**Carbon Management Collegiate Competition Final Submission Template**

**1. Cover Page**

**PROJECT NAME**

Innovation tagline (e.g., your mission in a few words)

*Keyword tags*

**TEAM**

**Participant Name**
School
Geographic Location
Contact Info
LinkedIn Profile

**Participant Name**
School
Geographic Location
Contact Info
LinkedIn Profile

**Participant Name**
School
Geographic Location
Contact Info
LinkedIn Profile

**PARTNERS**

Key project partners and organizations (if applicable)

**2. Written Narrative**

The written narrative should address each of the five parameters and the associated content below. The individual parameter responses do not have a word limit; however, the aggregate response to these five parameters must not exceed 3,000 words, not including captions, figures/graphs, or references. A word count must be included at the end of your submission. Teams should also include up to five supporting maps in GIS or Google Maps format.

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| 0 Parameter 1: Economics and Business Model (20%) |
| **Points To Address**1. Identify the proposed region.
	1. In your region, assess and compare unit costs ($) per metric ton of CO2 transport through various transport modes—pipeline, rail, ship, barge, and truck. This sensitivity analysis does not include the cost of carbon capture, utilization, or storage and is strictly transport cost analysis following point of capture to point of disposition.
2. Introduce your proposed carbon transport network.
	1. For the identified mode(s) of transport in the proposed network, define the volume, boundaries, pressure and temperature conditions, and, if needed, intermodal storage facilities.
	2. Calculate the unit cost of CO2 transport mode(s) proposed and identify the location and volume of anthropogenic CO2 sources—point-source capture or carbon dioxide removal sources—and sinks, including secure geologic storage locations and/or CO2 conversion locations to carbon-based products.
3. Outline a business and economics model for the transport costs of this network.
	1. The business and economics model should strictly focus on compression and transport costs and should not include costs for capture, utilization, or geologic storage.
	2. Considerations for the business and economics model should include existing U.S. federal, state, or regional incentives placed on reducing carbon, and the applicant should address which incentives are relevant or employed. Some examples of incentives include California’s Low Carbon Fuel Standard (LCFS) and the U.S. IRS section 45Q tax credit.
4. Understand risks and sensitivity analyses associated with your business and economics model.
	1. Determine if your business model is driven by production (sources) or consumption (sinks), and if the regional network can handle future demand of sources and sinks that may not exist today and/or interconnection with other networks/hubs.
	2. Identify if there are any material supply chain constraints or challenges with the proposed transport network in the near term.
	3. Demonstrate clear understanding of challenges associated with land access, road access, and other access and right-of-way considerations.
	4. Propose a timeline of project development with consideration toward local and regional regulations, permitting, and other factors or policies that may impact feasibility of development.
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**Parameter 1 Response:**

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| 0 Parameter 2: Operational Safety Considerations (20%) |
| **Points To Address**1. What safety considerations do you propose within this network?
	1. Summarize CO2 handling and safety considerations for any CO2 transportation mode (ship, barge, train, rail, or pipeline) utilized in your transport network.
2. What are the operational and emergency response plans for this proposal?
	1. Provide dispersion modeling scenarios for the relevant CO2 transportation mode(s) in your proposed transport network.
3. How are operational safety considerations incorporated with or addressing local community concerns?
	1. Identify nearby communities, the resources required to execute emergency response, and whether they have these resources already or will require further resources.
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**Parameter 2 Response:**

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| 0 Parameter 3: Life Cycle Analysis (20%) |
| **Points To Address**1. Analyze and summarize potential life cycle environmental impacts for the different CO2 transportation modes and scenarios from point of capture to disposition using the principles of LCA.
	1. This analysis is strictly focused on carbon dioxide transport and does not include emissions accounting at capture, utilization, or storage.
	2. The functional unit for the LCA should be the transport of 1 metric ton of CO2 over a defined distance in the transportation network.

