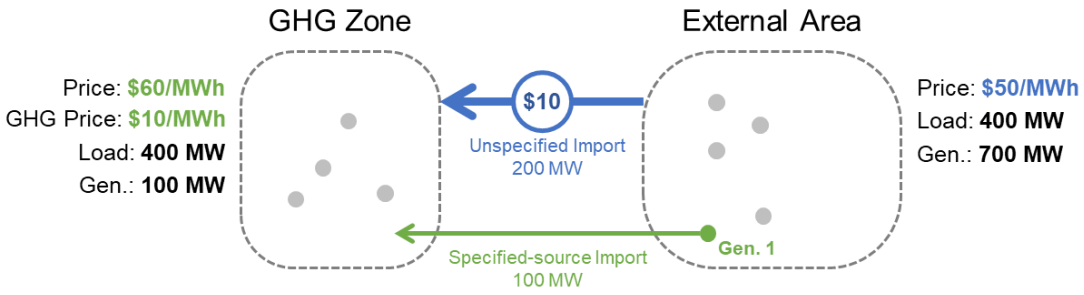
Unspecified imports also result in an obligation to report and comply with applicable rules of the GHG-pricing program adopted in the GHG zone. This generally includes responsibility for procuring GHG allowances (or paying a GHG tax) on the GHG emissions associated with the unspecified imports.

The market design process will need to clarify the entity that will assume responsibility for reporting and compliance obligations related to unspecified imports (*i.e.,* the entity that will be the "importer" and subject to the rules of the GHG-pricing program). For example, this responsibility may be assigned to a third party, allocated broadly to all load in the GHG zone, or performed by the market operator itself. The entity with responsibility for GHG reporting and compliance will also be the entity that receives the surplus market revenues associated with financial settlement of unspecified imports, described previously. In this manner, the cost of compliance with the GHG-pricing program (*i.e.,* purchasing GHG allowances or paying a GHG tax in connection with the unspecified import) will be fully funded by the surplus market revenues arising from this activity. Section III.C, below, provides an illustrative example of the market settlements and GHG-related responsibilities for unspecified imports.

C. Illustrative Example

The proposed conceptual framework is illustrated in the following example, comprised of a GHG Zone and an External Area. The GHG-pricing program for the GHG Zone has established an Import GHG Rate for unspecified imports of 0.5 $MTCO_2$/MWh, and GHG allowances in the GHG Zone are estimated to cost $20/MT. The market software therefore calculates a "toll" for unspecified

imports of $10/MWh. In the example below, load in the GHG Zone is met by supply that includes 200 MW of unspecified imports from the External Area and 100 MW of specified-source imports from a non-emitting generation resource located in the External Area, Gen. 1. The price in the External Area is $50/MWh, whereas in the GHG Zone the price is $60/MWh, implying a GHG Price of $10/MWh. This example is shown below.



The market settlement process will charge all load the market price in the respective zone; and will pay all generation resources the market price in the respective zone. Additionally, Gen 1 (the identified source of the specified-source import) will receive the GHG Price. These settlements are summarized in the following table:

Zone	Activity	MW	Price $/MWh	Total	GHG Responsibility
GHG Zone	Load	400 MW	$60	$24,000	None
	Gen	100 MW	$60	-$6,000	100 MW *at GHG rate of each resource*
External Area	Load	400 MW	$50	$20,000	None
	Gen. 1 *specified-source for import*	100 MW	$60*	-$6,000	100 MW Specified-Source Import *at GHG rate of Gen. 1*
	Gen (other)	600 MW	$50	-$30,000	None
	Unspecified Import	200 MW	$10	-$2,000	200 MW Unspecified Import *at Import GHG Rate determined by GHG-pricing program*

In addition to these financial settlements that occur through the market settlement process, certain entities will have reporting and compliance responsibilities under the GHG-pricing program adopted in the GHG Zone. Specifically, Gen 1 must report the GHG emissions for its 100 MW specified-source import. Since Gen 1 is a non-emitting resource, it will not incur a compliance cost. In this manner, it will receive a net payment of $10/MWh related to the delivery of its clean supply to the GHG Zone.

The entity assigned responsibility for unspecified imports, meanwhile, will report 200 MW of imports at the established Import GHG Rate of 0.5 $MTCO_2$/MWh, or 100 MT. It will need to procure this quantity of GHG allowances which, at the assumed cost of $20/MT, will cost $2,000. This precisely matches the surplus revenue collected in the market settlement process, which was paid to the entity assigned reporting and compliance responsibility. By collecting a "toll" for unspecified imports that matches the compliance cost that will be incurred for those unspecified imports under the GHG-pricing program, the entity assigned compliance responsibility has minimal financial exposure, and is largely performing an administrative rather than a risk-management function.

