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California Hydrogen Coalition IEPR and CTP Benefits Comments

Additional submitted attachment is included below.

August 11, 2021

Mike Petouhoff
Larry Rillera
California Energy Commission
1001 Ninth Street
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Re: IEPR – Comments Regarding Commissioner Workshop on Hydrogen to Support California's Clean Energy Transition and Commissioner Workshop on Benefits from the Clean Transportation Program

The California Hydrogen Coalition (CHC) appreciates the opportunity to provide comments on the 2022 Integrated Energy Policy Report (IEPR). We appreciate the work the California Energy Commission (CEC) has put into the IEPR to date and the opportunities and investments it generates for the build out of hydrogen fueling infrastructure through the Clean Transportation Program (CTP) to support the state's growing fleet of fuel cell electric vehicles. To that end, we provide several policy recommendations that could enhance the outcomes of the IEPR and CTP to accelerate the transition of California's fleet to zero-emission hydrogen powered fuel cell electric vehicles and accelerate bringing additional decarbonized hydrogen into the marketplace.

The mission of CHC is to enable California's transition to zero emission vehicles (ZEVs) by expanding the availability of reliable, convenient, and affordable hydrogen fueling to support the state's emission reduction goals. We are confident light, medium, and heavy-duty FCEVs will play a critical role in California's transition to a zero-emission transportation sector because of the advantages this technology provides today with respect to range, duty-cycle, and fast refueling, and may soon provide for cost and carbon intensity reductions. CHC is equally confident in the development of a hydrogen fuel market that will continue providing quality jobs and opportunities to decarbonize locally owned fueling stations throughout California. FCEVs and hydrogen closely emulate existing consumer behavior for the gasoline and diesel vehicle experience, eliminating the pressure to change consumer behavior while decarbonizing the jobs associated with the existing distribution and fuel delivery markets. We are excited and prepared to accelerate the adoption of this ZEV technology over the next several years.

Embrace the "Earthshot"

On June 7, 2021, Secretary Granholm announced the federal government's "Earthshot" initiative to reduce the costs of clean hydrogen to $1 per kilogram in a decade. This ambitious pricing target reflects the importance of hydrogen as an energy carrier in decarbonization, but also recognizes that California's climate allies in Asia and Europe are much further ahead in

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planning and execution of the deployment of hydrogen in their carbon reduction strategies. Achieving $1 per kilogram of clean hydrogen far exceeds the cost reductions needed to directly compete with existing fossil fuel resources and in California makes hydrogen more cost-effective than retail electricity.

This initiative is wakeup call to the country and a market signal to industry; California must similarly send market signals and create a predictable policy environment to encourage investment. The world often looks to California not only for leadership but also partnership when it comes to decarbonized energy and mobility. Our climate partners are leading the way and it is time for California to embrace our leadership role in this space. The hydrogen economy will not be built by one jurisdiction alone. We can partner in the development of a zero-carbon and domestic energy resource that when paired with zero-carbon end uses can displace 1:1 fossil fuel without an expectation of mass behavioral change from the public and while providing a just transition for thousands of businesses and hundreds of thousands of Californians.

The members of CHC are investing billions into the establishment of a hydrogen economy that will help adoption of hydrogen as an energy carrier. However, there is more work to be done and the IEPR presents some immediate opportunities to send investable signals to the private market and drive capital toward the appropriate investments for California's future.

Now more than thirty-five countries have recognized there is a large role for hydrogen in achieving national strategies for climate change emissions reductions and in attempts to achieve carbon neutrality have released comprehensive hydrogen strategies. While CHC is currently focused on the development of a hydrogen transportation market, we want to acknowledge the benefits of hydrogen and fuel cells for stationary power (baseload, peak, and backup), longer-duration energy storage, and industry processes (most of the cap-and-trade facilities could benefit from decarbonization of the natural gas pipeline with hydrogen injection). The opportunities hydrogen and fuel cells provide for on-road and off-road mobility do not end with light-duty passenger or medium and heavy-duty trucks and buses, but extends to off-road applications including material handling, aviation, maritime, and rail.

