

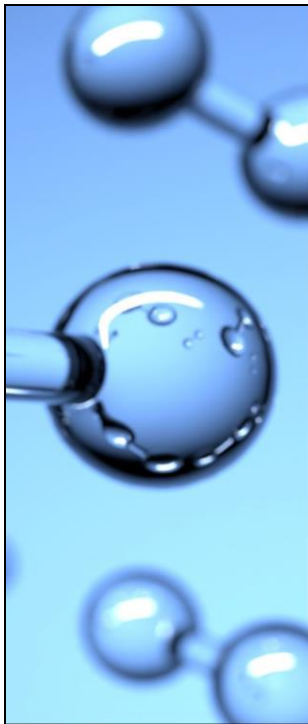


In August 2023, Governor Newsom tasked GO-Biz with developing an “all-of-government Hydrogen Market Development Strategy, similar to the Zero-Emission Vehicle Market Development [GO-Biz] published in 2021. The Strategy should be organized around our north star: leverage hydrogen to accelerate clean energy deployment and decarbonize our transportation and industrial sectors.” Since then, California’s ARCHES Hydrogen Hub was selected as one of seven national hydrogen hubs, with considerable focus on getting the federal portion of the hub established. ARCHES is now actively integrating federal, state, local, and private investments to create a system that will grow well beyond the initial federally co-funded state-wide hub.

The following slides offer a presentation of our latest thinking about how to best organize and structure efforts around a shared System – setting up the market for long-term success. Most of the slides have notes below them to help the reader understand key messages and/or next steps. For each element, we include quotes from stakeholders that are intended to help the reader understand core issues from different stakeholder perspectives.

Our plan is to build on this Framework and create a dynamic webpage designed to communicate the Strategy and facilitate multi-stakeholder collaboration (allowing stakeholders to be able to quickly get a high-level overview as well as dig into details). We are looking for feedback on this foundational Framework – does it make sense? Any components we should change? Does it spur additional ideas we should

be considering? We appreciate any feedback you have--our purpose is to help you succeed in your role building out California's renewable hydrogen market.



## North Star

Create a renewable hydrogen ecosystem that drives innovation, jobs, and regional economic prosperity while reducing pollution and improving health outcomes for all Californians.

## Core Principles for Implementation

- Prioritize renewable hydrogen
- Ensure all hydrogen has a low carbon intensity
- Maximize the long-term impact of public investments
- Synchronize supply and demand
- Focus on delivering benefits in impacted communities
- Build collaboration across industry, government, and communities

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This North Star was laid out in Governor Newsom's letter to GO-Biz directing GO-Biz to develop California's Hydrogen Market Development Strategy.

## Why Renewable Hydrogen?

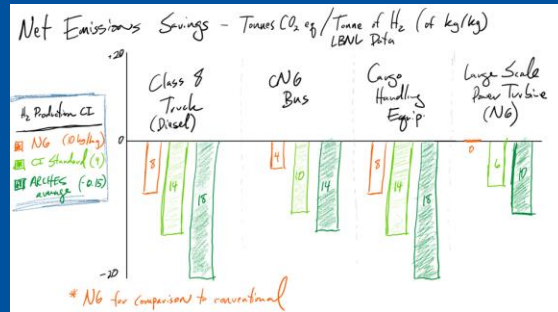
Hydrogen can displace:

- Diesel, Gasoline
- Natural gas
- Kerosene-based fuel (aircraft)
- Low sulfur fuel oil (marine)
- Carbon-intensive ammonia (Ag)



**"California needs to scale up the current hydrogen market by 1,700 times by 2045 to meet our climate neutrality goals"**

CARB 2022 Scoping Plan



\*Net GHGe savings from adopting renewable hydrogen fuel across sectors and end use cases compared to incumbent fuels

ADA Description of the graphic: For every tonne of ARCHES hydrogen put into service in a Class 8 Truck or cargo handling equipment, instead of diesel, 18 Tonnes of CO<sub>2</sub> are saved. Fossil derived hydrogen, pulling from existing sources, still saves 8 tonnes of CO<sub>2</sub> equivalent. The benefits of deploying any type of hydrogen into transportation generates immediate benefits.

Key messages: We need a LOT of renewable hydrogen to meet our 2045 carbon neutrality requirement.

Note: Clean hydrogen's carbon intensity standard is 4kg CO<sub>2</sub> eq per kg of hydrogen.

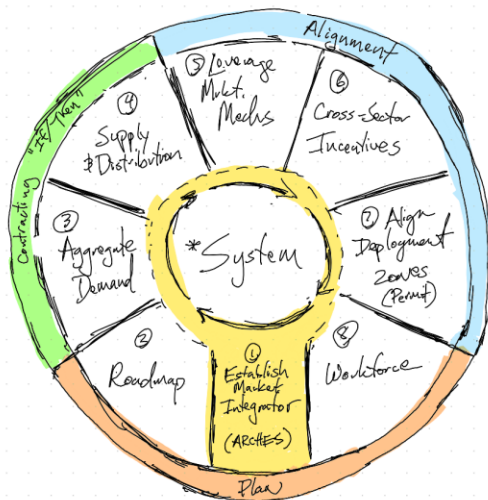
## Purpose of the Hydrogen Strategy

1. Articulate core principles for collective action
2. Clearly identify metrics/targets
3. Establish roles/objectives of agencies and major stakeholder groups
4. Organize collective problem-solving to increase transparency and target stakeholder engagement
5. Ensure lessons learned are accessible and incorporated



It is time to move from a patchwork of policies to an integrated system

## Foundational Elements of the Strategy



1. Establish Market Integrator (ARCHES)
2. Roadmap
3. Aggregate Demand
4. Supply & Distribution
5. Leverage Market Mechanisms
6. Cross-Sector Incentives
7. Align Deployment Zones
8. Workforce

\*these do not need to happen in order

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ADA Description of the graphic: The graphic is circular sketch, in the shape of a wheel, organized around a central System managed by ARCHES as California's Market Integrator. The slices of the wheel are organized in three main sections: Planning, Contracting, and Alignment, with sub-sections 1 – 8 typed out on the right side of the page.

Key Messages: ARCHES, as the Market Integrator, is central to organizing efforts around the shared System.

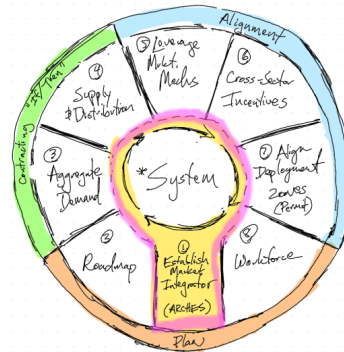
Each of the Foundational Elements must exist and act in concert to enable the full benefits of the System. ARCHES role is to be the backbone integrator of the System, tasked with reflecting and balancing the needs of all market stakeholders to drive down costs for all participants.

The following slides break down each of the foundational elements of the Strategy. Each section ends with a "Next Steps" slide, which we hope helps reviewers understand our proposed pathway.

Note: if you are unfamiliar with ARCHES, you can refer to [www.arches.org](http://www.arches.org) to learn more. ARCHES stands for the Alliance for Renewable Clean Hydrogen Energy Systems -- California's hydrogen hub. Please visit [www.arches.org](http://www.arches.org) to learn more.

# 1 Establish Market Integrator

*"The key to unlocking the system"*



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ADA description: H2 Market Development Strategy Wheel with 1) Establish Market Integrator (ARCHES) and the central System highlighted.