D. Implementing Proposed Conceptual Framework In A Market Optimization

1. Market Optimization Of Unspecified Imports

The concept of a "toll" for unspecified imports can be implemented in the market optimization by enforcing a constraint on the quantity of unspecified imports for each GHG zone, as follows:

Unspecified Import ≤ 0; where

Unspecified Import = [Load] + [Specified-Source Exports] + [Losses] – [Internal Generation] – [Specified-Source Imports]

This "unspecified import constraint" prevents any net imports into the GHG zone other than specified-source imports. However, this constraint can be relaxed when the cost of continuing to enforce the constraint exceeds a defined value. This penalty price would be calculated as the Import GHG Rate for unspecified imports into the GHG zone (as established by the GHG-pricing program) multiplied by the prevailing price or tax rate for each ton of GHG emitted.

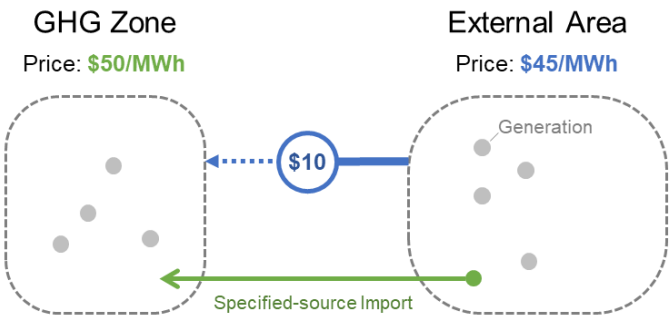
This approach will ensure that unspecified imports from a non-GHG zone accurately incorporate the cost of GHG emissions, according to the rules of the applicable GHG-pricing program. In the prior example, in which unspecified imports are assumed to have GHG emissions of 0.5 $MTCO_2$/MWh and each ton of GHG emissions carries a cost of $20, the unspecified import constraint would have a penalty price of $10/MWh. Consequently, unspecified imports would only be scheduled—*i.e.,* the constraint would only be relaxed—if the value of electricity in the

GHG zone was at least $10/MWh more than the cost of producing additional electricity in the non-GHG zone. This approach ensures that unspecified imports are only scheduled if they are economic *even after accounting for the GHG zone's cost of GHG emissions.*

2. *Calculating The GHG Price*

The market price of electricity in a GHG zone will exceed the market price of electricity in a non-GHG zone, all other things being equal. This price differential is referred to as the "GHG Price." In the market formulation, the GHG Price is equal to the shadow price of the unspecified import constraint, defined above. The shadow price of a constraint reflects the additional total production cost incurred as a result of respecting the constraint. In this case, the shadow price reflects the increase in total production cost associated with not allowing the market to schedule any imports into a GHG zone other than specified-source imports. Since the constraint enables the GHG zone to only access supply that already includes the cost of GHG emissions in its offer prices, the shadow price reflects the cost savings that would be available if the GHG zone could access supply that does not include GHG costs.

In the example below, a specified-source import is scheduled from a generation resource located in the external area, where the market price (excluding GHG costs) is $45/MWh, into the GHG zone, where the market price (including GHG costs) is $50/MWh. As in the earlier example, it is not economic to relax the unspecified import constraint, at a penalty price of $10/MWh. The value of relaxing this constraint—that is, its "shadow price"—is $5/MWh, since that is the reduction in total production cost that would occur if imports were not restricted. This is also the GHG Price in the GHG zone, which is paid to the generator in the external area associated with the specified-source import.



The GHG Price is equal to the total production costs that would be saved if the unspecified import constraint was not enforced (i.e., electricity could be purchased in the External Area at $45/MWh and displace production from a $50/MWh generating unit in the GHG Zone).

The $5/MWh GHG Price is paid to the generating resource in the External Area that base schedules the specified-source import. This compensation is in addition to the $45/MWh market price at its bus bar, for total compensation of $50MWh.

Note that the GHG Price can be anywhere from $0 up to the penalty price for unspecified imports. When the GHG Price is just equal to the penalty price for unspecified imports, the market optimization does, in fact, relax the constraint, providing additional supply into the GHG zone (up to the limit of any transmission constraints).