The Role and Benefits of Hydrogen and Fuel Cell Electric Vehicles for Decarbonization
CHC's current focus is to support the build out of some of these early commercialized applications and with that comes the need for the IEPR to help leverage the immediate infrastructure opportunities to help achieve cost-effective and equitable compliance with regulations promulgated by the Air Resources Board like Advanced Clean Fleets, Advanced Clean Cars, Innovative Clean Transit and Zero Emission Vehicle Program requirements – Californians need choice. Investments and market signals will drive:

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- Environmental justice and equity -- The shared infrastructure of FCEV hydrogen fueling provides an option for Californians who live in multi-unit dwellings or older housing stock and have no daily ability to charge at home or work.
- Consumer adoption advantages -- Californians who require rapid refueling or face long daily commutes, including transportation networking companies as well as our construction and agricultural workforce, can access a long range zero-emission vehicle with rapid three to five minute refueling times.
- Heavy-duty and fleet operations – the weight advantage and rapid refueling benefits of hydrogen will serve existing goods movement business models with the same freight efficiency without placing requirements on our warehousing to bring in expensive infrastructure that may not provide the same level of service or uptime.
- More reliable vehicle performance -- Californians can expect good vehicle performance in hot or cold weather since FCEVs are less impacted by weather conditions.
- More zero emission vehicle miles traveled -- On average, FCEVs are driven between 10,000-14,000 miles per year, while plug-in electric vehicles are driven between 6,000-9,000 miles per year.[1]
- Internal combustion engine replacement -- A 1:1 replacement for gasoline and diesel vehicles which eliminates the growing trend of households rely on both a gasoline/diesel and plug-in electric vehicle to meet driving needs.
- More efficient goods and people movement -- A better option for public transit and goods movement where moving large loads and fleets demands fast refueling and lower unladen weight to maintain operational efficiency.
- Different clean production pathways provide different co-benefits to California's climate and air quality programs.
    - Steam methane reformation of biogas is a high efficiency low-carbon pathway for mitigating methane emissions from anthropogenic sources like landfills and wastewater treatment plants, while also creating favorable economics for the anerobic digester capacity needed to achieve our statutory organic waste diversion goals and short-lived climate pollutant strategy.
    - Electrolysis will eventually be the predominant source for hydrogen and paired with dedicated renewable electricity generation, we can see scenarios, where curtailment of electrolyzers will backup grid resources or hydrogen will be used in turbines and fuels cells to provide baseload to the grid.

[1] https://www.energy.ca.gov/data-reports/surveys/california-vehicle-survey/vehicle-miles-traveled-fuel-type

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  - Thermochemical conversion of biomass to hydrogen is another way to manage the waste from forestry and agricultural operations. This will also provide favorable economics to mitigating wildfire risks while lowering the emissions by eliminating the open combustion-based practices highlighted by the state procurement of incinerators in recent budgets for CalFire.
- Just transition away from fossil fuels -- Fueling stations, which number in the several thousands and are predominately small, minority-owned businesses, have a viable transition to fueling zero-emission vehicles allowing their businesses to thrive as we transition away from fossil fuels.
- CHC emphasizes that unionized refinery and pipeline workers' high skill – high wage jobs would be preserved with a transition to a zero-carbon molecular energy carrier like hydrogen. This also transitions the public's multibillion dollar pipeline infrastructure and lowers the reliance on a grid which cannot handle all the demand envisioned.
- Self-Sufficiency within the Decade – According to an ARB draft report the light-duty hydrogen refueling sector can achieve self-sufficiency within the decade for as little as $300,000,000 additional dollars.
  - This is a small fraction of the funds that have already been spent and allocated to charging infrastructure.

Enabling Policies

CHC would also like to request the IEPR examine how the various policies included can further enable the demand for renewable and clean hydrogen. Hydrogen serves as an energy vector that can utilize existing resources with minimal retrofit costs, minimizes the behavioral changes for end-uses, and can unlock the full potential of 24/7 clean energy. If we are to unlock the full potential of this energy vector California should support the early commercially available end uses like light-duty FCEVs and develop a series of finite policies to enable low and zero carbon hydrogen production.