The System Integrator (ARCHES) roles:

- Create supply and demand certainty
- Operate, balance and coordinate the hydrogen ecosystem from upstream thru midstream to downstream
- Enable multiple contributors to actively participate, creating opportunities
- Problem solve to benefit the entire system
- Drive costs down at the system level

## Quotable insight

**“How do I get access to....?”**



GO Biz

7

How do I get access to affordable, renewable fuel? To vehicles? To equipment?

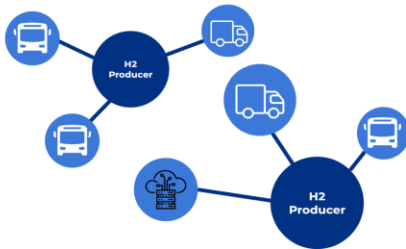


# The Hydrogen Market Works for Large Producers & Offtakers



## Today

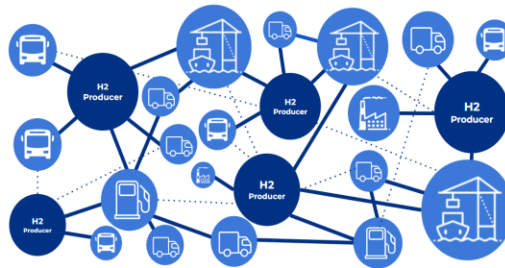
- Biased to benefit large producers used to serving large industrial customers
- Small consumers have little choice and minimal price transparency
- Very sensitive to disruptions



## Goal

- Predictable, reliable, equitable market access

- Standardized contracts
- System redundancy
- Balanced supply and demand
- Accelerated market development
- Displace fossil

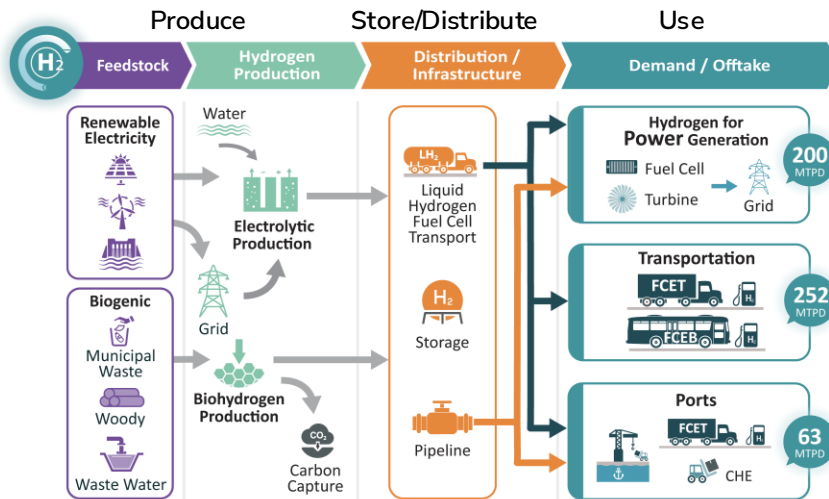


Quotable Insight: How do I get access to...?

Answer: you don't really get affordable access unless you are a large player.

Today's market is built on 1-to-1 take-or-pay contracts. Our goal is to move from 1-to-1 contracts to a many-to-many arrangement that enables both newcomers and incumbents to participate.

# ARCHES Foundation

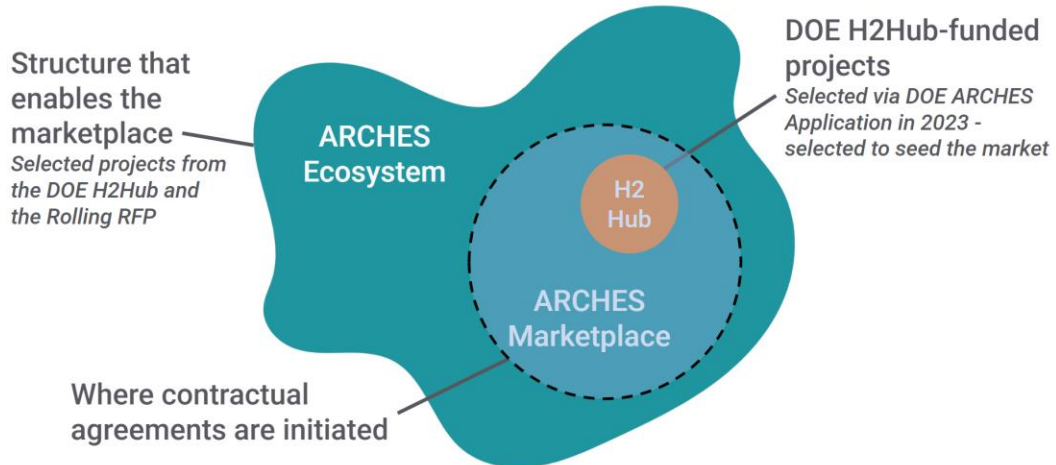


*Any proposed future work is subject to change based on funding levels*

This graphic captures the system ARCHES proposed to the U.S. DOE in its original application. This system is designed to be the catalyst for broad market expansion.

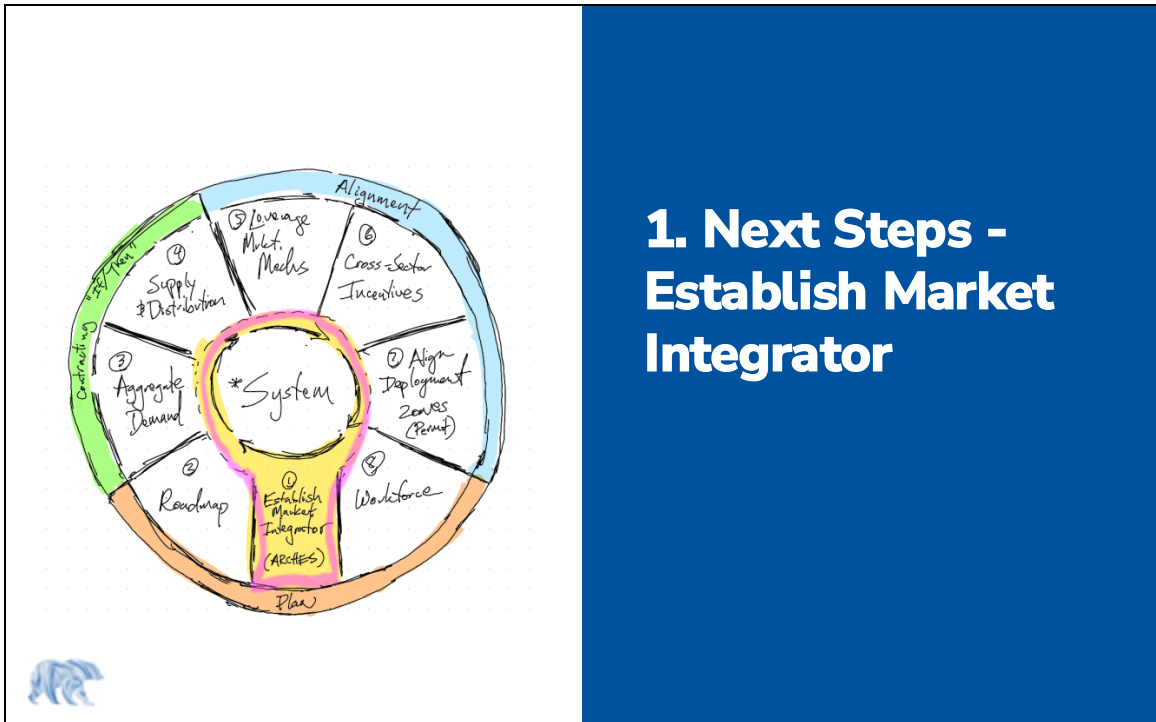
**Key Message:** The ARCHES-proposed DOE co-funded system was designed to catalyze the market by connecting production to three early markets for renewable hydrogen – power generation, heavy-duty transportation and ports.

