NAESB - Carbon Intensity Clause Comments

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Introduction

In commodity markets, attributes directly ascribe marketable value to a commodity. For example, the sulfur content in crude oil and the moisture content in natural gas both inversely affect their prices. Similarly, in clean hydrogen contracting, the price should be directly related to its carbon intensity (CI) attribute. However, unlike physical properties such as sulfur or moisture content, CI is complex to measure. It requires the aggregation of extensive data from various supply-chain partners and making several methodological decisions that significantly impact the final CI results.

CI values are highly sensitive to these methodological choices and the data used. Understanding the data and methodological choices is just as crucial to the negotiation and contracting process as the final attribute value itself. Transparency in the decisions made to arrive at a CI value is crucial to ensure accurate and fair CI values. Suppliers must clearly communicate their data and methodological decisions. The following list outlines the key elements in calculating CI for clean hydrogen. There should be mutual consent between counterparties on an agreed-upon approach to each aspect listed below in the contract to minimize variability and prevent manipulation of CI values.

The CI clause should also recommend a unified set of best practices for addressing these decision points. Over the last two years, the Open Hydrogen Initiative (OHI) has collaborated with a broad cross-section of the hydrogen community to develop standardized operating procedures for calculating carbon intensity, integrated into an open-source toolkit. OHI is ready to support NAESB by providing complementary source material for the future development of a standardized procurement contract.

General Methodology Best Practices

Any unified methodology should, at a minimum, adhere to these general tenets:

A. **ISO Compliance**: The selected methodology must align with ISO guidelines for Life Cycle Assessment (LCA) calculations, ensuring international standards are met.
B. **Global Applicability**: The methodology should be structured to be applicable worldwide, accommodating diverse regional conditions and practices.
C. **Technology Neutrality**: The methodology for calculating the carbon intensity of hydrogen production should treat all production pathways equally, avoiding biases against any specific pathway.
D. **Facility & Supply Chain Specificity**: Many parameters influencing lifecycle emissions vary in real-world deployments, and literature clearly shows that there is a high degree of variability in the carbon intensity of hydrogen production, even when using the same production process or primary energy source. A single static value will not accurately assess the carbon intensity of

individual hydrogen production at the facility level. Regional averages, whether spatial or temporal, are insufficient for determining the carbon intensity for a given facility. Therefore, it is essential to have carbon intensity values that go beyond industry averages and instead provide facility-specific CI calculations. Market participants should use agreed-upon methodologies along with facility-specific and supply-chain-specific data to calculate the carbon intensity of clean hydrogen. A facility-specific approach increases accuracy and allows producers investing in decarbonization efforts within their supply chains to capture the resulting value from that investment. For instance, if a facility pays a premium for lower-emission electricity or responsibly sourced natural gas, the model must reflect this in the carbon intensity calculation for the associated hydrogen production facility.

E. **Auditability and Transparency**: The methodology should be transparent and easily auditable by assurance providers. It should be open-source and publicly available to support transparency and facilitate audits.

Key Methodological Considerations:

In addition to these general tenets, the following are key considerations in the calculation of hydrogen CI. The approach to each of these considerations should be mutually agreed upon by both counterparties and remain consistent throughout the duration of the contract.

A. **Functional Unit**: The GHG intensity must be paired with a functional unit that defines the purity and pressure of the hydrogen. The CI value must represent hydrogen production to these specifications, as pressurizing and purifying H2 has significant GHG implications.
B. **System Boundary**: The system boundary should be clearly defined, as it substantially impacts CI calculations. We suggest a cradle-to-gate approach, indicating whether embodied emissions are included or not.
C. **Co-product Allocation**: Co-product treatment can be done through system expansion, displacement (e.g., substitution), or allocation (energy allocation, mass displacement, or market value). Each approach results in different CI values, with no single approach being universally favored. The methodology should be chosen to (1) suit facility-level analysis and (2) harmonize with stakeholder consensus. **The methodology should be clearly stated in the contract and agreed upon by both parties**. **System expansion with displacement is recommended**, as endorsed by ISO and the OHI cohort. The clause should discourage using mass, energy, molar, or economic allocation due to their susceptibility to manipulation.
D. **Waste-to-Hydrogen**: The methodology for assessing the carbon intensity of hydrogen production should treat biogenic and waste-to-hydrogen processes consistently. Greater consistency is needed in treating waste across different LCA standards and within individual standards, driven by stakeholder engagement. Currently, there is a lack of consistency, with waste sometimes considered zero-emission in some LCA frameworks and negative emission feedstock in others due to consequential effects (avoidance). The example below is pulled from a mainstream LCA framework used in the US. This demonstrates how one toolkit might treat multiple waste streams with different methodologies, providing unintended support to one waste stream over others and creating market distortions.

   - Manure: Treated as a zero-emission waste stream in meat/dairy LCA but gains negative credits in RNG production LCA for avoiding methane emissions;

- Waste Natural Gas: Emission in oil production LCA but not considered for negative consequential emissions when utilized (e.g., reformed to H_2);
- Petroleum Coke (Pet-coke): Considered waste but unclear if gasification to hydrogen and avoidance of combustion emissions are accounted for.

E. **Global Warming Potential (GWP)**: All GWP values should be defined by the IPCC. The GHG species considered should at a minimum include CO_2, CH_4, N_2O, and H_2. A GWP over **100 years** (GWP100) should be used to convert non-CO_2 species to CO_2-equivalent (CO_2e). Default to the latest IPCC assessment (currently AR6).
F. **Lower Heating Value (LHV) vs. Higher Heating Value (HHV)**: We recommend using **LHV** in alignment with industry norms.
G. **Durability of Storage for CO2 Emissions Mitigation**: Suggest a 100-year permanence for storage.
H. **Direct and Indirect Land Use Change**: Suggest that the methodology include direct but not indirect land use change in LCA.
I. **Limits on Product Blending**: Limits should be placed on accounting methodologies for product blending to achieve desired CI values. Blending should not shift environmental burden to a unit of hydrogen beyond its CI at the point of production at the plant gate (or point of delivery, as outlined in the system boundary).
J. **Environmental Attribute Certificates (EACs)**: The clause should specify whether sellers can use tradable EACs to meet CI stipulations in the contract. If allowed, the methodology for calculating CI in the EACs should align directly with the methodological decisions and data choices outlined in the procurement contract.
K. **Data Transparency**: All data not directly informed by measurements of facility or supply-chain specific operations should be treated as 'default data sources' and made available to counterparties, certification agencies, and assurance providers, along with justification.