Breakout Session - Topic

Group1: **CA Policies and attitude towards Hydrogen Technology**

Discussion Leader: David Zilberman

Note Taker: Bert Harvey

Who will represent the group: Bert, Janice

Discussion Members

Allan Lloyd, Chris Rao, Janice Lin

David, Bert

Others (3+) - Jo to add from invite accepts

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Discussion Topic: CA Policies and attitude towards Hydrogen Technology

What did you learn? Your main takeaways?

To what extent does CA look at decarbonization vs electrification
To what extent is H2 part of the policy
What policy in CA can most benefit advocacy

- Most policy geared toward transportation – CEC and MD point toward buses and trucks and not toward LD transport
- H2 is amazing flexible resource needing better organization – CA at precipice of creating required framework to capture H2 as solution – need project that can scale
- Need to establish the right policy container to establish the right multidiscipline oversight body
- The strength of H2 is that it is a multipurpose solution – needs to broaden outward and we need a roadmap
- Need for seasonal storage ; could be H2 geologic storage – new technologies are being looked at to storage H2 long term; geo storage available from O&G reservoirs
- What is mechanism to compensate H2 – CEC focus and concern in CA is PM, NOx , also impact on low income communities – get big benefit from cleaning up current (HD) emissions
- Need bankable off-taker for hydrogen at scale
- Blue vs green H2: In CA: cost and env benefit + public perception important; leading with green H2 can have benefits – Roger made compelling case for blue H2 – need to strengthen environment case; need to prove reservoirs are viable – ultimately we need both; using H2 as energy carrier
- Benefits that H2 can provide is resiliency = longer duration storage; capacity of subsurface storage for H2 as reserve
- What knowledge do policy makers need – understanding how H2 connects to infrastructure in new ways. Policy makers not fully aware of safety measures in place.

What surprised you?

- **CA does not have a H2 policy; however there is a low carbon policy**
- **There is no awareness of potential for H2**
- Surprised to see CEC pivot toward MDHD sectors
- No real mandate for H2 at CEC –
- Need real projects to build momentum and demonstrate value of H2

Opportunities	Barriers	Potential Solutions	Next Steps? What's actionable?
Urgent action to step up H2 geo storage; pipeline storage is also potentially viable option – RNG standard and how renewable H2 needed to scale	Lack of coordinated regulatory focus – potential to reduce cost / risk	Education among policy makers How to organize reg structure; general public education; industry stakeholders needs to be more aligned and speak from one voice	Need agency to develop, lead and maintain vision
Electrolytic H2 as storage – bill pending implementation	Cost and infrastructure / duplication		Need oversight agency to oversee all of the parts
Demonstrating O&G reservoirs are viable technically	Need piloting opportunity to demonstration recovery		
Need MM or even 100's of MM of units to drop cost	Focus is on MD HD sector	Need to consider LD sector	
Expand LCFS for backup generator power units	Replace diesel / gas generation – small units		
Benefits that H2 can provide is resiliency = longer duration storage; capacity of subsurface storage for H2 as reserve	Need leadership from CARB	There are lots of chemistry solutions that can be combined	
Consider development of the corridor in the center of CA (Arnab) to bridge transportation and industry	Absence of rate design; Electric tariff needed to have rate design to take advantage of low-cost electricity to make H2		Need oversight agency to oversee all of the parts

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   - What did you learn? Main takeaways?
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   - Then guide the discussion towards filling out the table on opportunities/barriers/solutions/next step
6. Have the group decide who will present the discussion summary to the broader audience. Each group has 10min MAX

Day 1

Topic	Discussion Lead	Note Taker
Group1: CA Policies and attitude towards Hydrogen Technology	David Zilberman	Bert
Group2: The Role and Potential of hydrogen in California	Tim Olson	Arnab
Group3: Blue H2 value proposition for California	John Coates	Nikunj

Day 2

Topic	Discussion Lead	Note Taker
Group1: What is the near term opportunities for large scale H2 utilization?	David Zilberman	Nikunj
Goup2: How can policy help to realize this opportunity?	Jo Liao	
Group3: What are the major technical (scientific) challenges?	Bert Harvey	

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Notes

- Focus on transportation in California:
  - GHG (40%) and 10% from refining
  - LCFS value has been central to govnt interventions (values CI)
- Does the existing set up spur us in the appropriate direction today
  - Regulatory scheme and market based schemes?
  - Progress on Renewable electricity but include engagement of refining sector and RNG
- Main Challenges
  - Set appropriate incentives to take advantage of multiple value streams of hydrogen
  - Hydrogen delivery infrastructrure that enables sector coupling vs current model (government interventions for H2 transport vs others)
  - Generation opportunity spaces—Green vs Blue