## ARCHES Ecosystem and Marketplace Enables Market Access



ARCHES initial DOE co-funded hub is part of a larger system of projects that will exist in the ARCHES Marketplace, through which ARCHES will build an open, robust hydrogen marketplace to drive prices down for end users and increase revenue certainty for producers. To do this, ARCHES will work with partners to:

- Vet projects
- Aggregate demand
- Connect supply to demand, balancing across sectors
- Ensure reliable distribution
- Connect projects to financing



## 1. Next Steps - Establish Market Integrator

ADA description: H2 Market Development Strategy Wheel with 1) Establish Market Integrator (ARCHES) and the central System highlighted.

### Next Steps:

- Establish a broadly understood, baseline understanding of ARCHES' governance and integration with market members (industry, communities, agencies, etc.)
- Clearly define how projects integrate / can integrate into the ARCHES system
- Solicit feedback for how ARCHES can help participants be successful (on-going)
- Establish ARCHES market participant working group

### H2 Strategy Website will include:

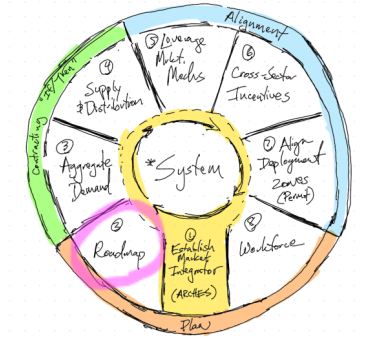
- Establish a system level view of the Strategy, and role of Market Integrator
- Show how ARCHES integrates with market players and state agencies
- Link to ARCHES website

### Targeted Outcomes:

1. ARCHES is explicitly integrated into state policymaking frameworks, with a responsibility for integrating and caretaking of the broader hydrogen system, facilitating information flow, and enabling multi-stakeholder successes.
2. Market stakeholders fully understand how to interact with ARCHES and various agencies to contribute to market development.

## 2 Roadmap

*"Lay it out so we can play it out"*



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ADA description: H2 Market Development Strategy Wheel with 2) Roadmap highlighted.

***“I look forward to the day when we are competitors.”***

**-Station developer A to station developer B**



Key point – both successes and failures are shared in the early market. Everyone should learn from both.

## Shared focus will help enable success

### End Use Sectors

#### Transportation



**Deploy 5,000**  
Fuel Cell Electric Trucks



**Deploy 1,000**  
Fuel Cell Electric Buses

#### Ports



#### Aviation



#### Power



#### Maritime



#### Agriculture



ARCHES first sectors (Power, Ports, Transportation) are California's early market focus areas. New opportunities will not be excluded – our focus is on developing projects that get the market moving.

## Align Efforts to Deliver Projects

### CA Planning:

- AB 32 Scoping Plan
- SB 1075
- Integrated Energy Policy Report
- Investment Plans
- Workforce Planning

### CA Implementation:

- Regulatory frameworks: LCFS, ACF, ACT, ICT, local drayage regulations
- Direct investments: HVIP, EnergiIZE, TIRCP, etc.
- Permit support/streamlining
- Jobs First: workforce training, connection to careers



### ARCHES Hydrogen Hub:

- Regional Network
- Organized to Reduce the Cost of Clean Hydrogen
- Leverage demand in high impact sectors

### U.S. National Clean Hydrogen Strategy and Roadmap:

- Target Strategic, High-Impact Uses of Clean Hydrogen
- Reduce the Cost of Clean Hydrogen
- Focus on Regional Networks



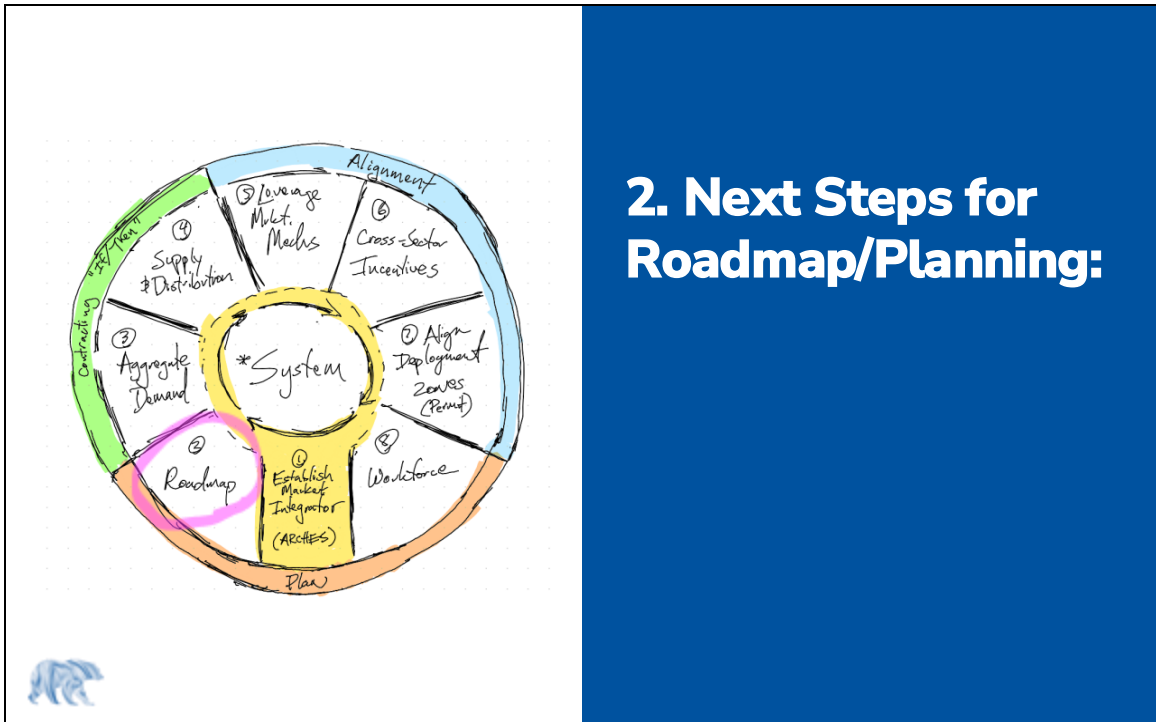
California has numerous planning and implementation initiatives long underway. The H2 Strategy will aim to:

- Articulate how the efforts are connected (and connect efforts that need to be more connected), so that a newcomer can understand the broader system.
- Integrate ARCHES into planning frameworks.
- Identify additional roadmap/planning efforts that the initiative can leverage (e.g., the Hydrogen Fuel Cell Partnership Roadmaps)

Furthermore, the H2 Strategy will show how ARCHES directly supports the implementation of the DOE's [National Clean Hydrogen Strategy and Roadmap](#), by:

- Targeting high-impact uses for renewable hydrogen (i.e., heavy-duty vehicles, power generation, ports)
- Reducing the cost of renewable hydrogen
- Building out a foundational regional network





## 2. Next Steps for Roadmap/Planning:

ADA description: H2 Market Development Strategy Wheel with 2) Roadmap highlighted.

