



# Request for Information: Heavy-Duty Fuel Cell Vehicle Market Development Strategy

November 5, 2024

## Section 1: RFI Overview

The Alliance for Renewable Clean Hydrogen Energy Systems (ARCHES) and its partners are uniquely positioned to capitalize on a range of federal, state, local, and private funding opportunities to accelerate the adoption of fuel cell buses and trucks. ARCHES aims to supply clean, renewable hydrogen for 5,000 fuel cell electric trucks (FCET) and 1,000 fuel cell transit buses (FCEB) in California by 2030. The proposed frameworks outlined in Appendix A: Fuel Cell Electric Truck Market Development Strategy and Appendix B: Fuel Cell Transit Bus Market Development Strategy are targeted approaches to achieving this transformation, building on the data-driven insights from ARCHES' initial U.S. Department of Energy application. Our collective mission is to provide the market certainty needed for manufacturers to attract sufficient investment in hydrogen production and distribution, hydrogen fueling stations, and fuel cell vehicles to expand product availability, reduce costs, and enable fleets to define a business case for choosing fuel cell vehicles. The strategy frameworks below are built on a foundational premise: *moving from a year-to-year, first-come, first-served incentive funding system to one that creates certainty that there will be long-term vehicle and hydrogen funding support for fleets and original equipment manufacturers (OEMs) will reduce complexity and costs for everyone.*

The market development strategies in Appendix A and B aim to provide fleet operators with a long-term, affordable total cost of ownership (TCO) to compete with incumbent technologies, taking into account the attributes unique to the value proposition of heavy-duty fuel cell electric vehicles, such as clean, quiet, and smooth operation. Initially, this will require capital incentives for trucks, buses, and fueling stations, and

potentially operating incentives, until scale drives down the cost of hydrogen. This assumes transit agencies will receive capital funds for buses and private stations located at transit agency facilities, and truck fleets will have access to sufficient public fueling stations to fulfill their daily operating requirements. Both capital and operating incentives are expected to decline over time as fuel cell electric vehicle and hydrogen fueling equipment production volumes increase and economies of scale and an expanded supply chain lead to competitive market pricing. The incentive systems must not in any way encourage higher markups by suppliers. The goal is to reduce costs for end users.

### **RFI Timeline**

RFI Released:	November 5, 2024
RFI Info Session:	November 8, 2024 from 1:00 to 2:00 pm PST
Responses Due:	November 27, 2024 at 5:00 pm PST

### **Information Session**

ARCHES will host an online informational session to provide more details on the RFI and answer RFI questions on Friday, November 8, 2024, from 1:00 to 2:00 pm PST. Please [register here](#) for the information session.

### **RFI Contact**

Please contact ARCHES at [strategy@arches.org](mailto:strategy@arches.org) with any questions.

## **Section 2: Information Requested**

ARCHES is especially interested in hearing feedback from truck and bus OEMs, truck and bus fleet operators, transit agencies, and hydrogen fueling station developers. Respondents are invited to provide feedback on the Fuel Cell Electric Truck Market Development Strategy (Appendix A) and the Fuel Cell Transit Bus Market Development Strategy (Appendix B) and answer the following questions:

### **Truck and Bus OEMs:**

1. Would the strategic frameworks help increase investment in FCET and FCEB production? Why or why not? If yes, can you quantify the impact?
2. What volumes of truck or bus production, over eight years, would help you drive down costs (and purchase prices) to be competitive with diesel, considering factors such as your supply chain and economies of scale? This can include sales within California as well as other states.