E. The Design Proposal Is Workable Under Multiple Configurations Of GHG-Pricing Programs

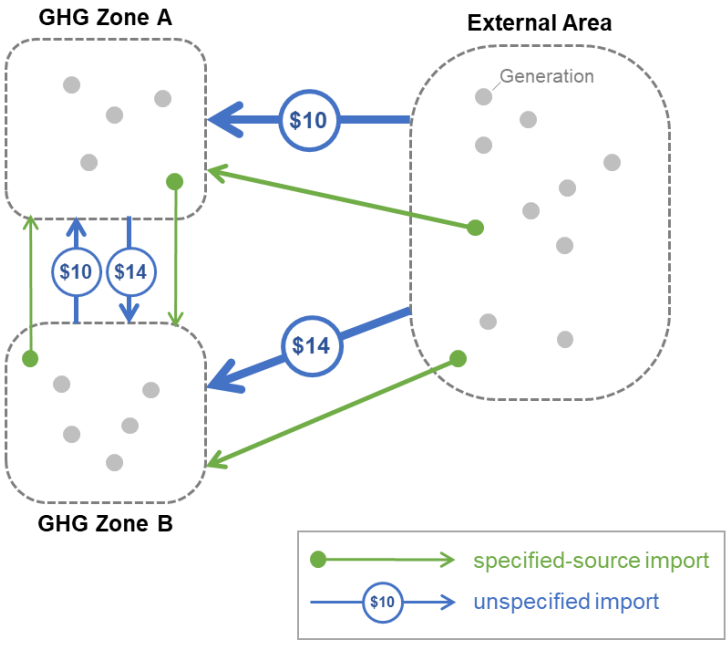
For explanatory purposes, the design proposal was described above generally in the context of a single GHG zone, with all other market areas having no GHG-pricing program. The design proposal is readily extended to accommodate several different configurations of GHG-pricing programs, as is likely to be encountered in the coming years.

1. Scenario 1: Multiple Separate GHG Zones

It is likely that the market footprint will involve multiple states or provinces, each of which has adopted its own independent GHG-pricing program, as well as other states or provinces that have not. The design proposal can reflect this configuration. For specified-source imports, no modification is necessary, as each generation resource is already required to signal its intent to import to a particular GHG zone on a resource-specific basis. The fact that there are multiple potential GHG zones does not add any additional complexity to this approach.

Unspecified imports would be defined for each GHG zone in the same manner as described in Section III.B.1, above. Importantly, however, each unspecified import constraint would have its own penalty price at which that GHG zone's constraint could be relaxed. The penalty price would reflect the particular provisions of that GHG zone's GHG-pricing program.

The figure below illustrates both specified-source and unspecified imports between an external area and two independent GHG zones.



2. Scenario 2: Multiple Coordinated GHG Zones Under A Reciprocity Framework

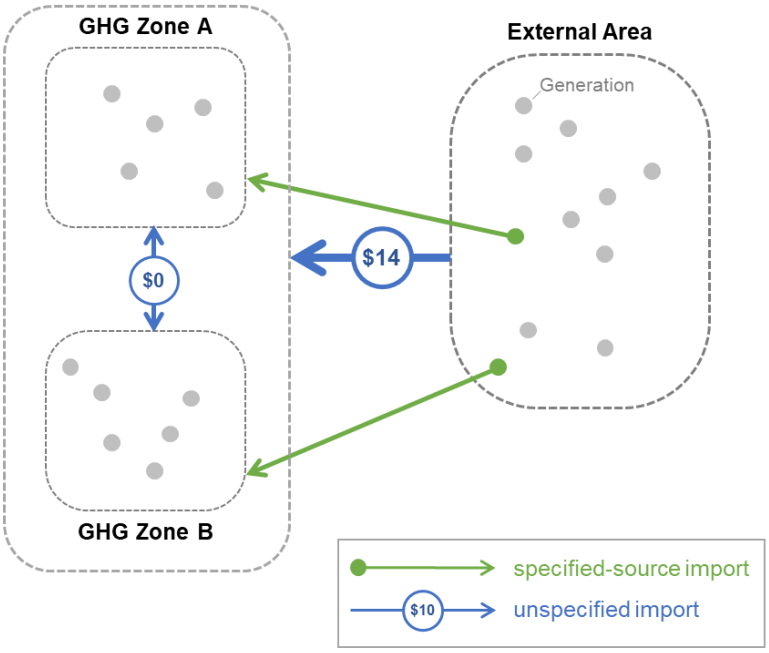
The prospect of multiple GHG zones has the potential to result in overlapping GHG-related costs. Consider the specified-source imports from a generator located in GHG Zone A and delivered to GHG Zone B in the prior example: GHG-related costs would be incurred both when electricity is produced (by the generator located in GHG Zone A) and again when it the output is imported into GHG Zone B. A similar issue arises for unspecified imports into GHG Zone A, which have the same penalty price regardless of whether they reflect imports of aggregate supply from the external area (where there is no GHG-pricing program) or aggregate supply from GHG Zone B (which has adopted a GHG-pricing program, albeit a different one than in GHG Zone A).

It is expected that the agencies with jurisdiction over the different GHG-pricing programs would seek to avoid inefficiencies due to "pancaking" of GHG-related costs, and develop frameworks that distinguish between imports from another GHG zone as opposed to imports from areas with no GHG-pricing program at all.