### Next Steps:

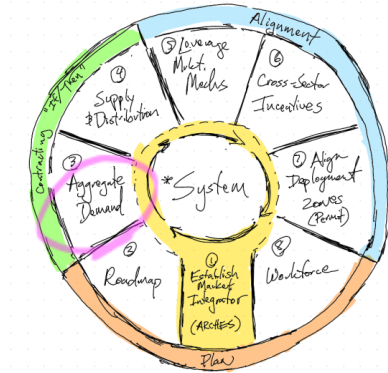
- H2 Strategy Website will include:
  - Clear description of target sectors, connecting to the various documents backing up the approach
  - Visuals and connections to the relevant planning efforts, the top-level questions each effort aims to answer, etc.

### Targeted Outcomes:

- Shared understanding of early market target sectors for hydrogen, with clear Roadmaps for each sector.
- Someone new to the industry could visit the H2 Strategy Website and understand the role of relevant policy documents and initiatives.

# 3 Aggregate Demand

*"If you build it [bankable demand],  
they will come [hydrogen supply  
investments]"*



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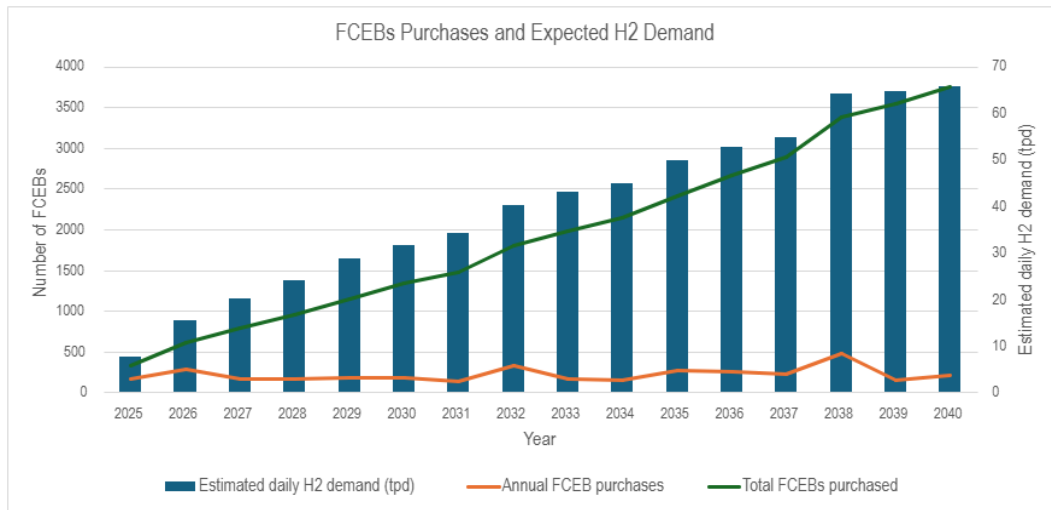
ADA description: H2 Market Development Strategy Wheel with 3) Aggregate Demand highlighted.

***“If you get me 30, 60, 90 tonnes of bankable demand, I’ll start building tomorrow.”***

**-Hydrogen supply developer**



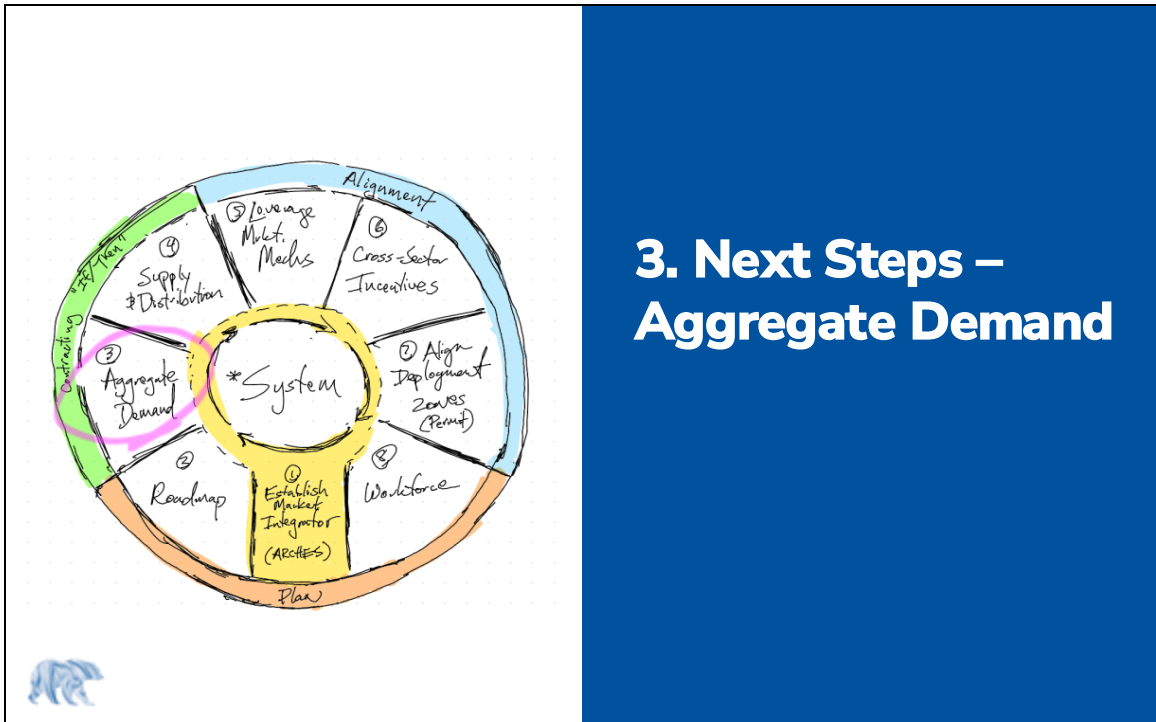
The quote is emblematic of the broader opportunity – with credit worthy off-takers, hydrogen projects are easy to finance.



*Based on plans submitted by the 39 California transit agencies planning to integrate FCEBs*

This one example of projected hydrogen demand, based on the published plans of 39 CA Transit Agencies.

Fuel Cell Electric Trucks (FCET) can be another reference point: we estimate 40 kgs of hydrogen per day per truck. 5,000 FCETs = 200 tonnes per day (TPD). The key is turning this potential into bankable offtake – ARCHES is actively working its Truck & Bus Strategy to create certainty on a system level (<https://archesh2.org/strategy-rfis/>)



ADA description: H2 Market Development Strategy Wheel with 3) Aggregate Demand highlighted.

Current Actions or Next Steps:

- ARCHES to facilitate offtake agreements, meeting parties where they are in their own processes
  - ARCHES is creating processes for off-takers to participate at all levels of readiness
  - Agreements will reflect where each project is in their own process, including conditions precedent to enable on and off-ramps, etc.
  - ARCHES is positioned to balance demand across multiple sectors and parties within those sectors.

H2 Strategy Website will include:

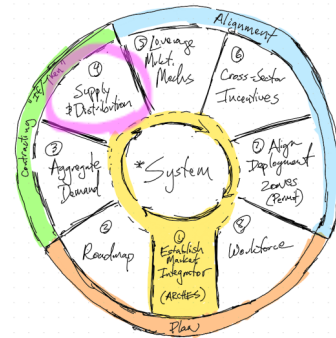
- Aggregated demand projections, to be updated with ARCHES data
- Clear pathway to direct offtakers to ARCHES

Targeted Outcomes:

- ARCHES aggregates bankable demand sufficient to bring new sources of hydrogen supply online (as well as leverage existing sources).
- Offtakers have access to a reliable supply of clean hydrogen at a defined affordable price.
- Each new hydrogen offtaker drives down cost for all offtakers.