3. ARCHES has a limited budget available for incentives. What incentive levels would be a game changer? Where should those incentives be applied? What would be an appropriate incentive step-down level that encourages system cost reductions? For example, the first 100 or 500 vehicles get \$X, and the next gets \$Y until the incentive is zero.
4. What production volume of trucks or buses would be most helpful for ARCHES to support over an eight-year period, considering your specific situation? Note that our overall goals are 1,000 buses and 5,000 trucks, but those numbers represent a floor, not a ceiling.
5. Is it helpful for the ARCHES framework to encourage OEM convergence on certain vehicle parameters and standards, such as on-board fuel storage? If so, what would be the most helpful? Are production commitments useful? How about fleet purchase commitments, given certain guaranteed purchase prices and/or operating costs?
6. ARCHES truck strategy is generally focused on goods movement. Should other use cases, such as refuse trucks, be considered? If so, what volumes should be considered?
7. How can ARCHES ensure sufficient price transparency to instill confidence that we are not causing incentive-based price inflation?
8. Anything else the ARCHES team should be aware of or consider?

#### **Heavy-Duty Vehicle Fleet Operators:**

1. Would this strategic framework help facilitate your transition to hydrogen fuel cell electric vehicles? Do you need specific price points (e.g. relative to diesel trucks and diesel fuel) in order to commit to making FCET purchases? If so, what is the target price point and why?
2. Would your fleet want to partner with OEMs on an application to ARCHES for incentives? Is there a different preferred arrangement?
3. If your fleet supports the OEM partnership model, should the ARCHES framework be structured to encourage partnering with a single OEM, or would you like the flexibility to partner with multiple OEMs?
4. What is the average vehicle availability of your fleet, and what level of maintenance support do you require to sustain your business?
5. What payload capacity do you require to service your customers? Alternatively, how many pounds of weight reduction is manageable for your fleet given the higher FCET weights?
6. What is the required vehicle driving range on the routes you would deploy these trucks?

7. What vehicle attributes would make FCETs beneficial to your business operations, such as providing added value compared to diesel vehicles or providing a better use profile for operators?
8. What provisions should be added or subtracted to the framework to increase fleet confidence?
9. Anything else the ARCHES team should be aware of or consider?

**Transit Agencies:**

1. The ARCHES application submitted to the U.S. Department of Energy (DOE) designated the number of buses planned for each agency. ARCHES is considering issuing an RFP that would seek proposals from OEMs (overseas manufacturers as well as domestic suppliers) to offer competitive pricing based on a guaranteed quantity of buses manufactured over an eight-year period. This would assume standardized transit bus designs and specifications. Agencies committing to purchase from a specific OEM could customize the bus at an additional cost that would be the transit agency's responsibility. With this context in mind, which approach would drive a better outcome, knowing that we have already agreed to a baseline volume of buses for each agency:
  - a. Would your transit authority like to review the bus OEM proposals when they are submitted?
  - b. Would it be beneficial for transit agencies to provide input or be part of the proposal development in partnership with OEMs?
2. To what extent are you able to obtain additional matching and stacking funds from other sources to expand the program and/or respond to cost increases? If you are short on funds, how many buses could you procure assuming the full amount of subsidy from ARCHES for your original procurement plan? If more incentive funding were available, and/or bus prices drop, how many buses would you ideally like to procure?
3. If you are not one of the original 13 transit agencies in the ARCHES application, how many FCEBs would you ideally like to purchase between now and 2030? If we are able to drive bus prices down and establish cost-competitive hydrogen by 2030, would you increase your purchase volumes?
4. If you are one of the original 13 transit agencies in the ARCHES application, have your numbers changed? If we are able to drive bus prices down and establish cost-competitive hydrogen by 2030, would you increase your purchase volumes?
5. Anything else the ARCHES team should be aware of or consider?

## Station Developers:

1. ARCHES will coordinate with station developers to connect fleet demand and station rollout strategies to ensure sufficient coverage. Are there any changes to the framework that would help increase certainty for fuel demand?
2. ARCHES will also work closely with station developers on station sizing and location, relative to where trucks and buses are being purchased and how they are utilized. Is there anything specific to this coordination that you feel should be a priority early on, such as a committee of the different stakeholders to undertake planning?
3. Anything else the ARCHES team should be aware of or consider?