The design proposal can accommodate multiple distinct GHG zones under a reciprocal GHG-pricing framework. The primary difference is the need to distinguish between imports (both

specified-source and unspecified) from the reciprocity zone and those imports from all other external zones. In its simplest form (*i.e.,* with full reciprocity between multiple GHG zones):[8]

- Unspecified imports between GHG reciprocity zones would have a penalty price of $0, since GHG-related costs are already fully incorporated in the cost of all supply from that zone.
- All GHG reciprocity zones would effectively be combined into a single GHG zone for purposes of defining and enforcing the unspecified import constraint from other areas. This ensures uniform treatment of specified imports across the GHG reciprocity area.
- Specified-source imports from outside the GHG reciprocity zones would continue to base schedule from a specified generation resource to an identified load or zone.
- Specified-source imports from a GHG reciprocity zone would likely have a compliance obligation only to the GHG-pricing program in the jurisdiction where the resource is located; reciprocity would likely result in each program waiving the application of compliance obligations associated with specified-source imports from the other GHG region.



[8] The design proposal could also accommodate partial-reciprocity arrangements, where imports into a more stringent GHG zone are recognized as being subject to provisions under another GHG-pricing program, and there is a framework to reduce—but not to entirely eliminate—compliance requirements in the importing GHG zone.

3. Scenario 3: Exports Delivered To A GHG Zone That Is Outside The Market Footprint

The design proposal would enable both specified-source and unspecified deliveries to a GHG zone located outside the market footprint. A generation resource could inform the market operator a specified-source delivery (*i.e.,* export) to an external GHG zone.[9] While this would enable the market optimization to economically dispatch the specified resource in tandem with the scheduling of the export, there would be no compensation for the GHG attributes provided to the resource by the market settlement process. This is because the GHG Price at locations outside of the market footprint is not and cannot be determined by the market operator. Nevertheless, to the extent a generation resource had an arrangement to receive GHG-related value (*e.g.,* through a contract or through ownership), the design proposal could accommodate specified-source deliveries out of the market footprint.

All other exports from the market footprint would explicitly be for unspecified energy. The market operator would not enforce an unspecified import constraint for an external zone, nor would it collect any GHG-related revenue for those imports. Any party purchasing unspecified energy at a market export location would be solely responsible for complying with all GHG-related requirements associated with delivering that supply into a GHG zone.

4. Options For Managing Complex Cases

Additional special cases are likely to arise based on the unique circumstances of electricity arrangements in the west. For example, an entity may wish to directly delivery only a portion of the output of a generation resource as a specified-source import sold into a GHG zone, with the remainder of the output sold at its busbar in a non-GHG zone. Such arrangements present a complex case under any approach for implementing a GHG-pricing program in an organized market. There are several potential approaches that could be explored, including:

- Model the underlying resource as two (or more) "logical" resources;
- Employ a simplified representation in the market dispatch (*e.g.,* modeled as a purely external resource), but report direct delivery base schedules as specified-source imports after the fact; or
- Other methodologies consistent with applicable GHG-pricing program requirements.

Each of these options can be further explored in future stakeholder workshops on this topic.

[9] Exports from the market area would be subject to additional provisions to ensure reliability, addressed in other documents.

IV. Summary Of Benefits Of Design Proposal

The design proposal accurately applies the key principles of GHG-pricing programs in the context of a regional organized market.

For states and provinces that adopt a GHG-pricing program, the design proposal leverages the ability of an organized market to optimize the dispatch of resources and scheduling of imports while accurately accounting for GHG-related costs. The market prices paid by loads in a GHG zone and received by generation resources serving that load will reflect the cost of GHG emissions, consistent with the GHG-pricing program adopted by that state or province. At the same time, the design proposal enables clean and low-emitting resources located outside a GHG zone to arrange for their output to be imported to a GHG zone and receive a price for their output that reflects the GHG attributes of the resource. The design proposal provides clear and transparent price signals for incentives to both build clean resources and to invest in transmission to deliver those resources to states or provinces with GHG-pricing programs. Those states will also have granular, objective, and verified data regarding the generation resources that produced electricity in the GHG zone, the generation resources that delivered their output as specified-source imports into the GHG zone, and the volume of unspecified imports into the GHG zone. Since the GHG-pricing program's requirements for specified-source imports will be verified through the base schedule functionality, there will be increased confidence that any specified-source imports reported through the organized market will not enable mis-attribution of clean resources, and will reduce the risk of leakage.

As important, states or provinces that elect not to adopt a GHG-pricing program will have confidence that the price of electricity paid by loads in non-GHG zones will not be required to include the cost of GHG emissions, and that emitting resources located in non-GHG zones will not be disadvantaged in competing to serve load in those zones.