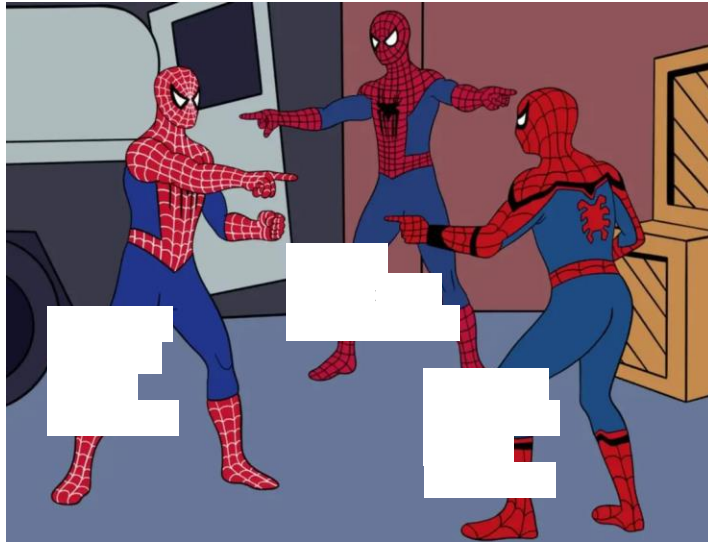
# 4 Connect Supply to Demand

"It's chicken AND egg."



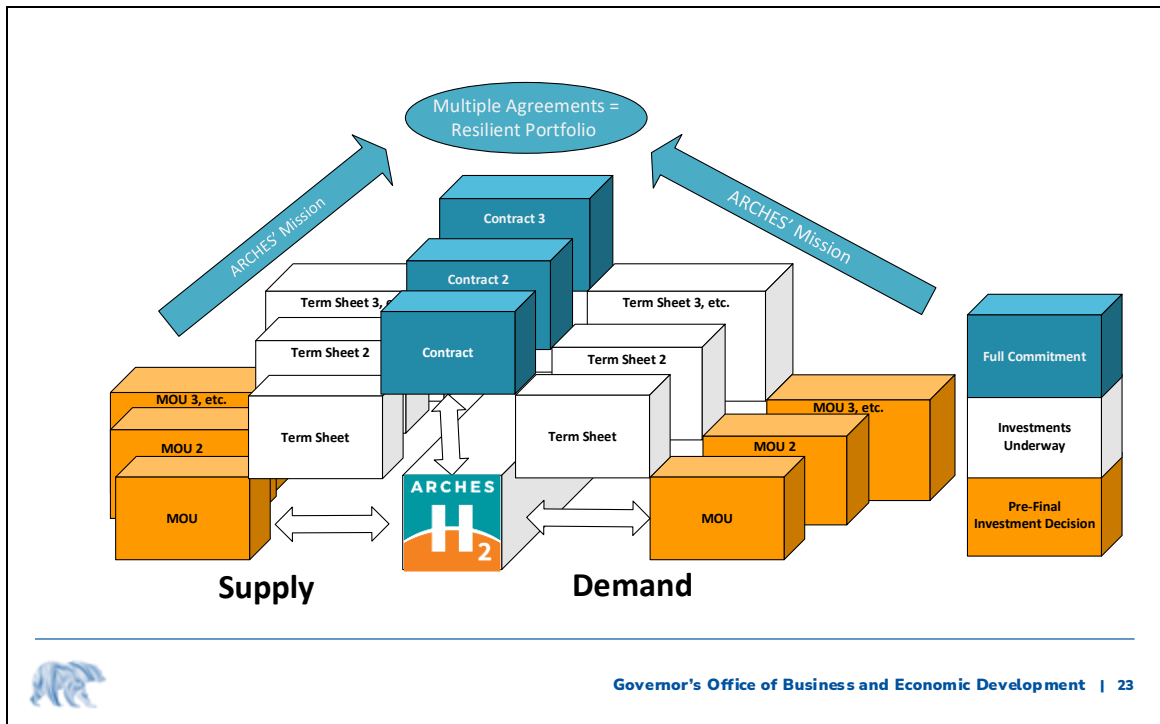
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ADA description: H2 Market Development Strategy Wheel with 4) Supply & Distribution highlighted.



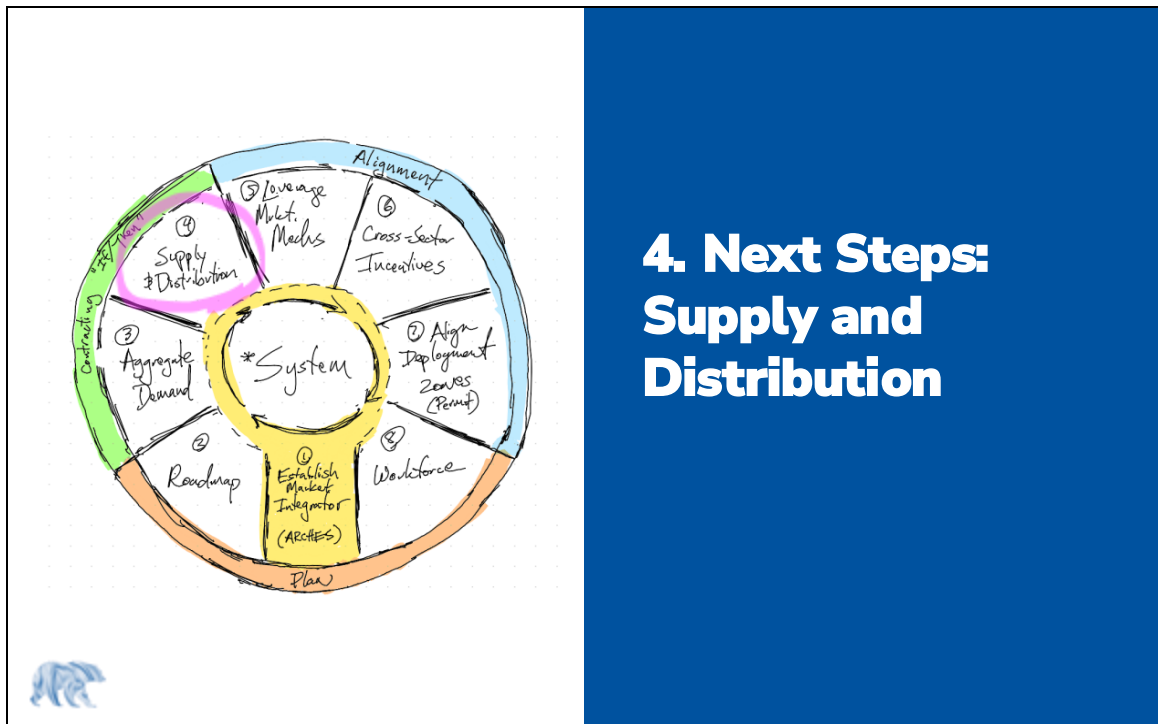
*"I'll do it if you do it, but you go first"*

We all need to jump in together for the system to work.



ARCHES is implementing a system to connect Supply and Demand, reflecting the level of investment commitment for each project as they go through the development process. Ultimately, this will help create a many to many system of Supply and Demand.





## 4. Next Steps: Supply and Distribution

ADA description: H2 Market Development Strategy Wheel with 4) Supply & Distribution highlighted.