## How to Submit a Response

Responses for this RFI must be submitted via the [Box link](#) by **Wednesday, November 27, 2024, at 5:00 pm (PST)**. To be considered, responses must be received prior to the closing date and time. Questions about this RFI should be directed to [strategy@arches.org](mailto:strategy@arches.org).

### Format

Responses must be provided as a Microsoft Word (.docx) or Adobe PDF (.pdf) and no more than 15 pages in length, 12-point font, 1-inch margins. The organization or respondent's name, full address, and the point of contact's email, phone number, and affiliation are required on the first page of the response document.

Note that respondents may answer as many or as few questions as they wish. However, respondents should correctly label which Section, subsection, and question number that each answer corresponds to.

### Important Notes

This RFI is not a request for proposals or funding opportunity. Responding to this RFI will help inform ARCHES' Heavy-Duty Fuel Cell Vehicle Market Development Strategy going forward. A response does not provide any advantage or disadvantage to potential applicants for current or future ARCHES funding opportunities regarding this or a related subject matter.

Any information obtained as a result of this RFI is intended to be used by ARCHES on an aggregated or non-attribution basis for planning and strategy development, and potentially to inform future funding allocations; this RFI does not constitute a formal solicitation for proposals. Your response to this notice will be treated as information

only. ARCHES will review and consider all responses in its formulation of strategies for the identified subject matters of interest that are the subject of this request.

ARCHES will not provide reimbursement for costs incurred in responding to this RFI.

Respondents are advised that ARCHES is under no obligation to acknowledge receipt of the information received or provide feedback to respondents with respect to any information submitted under this RFI.

Responses to this RFI do not bind ARCHES to any further actions related to this topic.

### **California Public Records Act**

ARCHES is a public-private partnership, with founding members that include the California Governor's Office of Business and Economic Development (GO-Biz) and the University of California (UC). To the extent that staff of public entities such as Go-Biz and UC may be involved in processing information submitted pursuant to this RFI, those responses to this RFI may be subject to a California Public Records Act request. (Cal. Gov. Code § 7920.000 et seq.)

ARCHES understands that responses may contain business sensitive, proprietary, or otherwise confidential information that is exempt from disclosure under the California Public Records Act. **If respondents choose to include business sensitive, proprietary, or otherwise confidential information, respondents should clearly and conspicuously mark such information in the response.**

If a California Public Records Act request for the respondent's information is received by GO-Biz or UC, respondents will be notified, as soon as practicable, but not less than five (5) business days prior to the release of the requested information to allow the respondent time to confirm and redact confidential information or otherwise seek an injunction. GO-Biz and/or UC will work in good faith with the respondent to protect confidential information to the extent a disclosure exemption is provided by law, including but not limited to proprietary information, financial information, and trade secret information.

## Appendix A: Fuel Cell Electric Truck Market Development Strategy

ARCHES aims to supply clean, renewable hydrogen for 5,000+ Class 8 fuel cell electric trucks (FCETs) in California by 2030. For fleet operators to adopt this technology at scale, the TCO and operational capability must be comparable to diesel trucks including vehicle and fueling costs, maintenance and repairs, drivability, reliability, as well as resale prices, which ultimately impact the economics of shifting to any new technology. ARCHES will facilitate FCET market growth by coordinating truck OEMs, fleet operators, fueling station developers, and hydrogen supply and distribution in regional clusters to ensure the reliability and robustness of the hydrogen fueling ecosystem.