Recommendation One

Finish the launch and fully fund light-duty hydrogen refueling to achieve self-sufficiency by 2030 with an additional $300 million as described in ARB's Draft Self-Sufficiency Study.

- 1,000 light-duty hydrogen refueling stations will provide 94% of Californians and 97% of disadvantaged communities access within 15 minutes of their residence.
  - Consumer decisions are driven by many different use cases and the state should support solutions for All Californians.

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- Convenient fast refueling that does not require consumer behavior change and is more similar to owning popular PHEVs.
- Allows equitable access to ZEV technologies for those who do not have garages, live in multifamily housing, rent, have no charging at work, or work remotely.
- Fuel cell stacks are becoming more efficient as is hydrogen production.
- The top two best-selling auto manufacturers in the California marketplace are committed to fuel cell technology and the three auto manufacturers with commercially available products represent almost 1/3rd of all vehicle sales in California.
    - Vehicle announcements are happening and there will be more options in the marketplace soon that will need this public retail network for successful deployment.
        - Honda is set to announce a new line up in 2022 including FCEVs
        - BMW X5 in 2022
        - Land Rover/Jaguar
        - Stellantis
        - GM Medium Duty Trucks and Vans
- A poll, conducted by David Binder Research in San Francisco for the California Hydrogen Coalition, found that:
    - 56% of those not interested in a zero-emission vehicle indicated interest for a "zero emission vehicle which can be refueled in 3-5 minutes at a local gas station."
    - 74% or almost three out of every four of those polled are favorable on fuel cell electric vehicles.
    - Public support for fuel cell electric vehicles is based primarily on quick refueling times (71%), larger vehicle capacity (65%) and vehicle range (58%).
    - 83% of those polled who own a zero-emission vehicle also own a gasoline vehicle. Two vehicles are not a practical option for all households and this demonstrates the value proposition of a zero-emission technology that aligns closely with the advantages of gasoline vehicles.

Recommendation Two

Support the launch of fuel cell electric trucks (FCET) by setting a goal of 200 heavy-duty hydrogen refueling stations by 2035

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- $100M initial HD fuel cell truck fueling infrastructure funds to get infrastructure kickstarted and achieve 2025 goals – with focus on the 10 infrastructure density regions.
    - Provide the long term, dedicated HD hydrogen infrastructure funding to get to point of self-sufficiency/tipping point for HD hydrogen infrastructure by 2035.
    - Need for near-term large HD fuel cell electric truck demonstration/pilot projects NOT (as is done with transit) many small projects. 50-100 trucks per fleet project in a single region – to accelerate ZET rollout, SCALE needs to be proven by learning and pushing projects to their limitations.
        - Smaller projects will not adequately test the infrastructure and are often too administratively burdensome.
- Heavy-duty and light-duty refueling infrastructure and vehicles are complementary in nature.
    - The medium duty vehicle market needs a statewide light-duty refueling network to support all the various customer classes and the heavy duty trucks and buses will experience cost reductions in components from a robust light-duty FCEV market. Likewise, light-duty fuel cell vehicles will benefit from the cost reductions in scaling hydrogen production to meet the demands of the heavy and medium duty markets.
    - Additionally, scaling production and distribution networks for the scale needed in heavy and medium duty applications will ultimately backstop the growth issues being experienced in the light-duty market today by helping stabilize the supply and demand limitations from the early stages of this market development.

Recommendation Three

Provide access to wholesale markets for electrolytic hydrogen production. This is a necessary policy to bring down the costs of electrolytic hydrogen and make it competitive and potentially more cost-effective than grey hydrogen production.

- Hydrogen can underpin a resilient and highly renewable grid while increasing system efficiency.
    - Intermittency of wind and solar combined with the impacts of drought on hydropower have highlighted the need for zero-carbon molecular energy like hydrogen which can be produced, stored and dispatched throughout the energy systems in California.

