



OPEN MEETING

REGULAR MEETING OF THE GOLDEN RAIN FOUNDATION MAINTENANCE AND CONSTRUCTION COMMITTEE

**Wednesday, December 8, 2021 – 9:30 AM
Hybrid – In Person and Zoom Meeting**

Laguna Woods Village owners/residents are welcome to participate in all open committee meetings and submit comments or questions regarding virtual meetings using one of two options:

1. Join the Committee meeting via a Zoom link at: <https://us06web.zoom.us/j/99465596924> or by calling 669-900-6833 Access Code: [99465596924](https://us06web.zoom.us/j/99465596924)
2. Via email to meeting@vmsinc.org any time before the meeting is scheduled to begin or during the meeting. Please use the name of the committee in the subject line of the email. Your name and unit number must be included.

NOTICE AND AGENDA *This Meeting May Be Recorded*

1. Call to Order / Establish Quorum
2. Acknowledgement of Media
3. Approval of the Agenda
4. ~~Approval of Meeting Report for October 13, 2021~~
5. Chair's Remarks
6. Member Comments
7. Department Head Update

Consent:

All matters listed under the Consent Calendar are considered routine and will be enacted by the Committee by one motion. In the event that an item is removed from the Consent Calendar by members of the Committee, such item(s) shall be the subject of further discussion and action by the Committee.

8. Project Log

Items for Discussion and Consideration:

9. Hydrogen - An Alternative to Fossil Fuels for Stationary Power (Presentation)
10. Additional Solar Lighting at Employee Parking Lot
11. Reconfiguration of Work Stations in Resident Services
12. Epoxy Line Remediation at the Golf Starter Building (Ian Barnette)

Future Agenda Items: *All matters listed under Future Agenda Items are items for a future Committee Meeting. No action will be taken by the Committee on these agenda items, at this meeting.*



- Broadband HVAC System

Concluding Business:

13. Committee Member Comments
14. Date of Next Meeting: February 9, 2022
15. Recess - *At this time the meeting will recess for a short break and reconvene to Closed Session to discuss the following matters.*

Closed Session Agenda

Approval of the Agenda

Chair's Remarks

Discuss and Consider Contractual Matters

16. Adjournment

*A quorum of the GRF Board or more, may also be present at the meeting.

Egon Garthoffner, Chair
Guy West, Staff Officer
Telephone: (949) 268-2380

GRF Project Log (November 2021) Prepared 12-2-2021

#	Type	Name	Description	Status	Estimated Completion	Budget
1	920 Projects	PAC Renovation Maintenance Upgrades	Funding for this project is allocated for the maintenance and safety upgrades at the Performing Arts Center. On June 22nd, the Corporate Members voted against completing the PAC maintenance improvements as submitted. A report to rescind the supplemental appropriation was approved on September 1, 2020.	<p>Work completed to date:</p> <ol style="list-style-type: none"> 1. PAC Theater Curtain Cleaning, Repairs and Fireproofing 2. PAC LED Lamp Conversion 3. PAC Lobby and Dining Room Improvements 4. PAC HVAC Replacement 5. Hearing Loop <p>Remaining work:</p> <ol style="list-style-type: none"> 1. PAC HVAC UVC Lighting System 2. PAC Dining Room Kitchens, Billiards Room and Rehearsal Room Improvements 3. PAC Dining Room Curtains 	On-going	Budget: \$1,000,000 Exp: \$656,092 Balance: \$343,908
2	920 Projects	PAC HVAC UVC Lighting System	Funding for this project is allocated to install a total of 11 new UVC Lighting Systems to serve the DX air handlers.	The new UVC lighting equipment has been ordered; however, there is a product shortage which has caused this project to be delayed. The contractor is unable to provide a delivery and installation date at this time.	December	Change Order Budget: \$21,548 Exp: \$0 Balance: \$21,548
3	920 Projects	PAC Dining Room Kitchens, Billiards Room and Rehearsal Room Improvements	Funding for this project is allocated for improvements to install new commercial grade flooring, ceiling tiles, baseboards, wall carpet, chair rails, window film, chair upholstery, as well as painting the walls, ceiling grid, doors and casing in the billiards room, rehearsal room and two kitchens.	Staff was directed to prepare a scope of work and obtain a cost estimate for the items identified during the scheduled site tour of the facility conducted on September 17, 2021. Staff has prepared an award of contract for construction to be presented at the December 8, 2021 Maintenance and Construction Committee meeting.	November	Budget: \$88,188 Exp: \$0 Balance: \$88,188
4	920 Projects	PAC Dining Room Curtains	Funding for this project is allocated to install new curtains in the PAC dining rooms.	The contract has been prepared and once it is fully executed, staff will provide a notice to proceed and schedule the work accordingly.	December	Budget: \$15,960 Exp: \$0 Balance: \$15,960