### Proposed Framework:

- Regions:** ARCHES establishes 3 regions to focus ARCHES initial support of FCET deployment in California: areas surrounding the Ports of Los Angeles and Long Beach in Southern California, areas surrounding the Ports of Oakland and Stockton (including Sacramento) in Northern California, and the Central Valley goods movement ecosystem that provides critical connections to the Northern and Southern California markets. Within these regions, ARCHES will help connect the needs of logistics, warehousing, manufacturing, agriculture, fleets, independent vehicle operators, and fleet users operating along the state's interconnected freight corridors.
- OEM + Fleet Proposals:** ARCHES would issue an RFP for OEMs to propose production of up to 2,000+ FCETs each, to be deployed by fleet partners within the identified regions from 2025 through 2030. OEMs would develop joint proposals with their fleet partners for these projects (one OEM could have multiple fleet partners, and one fleet could partner with multiple OEMs). In this scenario, up to 5000 total orders would be selected from the proposals (more FCETs can be added if the incentives can be stretched further, or if funding is added).
- Truck Incentive Structure:** The RFP would signal ARCHES' intention to create a declining incentive structure to help bridge the gap between the cost of production and workable purchase price while rewarding early action. The incentive schedule and per-truck funding levels would be determined based on RFP responses.

- a. Once under contract, OEMs would secure access to incentives on a predetermined schedule.
  - b. An example scenario might be a declining or step-down approach of \$200,000 incentive per vehicle for the first 1,000 FCETs (inclusive of HVIP), \$150,000 per vehicle for the next 500 FCETs, \$50,000 per vehicle for the next 500 FCETs, with support for up to 2,000 FCETs per OEM. Note: These numbers are for illustrative purposes - the objective is to stretch public funding as far as possible while ensuring the system works.
  - c. Under contract with ARCHES, OEMs would need to meet performance criteria, delivery schedules, and sales price targets to unlock subsequent funding tranches. Failure to meet these milestones would return the incentives to the main ARCHES funding pot, for other OEMs to access if they meet their targets.
    - i. ARCHES would work closely with the OEMs to help avoid the return of funds. If funds are returned, the same OEM could reclaim the funding if they return to meeting their targets.
  - d. Incentives could be provided to either OEMs or the customer (to be determined). The program would aim to increase competition, create downward pricing trends, and support fleet operators as they transition to hydrogen.
    - i. Note: Applying the incentive to the OEM could reduce sales tax and the Federal Excise Tax<sup>1</sup>. If this is done, ARCHES would need to ensure price transparency to ensure that the incentive reduces costs to the fleet operators.
4. **Infrastructure Inputs:** The RFP would reflect ARCHES draft station rollout plan, which will be based on a variety of existing efforts, including the California Transportation Commission's recent [Clean Freight Corridor Efficiency Assessment](#) and work within ARCHES' research team in an ongoing fashion during the rollout plan development.
- a. OEM and Fleet proposals would include preferred station locations (zip code or census tract level) to enable early market operations, including projected hydrogen consumption at each location.
  - b. ARCHES will leverage this information to further refine the station rollout plan with our station partners. This plan will be connected to renewable hydrogen supply development, with a system-level goal of matching (and ultimately beating) diesel on a TCO basis.

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<sup>1</sup> Only applies to trucks, not fuel cell transit buses.



5. **Combining Funds, Flexible & Transparent Implementation:** In addition to DOE funding largely aimed at creating a resilient renewable hydrogen supply chain, the State of California and regional/local funding agencies would contribute funding through ARCHES to support trucks, stations, and workforce development – with the flexibility needed to deliver projects that enable market growth.
  - a. Federal, state, local, and investor funding would be managed to deliver projects at the system level, including necessary infrastructure and workforce development.
  - b. ARCHES would work with and engage local communities on education and outreach to raise understanding of the opportunities of FCETs, FCEBs, and hydrogen.
  - c. For state and local funding, ARCHES would establish transparent and auditable procedures for determining incentive levels (while protecting business confidentiality, perhaps through clean room processes), including adjusting incentives based on technical capability (e.g., range or other operations-specific metrics). ARCHES would report to and collaborate with relevant state and local funding agencies, including transparent reporting and integrating appropriate staff.
  