### Next Steps:

- ARCHES is working two parallel tracks:
  - 1) advance privately funded hydrogen supply to be available in time for projected offtaker needs (e.g., 2028 LA Olympics).
    - This hinges on near term offtaker commitments.
  - 2) advance federally funded hydrogen supply and distribution projects, which will take longer

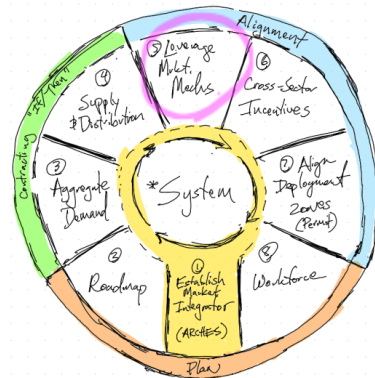
In both cases, offtakers would purchase hydrogen from the ARCHES marketplace.

- Additionally, ARCHES is developing a multi-pronged distribution strategy (including pipelines, trucks, and rail). ARCHES released a hydrogen pipeline RFI in June ([https://archesh2.org/wp-content/uploads/2025/06/RFI\\_H2\\_Pipelines-1.pdf](https://archesh2.org/wp-content/uploads/2025/06/RFI_H2_Pipelines-1.pdf))
- H2 Strategy Website will include:
  - Map of hydrogen production facilities (open, in-process, etc.) – ARCHES to maintain the map
  - Description of process to integrate into the system
  - Pictorial representation of the current balance between supply and demand (deepness of colors reflecting level of commitment)

- Targeted Outcomes:
  - Stakeholders understand hydrogen supply availability.
  - H2 Supply and Demand are balanced regionally and temporally.
  - H2 distribution systems are integrated and resilient.

# 5 Leverage Market Mechanisms to Scale

*"Faster than a speeding grant  
process"*



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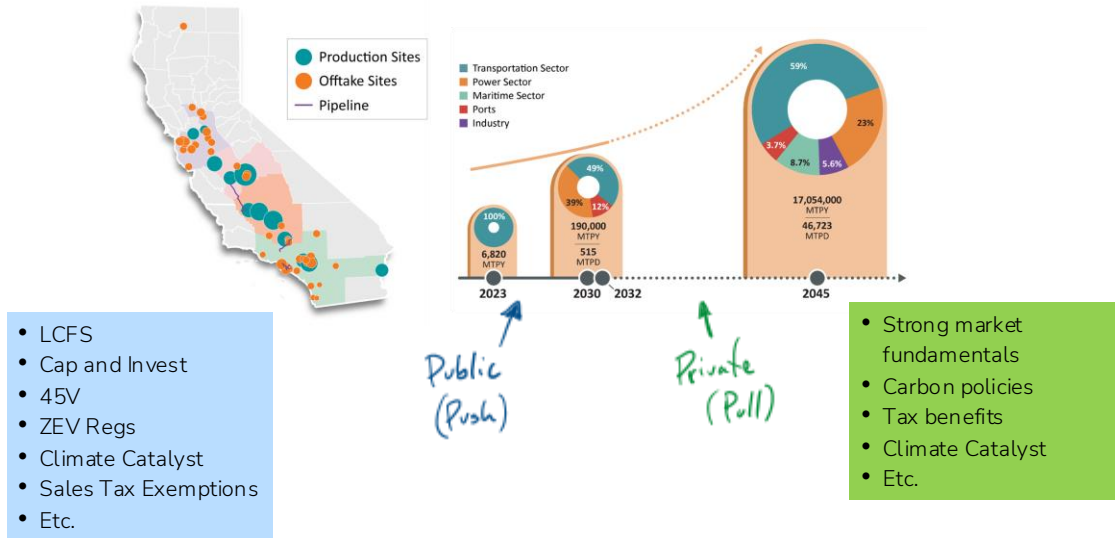
ADA description: H2 Market Development Strategy Wheel with 5) Leverage Market Mechanisms highlighted.

***“The LCFS is California’s secret weapon.”***

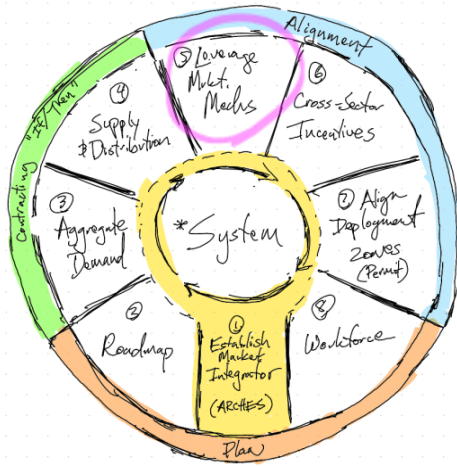
**-Market participant**



## Grants Don't Scale, but Private Financing Does



- Key point – policies are needed to push the hydrogen market forward in the early years (e.g., during the establishment of the foundational ARCHES hub), but every action should be done with an eye toward creating the strong market fundamentals needed to build a robust private market.

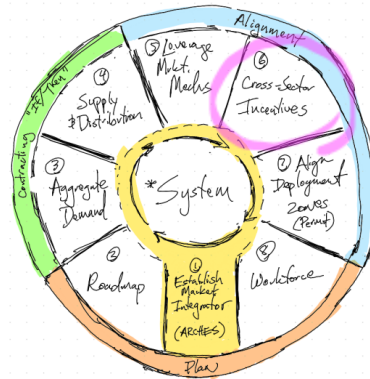


## 5. Next Steps: Leverage Market Mechanisms

- H2 Strategy Website will include:
  - Showcase / link to core market mechanisms and resources available to help developers access them (e.g., LCFS, 45V, etc.)
  - Create an intake form for additional ideas
- Targeted Outcomes:
  - Core market supporting mechanisms are broadly understood and leveraged
  - Venue for collecting market-based policy ideas makes it easy for stakeholders to contribute their insights

## 6 Cross-Sector Incentives

*"Invest in systems, not just projects"*



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ADA description: H2 Market Development Strategy Wheel with 6) Cross-Sector Initiatives highlighted

Goals:

- Enable investments in renewable hydrogen projects in CA that provide long-term signals, transparency, and affordability
- Reward system-level investment, planning, and implementation
- Leverage all sectors, including financial
- Fund systems, not just sectors

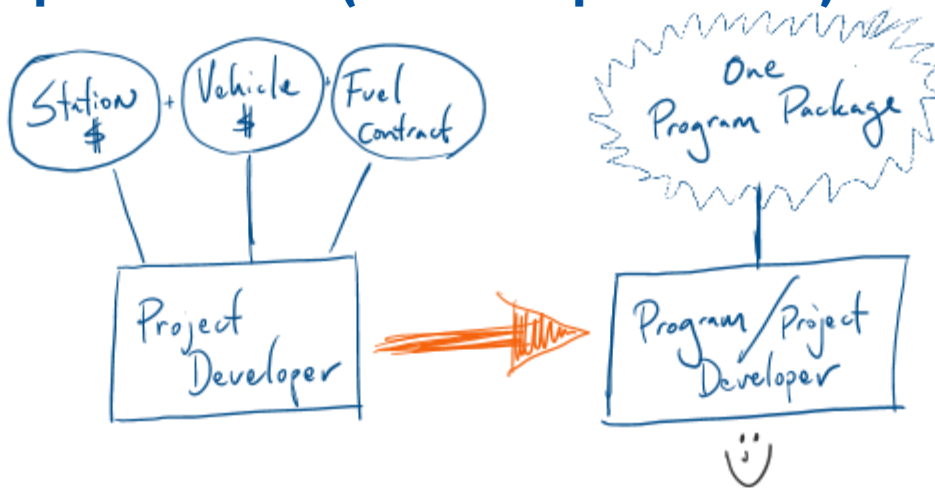
***“I need a team of grant writers to align funding to pull this off.”***