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- From January 1, 2021 to August 7, 2021, California has curtailed 1,198,522 MWh[2] of wind and solar. In lower efficiency electrolyzers it takes about 50kWh to produce a kilogram of hydrogen.
- Not accounting for compression, liquification, or distribution we could have produced 23,970,440 kg of zero-carbon electrolytic hydrogen this year.
- This electricity is ratepayer funded through long term contracts and curtailed, grounded, or negatively priced renewable energy is a loss of ratepayer value.
- By allowing access to wholesale electricity markets for hydrogen production we could recover $0.03-$0.05/kWh for the ratepayer and produce hydrogen for the transportation space at a cost that beats gasoline, diesel, and tesla supercharger rates.
- Zero carbon intensity electrolytic hydrogen production from this excess and curtailed renewable energy also equates to over a billion zero emission vehicle miles travelled from January 1st to August 7th of this year.
- If simply used as stored energy this is equivalent to 791,024,520 kWh of energy or 791,024 MWh of energy produced to this point in the year - meaning hydrogen production from curtailed wind and solar exceeds 3,600 MWh/day on average which would substantially help with the energy issues the Governor's Emergency Proclamation[3] is seeking to correct.
- Furthermore, hydrogen production from renewable electricity can help solidify the economic case for additional wind and solar production thus avoiding the negative pricing which is deflating[4] the value of renewable energy.

Recommendation Four

Accelerate studies and safety standards to implement pipeline injection and hydrogen blending standard with the natural gas pipeline.

- "The Joint Utilities emphasize that their gas infrastructure can be leveraged to provide a significant boost towards achieving gas pipeline decarbonization by blending hydrogen into the existing gas systems. A key advantage of hydrogen as a form of stored energy is that it can be transported, stored for long periods of time, and used as energy across the broad range of applications. Hydrogen blending into

[2] http://www.caiso.com/informed/Pages/ManagingOversupply.aspx

[3] https://www.gov.ca.gov/2021/07/30/governor-newsom-signs-emergency-proclamation-to-expedite-clean-energy-projects-and-relieve-demand-on-the-electrical-grid-during-extreme-weather-events-this-summer-as-climate-crisis-threatens-western-s/

[4] https://www.technologyreview.com/2021/07/14/1028461/solar-value-deflation-california-climate-change/

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the natural gas system, where feasible, could also be a lower cost option of transporting hydrogen compared to developing new hydrogen transmission and distribution infrastructure. With technological progress and sufficiently large, sustained, and localized demand, gas pipelines can be one of the most cost-effective long-term choices for hydrogen delivery."[5]

- Pipeline injection standards, even at less than 5-10% by volume, have the potential to rapidly scale renewable and clean hydrogen production and drive the cost-reductions needed to achieve cost-competitiveness with fossil fuels in many end-uses while aiding in additional reductions to existing natural gas end-uses.

In addition to these finite policies and in the examination of achieving carbon neutrality, it is our belief that the economics and environmental benefits of widespread hydrogen adoption will prove to be cost-effective. For example, in a cursory analysis of existing funding for hydrogen refueling it is apparent that the cost to convert every refueling station in California at current public grant levels is far more cost-effective than converting to charging. This is not to say California should pick one over the other, as we will need both to achieve carbon neutrality and decarbonization of the transportation sector. California, in this IEPR, should analyze the economics of scaling our energy and infrastructure to achieve carbon neutrality which far exceeds the goals of AB 32 and SB 32.

CHC would like to explore the role that state incentives can play in rapidly developing renewable and clean hydrogen incentives. In 2021, Assembly Member Rodriguez introduced AB 1312 which proposes a decade-long investment and production tax credit. CHC sponsored this legislative proposal and hired Capitol Matrix Consulting to perform an economic analysis. This analysis concludes, " Given the rapid progress made to date with respect to cost declines and capacity improvements in hydrogen fueling stations, we believe that a tax credit will be successful in attracting private investment, accelerating development of the infrastructure needed to grow the FCEV market and wean private investors off public subsidies altogether. Such an investment will have immediate economic impacts including thousands of good-paying jobs related to the construction, operations, and maintenance of the hydrogen fuel network. Just as importantly, it will provide the fueling infrastructure needed to give all Californians access to workable options as the state moves toward a zero-emissions transportation market." We have attached the bill and analysis for CEC's review.