POLA

- Port of LA: high demand utilisation, specific challenges for POLA (on footprint, duty cycles, integrated opportunity)
  - Decarbonisation of the Port== Long term vision is leaning heavily on H2
  - POLA by themselves in not sufficient condition to build the need
  - Local pressures on AQ: immediate HHC pollutant issues, particularly from Tailpipe. 17,000 class 8 trucks—real issues
  - Should we encourage NG transition or go to H2?? Is there a staircase or is it a trade off
  - 2035: all trucks need to be zero emission—H2 is the best pathway based on duty cycle.

CEC commentary

- Innovative financing in order to scale up; private capital incentivisation for MD and HD sectors
- Co-ordination with CPUC and CARB: inclusion of investment in transit
- Combination of grants, planning support, loans etc for Capital projects

Fuel

- Instate California fuel production or do we make it in Texas
- Can we do green hydrogen production in this state?
- We can build here and add the fuel play for green H2—based on policy incentive
- Barriers to blue hydrogen, inc does imported H2 account for LCFS
- Market mechanisms through the commodity market
  - CPUC as a regulatory function—will it be fast enough
  - Overall co-ordination gap
  - Capacity credits for HD and MD
  - ARB convening a work group to create the overarching guidance.

Deep Decarb pathway project

- How would Ca get to SB100? Methanation etc??
- LADWP (100% targets): what is the last 10%? What is the system cost if you can build up the transport/heat conversation
  - Timing: one solution today that is far from the ideal end state
- Progress on Power2Gas as a pathway to reduce cost/improve LCA for hydrogen
  - On-road applications for LD—huge efficiency benefits vs HD which is already quite efficient vis Diesel cycle. This is recognised in LCFS via CI and EER pathways
  - Less so for heating applications as part of a 10-20% blend (HHV)
  - How can we scale up quickly: few and bigger build, such as 100k cars or home heating systems vs 1 truck fleet or Port facility. (H2 hub model).
    - How do we jump to the right scale? What do we need?
    - Ports continue to come up as key economic, productivity, labor, LAQ and CO2 drivers

Discussion Topic

What did you learn? Your main takeaways?

What surprised you?

Opportunities	Barriers	Potential Solutions	Next Steps? What's actionable?

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Breakout Session – Blue H2 in California

Discussion Leader: John Coates

Note Taker: Nikunj Gupta

Who will represent the group: George Aines

Discussion Members

Michael, Abhishek, Joe, Ajay, more John to add

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Blue H2 value proposition for California

What did you learn? Your main takeaways?

- Integration of usage of Hydrogen across different sectors
- Carbon storage from Roger was very helpful
- Importance of scale-up for cost reduction? Vehicle manufacture to adopt technology
- Ports are incredibly important to focus

What surprised you?

- LCFS only applies to transport fuels (applies to aviation also but not industry)
- Stickiness of LCFS, $200/ t for the long haul?
- What about methane Pyrolysis
- LD (passenger cars) still a play for Hydrogen? – Pick up trucks still a good potential market for H2
- 2/3rd of LCFS is going out of state

Opportunities	Barriers	Potential Solutions	Next Steps? What's actionable?
LCFS upgrade	Does not cover other sectors than transport Limited options Bioenergy CCS is not applicable SMR to CCS?	PUC to participate	Decarbonization partnership, permitting in the state already happening Streamlining the permitting, traceability Industry single POC Cap & trade and focus on 45Q
Blue H2 export from TX to California	Transport, Import at Golden gate for Ship Equivalency of jurisdiction reqs in 2 states	Existing pipeline repurpose Permitting	Monitor South Dakota Ethanol mfr activity Engage with regulators, Federal permit for class 6 well
Transition plan from transport to other industry	There is no LCFS like support but 45Q – can it be decomplexified? Not much industry in cal, mostly transport & power, Socal gas	Optimizing 45 Q Fertilizer Industry in California?	Incentives for local low CI fertilizer industry
Hydrogen distribution (short & long distance) is a key challenge	Proximity to CCS Pipelines non exisiting	Repurpose existing pipeline/admixing and extraction (electrochemical)	
Methane pyrolysis	Not much experience	What about LA? Ship long distance C in use as prod	
Small scale SMR (<1 ton/day onsite)		Running with ren electricity (20% reduction), enter the LCFS regime	