6. **Proposal Evaluation:** RFP responses would be evaluated using criteria such as:
  - a. Truck specifications and performance to meet the fleet operator’s duty cycle
  - b. Manufacturability to meet demand and quality requirements and a strong dealer network to support truck purchases and service
  - c. Financial capability and a robust plan to support the program over five to eight years. This could include the capability to provide financing for lease and lease purchase agreements with fleets.
  - d. A commitment to service, repair, and supply parts for vehicles over at least 10 years
  - e. Provision of, or coordination with service centers with trained technicians capable of minimizing downtime for the fleet operator
  - f. A robust inventory and clearly identified, reliable supply chain for parts needed for service and repairs
  - g. Track record of performance through current deployments or demonstrations (e.g. leveraging telematics)
  - h. Proposed FCET volumes over time

- i. Potential to leverage economies of scale over multiple types of trucks, including different truck classes and functions.
- j. Pricing strategy competitive with incumbent technologies
- k. Level of ARCHES incentives the OEM expects to require each year, based on proposed annual volumes, in order to meet proposed price targets. The negotiated prices should quickly come close to achieving TCO parity with incumbent technologies taking into account all incentives. As the ARCHES incentive declines over time, prices should remain at levels that ensure ongoing TCO parity with incumbent technologies. This could be compared to independent price and cost data.
- l. OEMs would be able to provide different per-truck costs based on the total number of trucks produced over 5 years, factoring in economies of scale.
- m. Strategy for resale of trucks into secondary markets.

## Appendix B: Fuel Cell Transit Bus Market Development Strategy

Under ARCHES, 13 transit agencies aim to deploy 1,000 fuel cell electric buses (FCEBs) over 5-8 years. To date, transit agencies with FCEBs have benefited from programs run by federal, state, and local agencies. However, successful deployments often hinge on a transit agency's ability to patch multiple sources of competitive funding together. This reality creates uncertainty and risk, especially given that none of these programs are set up to invest in hydrogen supply. It also puts smaller transit agencies with limited grant writing staff at a disadvantage when competing for funds.

ARCHES has the opportunity to invest in a holistic approach—including hydrogen supply—with a clear focus on making the system work for transit agencies. Successfully making the program work for transit agencies should increase OEM confidence, enabling investments into their supply chains and manufacturing processes to drive down costs.

### Key Issues to Address:

1. **High capital costs for buses.** Currently, there is only one manufacturer of FCEBs for the North American market<sup>2</sup>, and the base price of a FCEB can range from as much as \$1.7 million for a 40' bus to \$2.3 million for a 60' bus, compared to the base price of a diesel or natural gas bus at approximately \$550,000-\$800,000. For comparison, there are over ten FCEB manufacturers in Europe, and FCEB prices are closer to \$1 million and \$1.5 million for 40' and 60' buses, respectively. A lack of competition and scale in the U.S. has contributed to keeping FCEB prices artificially high. Additionally, the customization of buses driven by variations in specifications among transit agencies has also contributed to higher prices. Adhering to a standard design for a large order of buses would significantly reduce the cost of production.
2. **Incentive uncertainty and complexity**, especially when fueling infrastructure is needed.
3. **Access to low-cost hydrogen.** ARCHES was established to specifically solve this problem and accelerate large-scale H<sub>2</sub> production, but bringing on new supply and distribution at scale will take time.
4. **Workforce training.** Leading transit agencies have set up training systems to ensure the safe operation and maintenance of FCEBs—this training can be

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<sup>2</sup> To be eligible for federal funding support, transit agencies must meet Buy America provisions which limit purchases to buses manufactured in North America.

extended to all in a variety of ways, and we need to identify the right funding mechanisms to achieve this.

The goal of ARCHES is to address all of the key issues, including reducing FCEB costs over time (and therefore the need for incentives), supporting station development, connecting transit agencies to reliable and affordable renewable hydrogen supply, and supporting workforce training.