Benefits of the Clean Transportation Plan

[5] Joint Application of Pacific Gas and Electric Company (U 29 G), Southwest Gas Corporation (U 905 G), Southern California Gas Company (U 904 G), and San Diego Gas & Electric Company (U 902 G) Regarding Hydrogen Related Additions or Revisions to the Standard Renewable Gas Interconnection Tariff

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Since the program's inception in 2008 and through its sunset in 2023, the Clean Transportation Program will have provided a total of $252 million for the development of predominately light-duty hydrogen fueling infrastructure.[6] This investment is a direct result of the 2013 reauthorization of the Clean Transportation Program which required 20% of program dollars be allocated "until there are at least 100 publicly available hydrogen-fueling stations in operation in California." Executive Order B-48-18 essentially increased that target to 200 fueling stations.

This has resulted in:

- $284M in private sector investment for the development of 179 hydrogen stations by 2027.[7]
    - Includes 13 stations to serve heavy-duty fuel cell electric vehicles by 2023.[8]
- A subsidy rate of 37% for hydrogen as opposed to 64% for charging.[9]
- Station costs have halved while station capacity has doubled.[10]
- With policy mechanisms like the Low Carbon Fuel Standard, 90% of hydrogen fuel dispensed today is renewable.[11]
- Fuel costs have decreased from $16 per kilogram in 2018 to as low as $12 per kilogram in 2020.
- Fifty-two percent of disadvantaged community residents live within a 15-minute drive of an open retail or planned station.[12]
- Hydrogen nozzles provide ten times the level of energy transfer per minute compared to the best DCFC connector at around 5% of the public cost per installed kW.
- Our first dedicated renewable hydrogen fuel production facility will open in 2022, providing 30 tons of fuel per day – an amount that can fuel 42,000 fuel cell vehicles.
- Hyundai increasing production volumes year over year. The 2021 Hyundai NEXO is being offered with a starting MSRP of $58,935 and are paired with generous incentives and a fuel card for up to $15,000 hydrogen fuel card.

[6] Page 3, Joint Agency Staff Report on Assembly Bill 8: 2020 Annual Assessment of Time and Cost Needed to Attain 100 Hydrogen Refueling Stations in California
[7] Williams, B, Capitol Matrix Consulting, June 2021, Analysis of Proposed Income Tax Credit for Hydrogen Fueling Infrastructure Development
[8] Page 3, Joint Agency Staff Report on Assembly Bill 8: 2020 Annual Assessment of Time and Cost Needed to Attain 100 Hydrogen Refueling Stations in California
[9] Williams, B, Capitol Matrix Consulting, June 2021, Analysis of Proposed Income Tax Credit for Hydrogen Fueling Infrastructure Development
[10] Williams, B, Capitol Matrix Consulting, June 2021, Analysis of Proposed Income Tax Credit for Hydrogen Fueling Infrastructure Development
[11] Page XXIV, 2020 Annual Evaluation of Fuel Cell Electric Vehicle Deployment & Hydrogen Fuel Station Network Development
[12] Page 1, Joint Agency Staff Report on Assembly Bill 8: 2020 Annual Assessment of Time and Cost Needed to Attain 100 Hydrogen Refueling Stations in California

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- Toyota increasing new vehicle production volumes ten-fold in 2021. The second-generation Toyota Mirais introduced in 2021 have a starting MSRP of $49,500 and are paired with generous incentives and a fuel card for up to $15,000.
- Toyota's first-generation Mirai fuel cell electric vehicles are available for approximately $16,000 including a fuel card up $15,000.
- Honda leasing its fuel cell electric vehicles for $379 a month.
- BMW introducing its hydrogen-fueled, sport-utility X5 in late 2022.

Due in large part to international climate agreements, support for the role of hydrogen in energy and transportation skyrocketed in 2020. Now more than 35 countries, all of them climate allies, have launched ambitious hydrogen programs centered around energy and transportation.