**-Market participant**





## A Cross-Sector Approach can streamline implementation (for the Implementers)

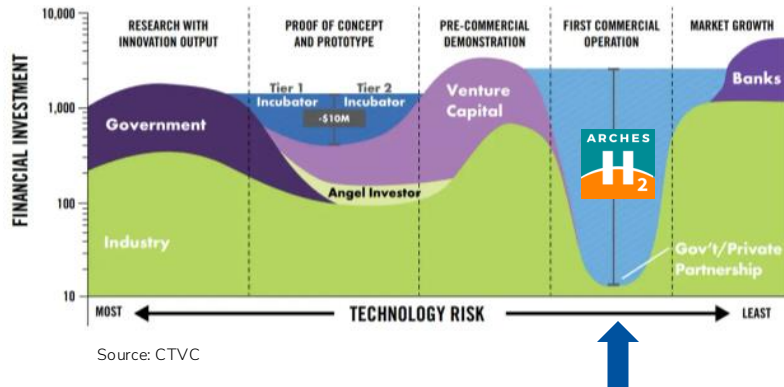


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ADA explanation: Drawing on the left shows that a Project Developer must align funds from Stations, Vehicles, and Fuel Contracts to make a project work (assuming the project is more expensive than incumbent technologies). The drawing on the right shows a happy project developer going after one, integrated program package.

Key message: State and local incentive programs often operate on different time-scales, with differing requirements, targeting narrow market segments. This reality drives uncertainty for project developers. To get the market moving, we need programs to integrate and invest in the system.

## Our Investments Need to Match Market Realities

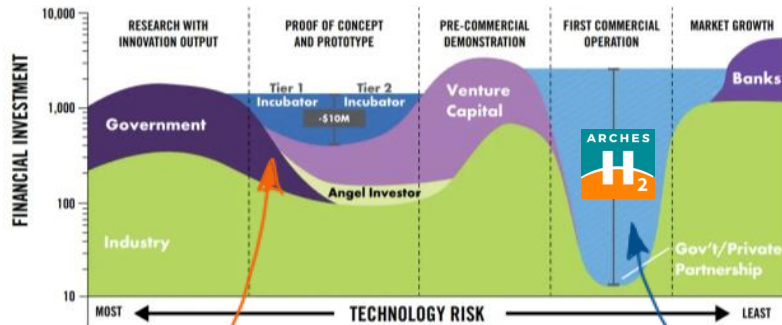


*The Hydrogen Strategy is essential to bridge the final valley of death and spur market growth in California.*

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Image source: <https://www.ctvc.co/project-finance-bankability/>

## Different Reality for Different Components



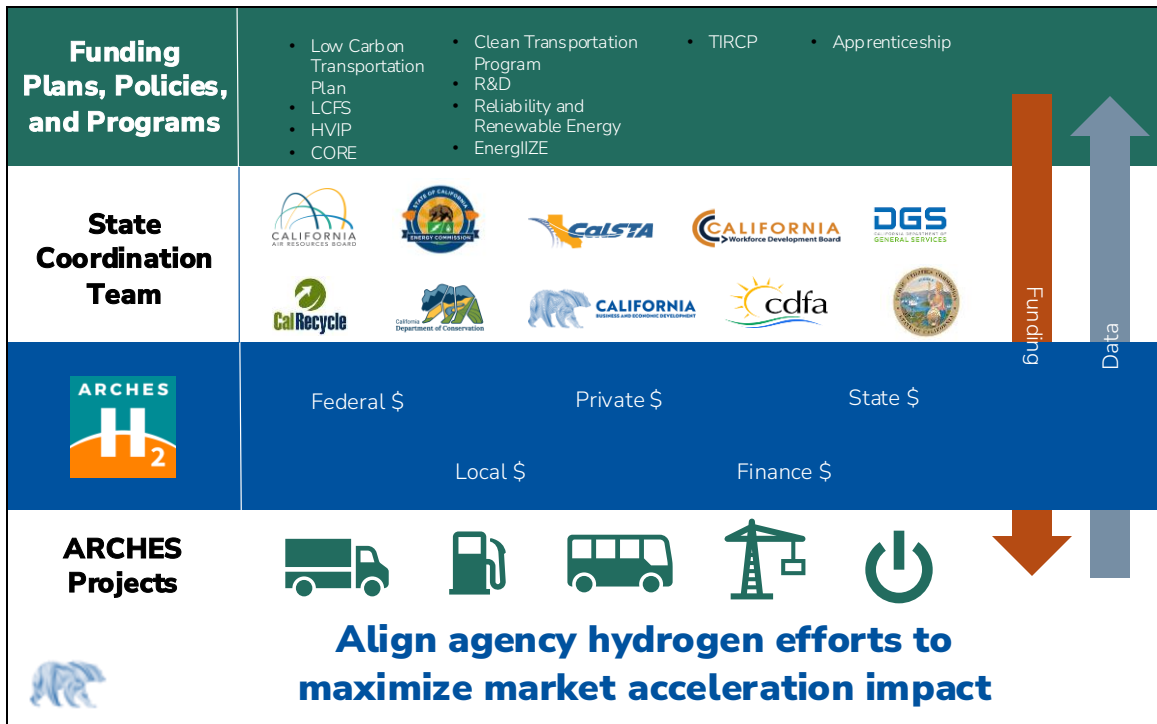
Source: CTVC

Trucks, Buses, Stations — Need to match — H<sub>2</sub> Supply

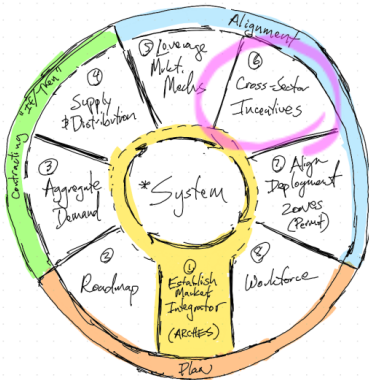
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Image source: <https://www.ctvc.co/project-finance-bankability/>

ADA description and key points: Trucks, Buses, and Stations may carry a higher technology risk compared to hydrogen production, which has been around for decades. System-level investments need to reflect this reality: H<sub>2</sub> Supply can be financed, whereas hydrogen trucks, buses, and stations will generally need grant-style incentives to make the economics work in the early years.



- This graphic captures one way the system could be organized to streamline funding, with ARCHES integrating funding from multiple public and private sources. The graphic shows various state agencies with direct or indirect roles in funding – the H2 Strategy initiative would focus on aligning this sources to streamline work for the project / program developers.