### **Proposed Framework:**

1. **OEM Requests for Proposals (RFP) focused on increasing U.S. based Manufacturing:** ARCHES issues an RFP for FTA “Buy America” approved OEMs to propose volume pricing for up to 500 (or more) buses each to be produced and delivered to California transit agencies between 2026 and 2030, assuming a standard design and specifications. Higher prices due to modifications beyond the adopted standard design would be the responsibility of individual transit agencies.
  - a. ARCHES would also encourage bids from OEMs that do not yet qualify for FTA “Buy America”. These proposals could qualify using a [Build America, Buy America \(BABA\) waiver](#).
  - b. OEMs could propose to produce FCEBs at any point in the offer period.
  - c. Key points of context:
    - i. For any BABA waiver OEMs, the ARCHES scoring system would heavily favor proposals with credible plans for on-shore bus manufacturing.
    - ii. ARCHES intends to partner with the other hydrogen hubs and non-ARCHES transit agencies to increase FCEB purchase volumes. These volumes would be reflected in the RFP.
    - iii. ARCHES is considering structures to expand bus manufacturing in the U.S., including allowing manufacturers to collect a partial incentive for an imported bus and then a full incentive once manufacturing is established in the U.S.
2. **Bus Incentive Structure:** ARCHES establishes a declining incentive structure that helps bridge the gap between the cost of production and workable purchase price, and rewards early action.
  - a. Example scenario: Offer incentives for the first 250 FCEBs an OEM produces, with a declining or step-down incentive level for each

- subsequent 150 FCEBs (e.g., \$300,000 per FCEB for the first 250, \$250,000 for the second 150, \$200,000 for the next tranche, etc.<sup>3</sup>).
- b. FCEBs from current OEMs would be eligible for incentives in year 1, with FCEBs from new OEMs eligible for incentives as they begin offering products for sale in the U.S. market.
  - c. FCEBs from each OEM would be eligible for the same per-vehicle incentive for each tranche of 250 FCEBs from that OEM.
  - d. ARCHES incentives would end after five years: The sooner an OEM can start production, the more overall incentive funding their FCEBs will be eligible to receive.
    - i. This is designed to encourage new OEMs to begin production near term, and for transit agency customers to consider products from new market entrants assuming maintenance and service remain available.
3. In addition to DOE funding largely aimed at creating a resilient renewable hydrogen supply chain, the State of California would contribute funding through ARCHES to support FCEBs, stations, and workforce development – with the flexibility needed to deliver projects that work for transit authorities.
- a. State funding would be combined with federal, local, and investor funding. This funding would be managed to deliver projects, including necessary infrastructure and workforce development. In other words, funding would be fungible between stations, FCEBs, workforce, and operations.
  - b. For state and local funding, ARCHES would establish transparent and auditable procedures for determining incentive levels (while protecting business confidentiality, perhaps through clean room processes), including adjusting incentives based on technical capability (e.g., range or other operations-specific metrics). ARCHES would report to and collaborate with relevant state and local agencies, including transparent reporting and integrating appropriate staff.
4. Under contract with ARCHES, FCEB OEMs would need to meet performance requirements and achieve an FCEB sales price after all incentives that meet vehicle price targets as outlined in their scope of work to unlock each subsequent 250 FCEB volume of incentives for their products. As the incentive drops, FCEB prices should remain at a competitive level. For example, FCEB prices would need to drop to unlock the next tranche of incentives.

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<sup>3</sup> These numbers are purely for demonstration purposes - the actual incentive would be carefully calibrated based on volume based projected production costs.

5. Incentives could be provided to either OEMs or the customer (to be determined), the program would aim to increase competition, create downward pricing trends, and support the transit agency customers as they transition to a new technology.
  - a. Note: applying the incentive to the OEM could reduce sales tax. If this were the approach, ARCHES would need to ensure price transparency to ensure that the incentive reduces costs to the transit authorities.
6. ARCHES would work with transit agency customers to develop and implement hydrogen fueling infrastructure to serve FCEBs in each region. This would include providing in-depth technical assistance on infrastructure development.
7. In all cases, ARCHES will work to leverage funding from all relevant sources, including federal, state, and local government agencies (including Air Districts).