The California Energy Commission has provided a useful statistic for the Clean Transportation Program including the average rebate cost (cost to the public) per level 2 and DC fast chargers installed through the CALeVIP program. If we were to extend this calculation for hydrogen and compare levels of service the case for a statewide hydrogen network becomes more apparent. From this comparison we can conclude that *a hydrogen refueling nozzle provide ten times the level of energy transfer per minute compared to the best DCFC connector at around 5% of the public cost per kW.*

Per connector/nozzle kW comparison – Based on GFO-19-602 awarded stations.

- Level 2 Charger = 3.6kW-22kW[13]
- DC Fast Charger = 50kW-120kW per connector[14]
- Extreme Fast Charging = 150kW-350kW per connectors[15]
- Hydrogen Station = 3960 kW per nozzle
    - (33kWh/kg of H_2 * 120kg of H_2 per hour) = 3960 kW/nozzle

CEC CALeVIP per kW rebate cost for per charger plug[16]:

- Level 2 average rebate per kW= $586
- DCFC average rebate per kW = $1,292

CEC CTP per kW rebate cost per hydrogen nozzle:

[13] https://pluginamerica.org/dc-fast-charging-for-electric-vehicles/
[14] Page 3-4 https://avt.inl.gov/sites/default/files/pdf/presentations/INL_DCFastChargerInfrastructure.pdf
[15] Page 8 https://avt.inl.gov/sites/default/files/pdf/presentations/INL_DCFastChargerInfrastructure.pdf
[16] https://www.energy.ca.gov/programs-and-topics/programs/clean-transportation-program/california-electric-vehicle/calevip-0

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- H2 average rebate per kW = **$61**
    - GFO-19-602 award for 100 stations = $ 96,748,796
        - 4 nozzles per station* 100 stations = 400 nozzles
            - $96,748,796/200 nozzles = $241,872/nozzle
                - $241,872/3960kW = **$61/kW**

This becomes increasingly important as the discussion of utilization was introduced in the NREL analysis. While it appears as though utilization during the pandemic is down to 45% plateau for hydrogen stations this compares to 9.7%[17] for public level 2 chargers and 10.7% for DC fast chargers according to slide 8 of NREL's presentation. We share these numbers not to detract from the investments in charging but to highlight the benefits and relatively lower capacity costs that hydrogen refueling provides and that investment in building out a statewide network to self-sufficiency is an investment worth making.

Despite the later start with commercialization and delayed infrastructure funding, NREL still expects similar results from charging and hydrogen refueling when it comes to greenhouse gas reductions and petroleum reduction. This shows that while small today, the growth potential of hydrogen and pursuit of policy to unlock additional private sector investments in hydrogen will have tremendous benefits in the future. The time is now to double-down and layout a comprehensive hydrogen strategy inclusive of a statewide network of light and medium duty stations plus the foundation of a heavy-duty network. Policies that enable hydrogen production and storage while driving market competition to lower costs and increase supply should also be emphasized.

In Conclusion

Following announcements for substantial national and international investments in hydrogen production and infrastructure it is important to capitalize on the moment in California. CHC believes the moment to advance policies that further enables the development of hydrogen as a low to zero carbon energy carrier with zero carbon end uses like fuel cell electric vehicles is now. We are hopeful the CEC is willing to work with CHC to capitalize on the signals sent by the Governor's Executive Orders to advance hydrogen production and refueling to further enable zero emission vehicles and energy resilience. CHC is committed to working diligently with CEC staff to further refine our recommendations over the next few months and bring more investment to California's transforming transportation and energy markets.

We appreciate the opportunity to comment and we look forward to working closely with CEC staff to enable hydrogen throughout the economy. If there are any questions, please contact me at TCooke@BHFS.com or our government affairs representative at the Gualco Group Inc., Mikhael Skvarla at Mikhael_Skvarla@gualcogroup.com.

[17] Slide 8, NREL IEPR CTP Benefits Presentation

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Thank you,

/s/

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California Hydrogen Coalition

cc: Commissioners, California Energy Commission
Drew Bohen

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