## 6. Next Steps: Cross Sector Incentives

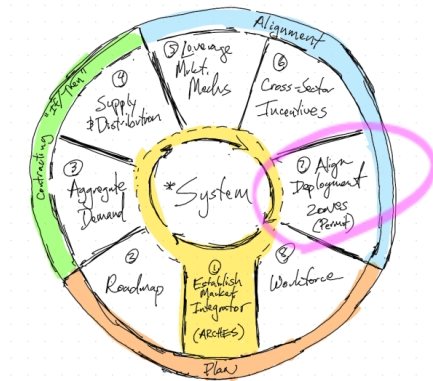
ADA description: H2 Market Development Strategy Wheel with 6) Cross-Sector Initiatives highlighted

- Next Steps:
  - ARCHES solicited feedback on an integrated funding strategy for Trucks and Buses (summarized here: <https://archesh2.org/wp-content/uploads/2025/03/RFI-HD-FCEV-Key-Takeaways-Summary.pdf>)
  - ARCHES plans to release a Truck OEM Request for Qualifications with a goal to select OEMs to commit to partner with ARCHES to scale the market as part of broader OEM, Fleet, Station Provider, and H2 Supply system.
    - A similar approach will be used to expand access to fuel cell buses – with a focus on attracting manufacturing to CA (and the US).
- H2 Strategy Website will include:
  - Outline a plan to align funding, particularly focused on core sectors.
  - Showcase Port of Oakland case study
  - Link to ARCHES Truck and Bus Strategies
  - Show how state funding plans and opportunities currently intersect
- Targeted Outcomes:

- Interim outcome, if necessary: We have clear roadmaps to establish cross sector incentive structures.
- Ultimate outcome: Priority sectors have system-based incentive structures that are fair, easy to understand, straight-forward to apply for, and drive down system cost.

# 7 Align Deployment Zones

*"Build success, region by region"*



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ADA description: H2 Market Development Strategy Wheel with 7) Align Deployment Zones (Permit) highlighted

## ***“What about the Hindenburg?”***

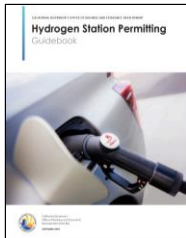
**-Local permit official**



Many people remain uninformed about hydrogen, which has been used safely in multiple applications for decades. Education and Outreach is central to success. It's ongoing process that needs to be tended to like a garden, leveraging peer to peer engagement whenever possible. It's important for stakeholders to know that hydrogen has been used safely for decades in multiple industries, thanks to robust codes and standards.



## Align Deployment Zones With:



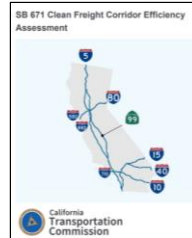
Permitting  
Guidebook



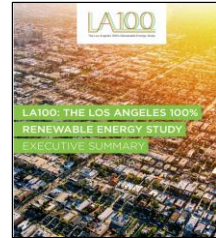
SB 1418 Permit  
Streamlining



Jobs First  
Regional Priorities



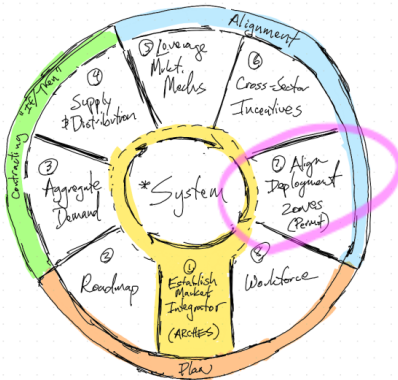
SB 671  
Corridors



Local Leadership:  
LA 100 Study

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- A number of existing resources help focus efforts in specific regions – the idea is to leverage these initiatives, and fill gaps where needed.



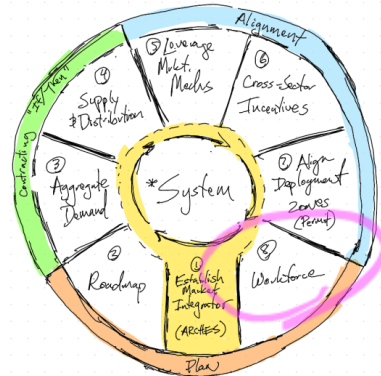
## 7. Next Steps: Align Deployment Zones

ADA description: H2 Market Development Strategy Wheel with 7) Align Deployment Zones (Permit) highlighted

- Next Steps:
  - GO-Biz to update Hydrogen Station Permitting Guidebook, adding other parts of the value chain through time
  - Establish coordinated education and outreach campaigns.
- H2 Strategy Website will include:
  - Map priority deployment zones and documents that support these priorities
  - Connect to permitting and education and outreach resources
  - Codes and Standards resources.
  - Information on opening hydrogen projects to the public (e.g., station testing, metrology, etc.).
- Targeted Outcomes:
  - Stakeholders have a clear understanding of geographic regions to focus outreach on
  - Permit officials in deployment zones are educated on hydrogen and have easy access to any materials they need to be able to approve projects.

# 8 Workforce Development

*"Jobs, jobs, jobs"*



Governor's Office of Business and Economic Development | 40

ADA description: H2 Market Development Strategy Wheel with 8) Workforce highlighted

Jobs First context:

- 12 of 13 statewide economic regions prioritized the Clean Economy as a strategic sector, with hydrogen featured as an important investment opportunity
- Hydrogen is also featured in other strategic sectors, including Working Lands and Water, and Transport and Logistics.

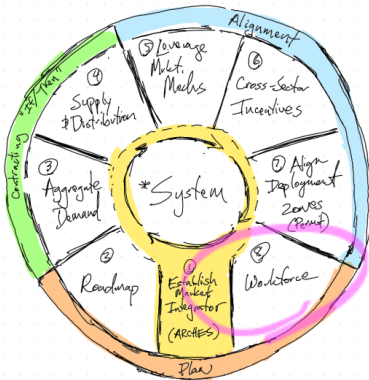
***“It’s not just about growth, it’s about inclusion. It’s an industrial policy that’s worker-centered. Growth and inclusion. Those are the values that we hold dear in California. And those are the values that make ARCHES so special.”***

**-Governor Gavin Newsom**

***“We have plenty of workers, just let us know what you need.”***

**-Labor leader**

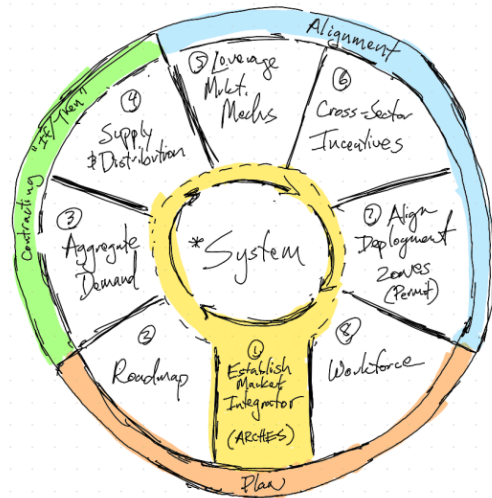




## 8. Next Steps: Workforce

- Next Steps:
  - ARCHES will establish a Workforce Development Working Group, focused on connecting project development needs with workforce training leaders
- H2 Strategy Website will include:
  - Workforce needs projections (temporal and regional overlays),
  - Show how workforce projections integrate into state frameworks (e.g. Workforce Development Boards, Apprenticeships, Community Colleges, Universities, etc.)
  - Connection to various state, regional and local initiatives, including the Jobs First Initiative
- Targeted Outcomes:
  - Hydrogen is fully integrated into California's workforce development system
  - Project developers have streamlined access to a skilled and trained workforce

# We Want to Hear from You!



Bottom line, the H2 Strategy's purpose is to help all market participants and stakeholders contribute to collective success, with minimal friction. We need your help to get there. We are always looking for opportunities to improve the system so that we can all streamline our path to a carbon neutral future with ample family supporting jobs, clean air, and reliable and resilient carbon-free energy, transportation, agricultural and industrial systems. We look forward to your feedback, advice and insights.

H2 Strategy Feedback Form button can be found here: [Hydrogen - California Governor's Office of Business and Economic Development](#)