All calculations should be documented in a spreadsheet model. The Resources section of HeroX contains a summary of the life cycle data that should be used to support these calculations.1. For the evaluation of potential climate change impacts, utilize the most recent global warming potential factors from the Intergovernmental Panel on Climate Change Sixth Assessment Report (IPCC AR6 GWP 100) Table 7.15.
	1. These factors are duplicated in the Resources section of HeroX for reference.
	2. Include evaluations of other potential environmental impacts associated with the modeled emissions.
	3. For characterizing impacts other than global warming potential, use the U.S. Environmental Protection Agency’s Tool for Reduction and Assessment of Chemicals and Other Environmental Impacts (TRACI)[[1]](#footnote-1) to translate the emissions inventory associated with the proposed transportation mode(s) into potential environmental impacts.
	4. Discuss trade-offs between potential environmental impacts across the range of transportation scenarios evaluated and how they might impact other optimization parameters in this assessment.
2. Develop additional scenarios to evaluate the potential impacts of the base transportation options due to changes in the energy mix and electrification of transport in the future.
	1. The quantitative scope of these scenarios should focus specifically on changes in the types and amounts of greenhouse gas emissions and their impacts on climate change.
	2. In addition, provide a qualitative discussion of any shifts in other potential environmental and resource impacts due to a transitioning energy mix.
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**Parameter 3 Response:**

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| 0 Parameter 4: Climate Change Projected Impacts (20%) |
| **Points To Address**1. Identify what projected climate change impacts are most relevant to each component of your transportation network through research and case studies.
	1. Assess the vulnerabilities of each component or mode of transport in your proposed network.
	2. Climate change projected impacts under consideration for this parameter include risks from wildfire, geohazards, ground subsidence, earthquakes, sea level rise, hurricanes, floods, droughts, and extreme heat.
	3. The CMRA tool can be useful for this assessment, as well as additional references located in the Resources tab on HeroX.
2. Analyze longer-term considerations related to climate change projected impacts.
	1. Where might proposed built or added infrastructure exacerbate certain climate change impacts identified?
	2. What adaptation or other measures could be taken to address resiliency of these carbon transport modes in your region?
	3. Considering climate change impacts and the unique vulnerabilities of each component of your overall network, how does your transport network change, if at all?
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**Parameter 4 Response:**

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| Parameter 5: Environmental Justice, Social Impacts, and Engagement (20%) |
| **Points To Address:**1. For your region, assess the most significant historical and ongoing concerns related to environmental and health impacts.
	1. These concerns can include but are not limited to:
		1. Environment pollution including impacts to air, water, and soil.
		2. Jobs, enterprise creation, and economic impacts.
		3. Other health, safety, and quality of life impacts (e.g., noise, public safety, land-use changes).
		4. Impacts to tribes and/or Alaska Native corporations.
		5. Any other relevant impacts identified through your research.
	2. Identify with as much spatial granularity as possible (e.g., census tract or block group level) where impacts are most concentrated and cumulative.
2. Summarize what is known about potential environmental and health impacts (both positive and negative) of the carbon transport modes employed (pipeline, rail, truck, barge, shipping) in your network.
	1. For your region, assess where impacts from your carbon transport network would be located and how they might interact with historical and ongoing community concerns and priorities.
	2. Analyze how benefits might be directed toward disadvantaged communities. What measures could be taken to mitigate harms? If there are potential benefits, what policies or actions would be needed to guarantee them?
3. Develop an engagement plan.
	1. Propose a strategy that could be used in future engagement with communities identified in the point above, including identifying relevant community-based organizations or other advocacy organizations and steps that could be taken to validate your research.
	2. Please note that direct engagement with communities for this collegiate competition is not expected or anticipated.
	3. Identify any gaps in literature, experimental, and/or field validation related to these impacts for future work.
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**Parameter 5 Response:**

**Narrative Word Count: \_\_\_\_\_\_\_\_\_\_\_\_\_\_ total words**

**3. Submission Summary Slide (Will Be Made Public)**

Make a public-facing, one-slide submission summary that introduces your team and school(s) represented. There is no template, so you are free to present the information in any format. Any text must be readable in a standard printed page and a conference room projection and should be in at least 14-point font.

1. <https://www.epa.gov/chemical-research/tool-reduction-and-assessment-chemicals-and-other-environmental-impacts-traci> [↑](#footnote-ref-1)