5	920 Projects	Service Center Generator	Funding for this project will provide back up emergency power at the Service Center including Security, Transportation and fueling services to enable the provision of critical services in an emergency.	At the February 10th M&C Committee meeting, the project was placed on hold pending a microgrid analysis. The Committee is working with General Services to review the maintenance records and will provide staff with further direction.	2022	Budget: \$150,000 Exp: \$0 Balance: \$150,000
6	920 Projects	Community Center First Floor Renovation Project	Funding for this project is allocated for the reconfiguration of Resident Services located in the Community Center.	Space planning options will be considered and discussed at a future M&C Committee meeting.	2022	Revised Budget: \$150,000 Exp: \$7,223 Balance: \$142,777
7	920 Projects	Gate 16 Driving Range Improvements	Funding for this project is allocated to upgrade and improve the appearance and functionality of the golf driving range and practice area.	Per the Committee's direction, staff prepared a limited scope of work to amend the existing soils and plant new turf at the golf driving range. The draft RFP has been presented to the Committee for review and comment. Once all comments are received, staff will revise the RFP accordingly and advertise for contractor bids.	2022	Budget #1: \$138,000 Budget #2: \$500,000 Exp: \$61,192 Balance: \$438,808
8	920 Projects	Maintenance Service Center Parking Lot Lighting	Funding for this project is allocated to install permanent lights in the Maintenance Service Center parking lot for staff safety.	The installation of one pilot light pole at the Maintenance Service Center parking lot was completed on March 5, 2021. Staff is preparing lighting options and estimates for Committee review and consideration.	2022	Budget: \$250,000 Exp: \$10,496 Balance: \$239,504
9	922 Projects	Broadband HVAC System	Funding for this project is allocated to the installation of five new HVAC units to replace the existing 17 year old HVAC system at the Broadband Building Data Center.	This project will be reviewed for potential energy saving solutions and further analysis and presented at a future M&C Committee meeting.	2022	Budget: \$300,000 Exp: \$0 Balance: \$300,000
10	920 Projects	Replace Welding Shop	Funding for this project is allocated to replace the existing Welding Shop with a pre-engineered metal building.	The design phase of the project was completed in 2020. The project was put on hold pending the Committee's review. Staff has been directed to prepare and advertise an RFP for contractor bids. The RFP is scheduled to be advertised late November.	2022	Budget: \$275,000 Exp: \$0 Balance: \$275,000

11	924 Projects	Building E Assessment and Design Development	Funding for this project is allocated to provide an assessment of the work needed on the building and develop a design based on the assessment.	Staff was directed by the M&C Committee to advertise an RFP for a feasibility study to determine the most economical option for a building replacement. The M&C Committee assembled a selection panel and consultant interviews were conducted on November 19, 2021. Staff has prepared an award of contract for an architect consultant to be presented at the December 8, 2021, Maintenance and Construction Committee meeting.	2022	Budget: \$50,000 Exp: \$0 Balance: \$50,000
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Completed Projects/Programs

	920 Projects	Gymnasium Wall Padding	Funding for this project is allocated to replace existing gymnasium wall padding and to install additional wall padding to increase the safety during game play.	COMPLETED	February 2021	Budget: \$45,000 Exp: \$39,954 Balance: \$5,046
	920 Projects	Clubhouse 2 Lawn Bowling Re-Roof	Funding for this project is allocated to replace the existing flat roof hot tar built up roof at the Clubhouse 2 Lawn Bowling building with a PVC cool roof system.	COMPLETED	April 2022	Budget: \$30,000 Exp: \$25,259 Balance: \$4,741
	920 Projects	PAC Theater Curtain Cleaning, Repairs and Fireproofing	Funding for this project is allocated to clean, apply new fire retardant, and make minor repairs to the theater curtains as needed.	COMPLETED	May 2021	Contract Budget: \$20,978 Exp: \$20,978 Balance: \$0
		PAC Lightbulb Conversion to LED	Funding for this project is allocated to replace the incandescent lightbulbs with LED lightbulbs throughout the entire Performing Arts Center.	COMPLETED Approved change orders are for repair work not included in the original scope.	June 2021	Contract Budget: \$57,948 Exp: \$36,453 CO #1: \$6,145 CO #2: \$15,350 Balance: \$0
	920 Projects	PAC Dining Room and Lobby Upgrades	Funding for this project is allocated to paint walls and clean lobby carpets, as well as to install new flooring, wall carpet, acoustic ceiling tiles and paint in both dining rooms.	COMPLETED	September 2021	Contract Budget: \$113,816 Exp: \$109,312 Balance: \$4,504

	920 Projects	PAC HVAC Replacement	Funding for this project is allocated to replace existing HVAC system components and install ion generator filtration.	COMPLETED	September 2021	Contract Budget: \$515,406 Exp: \$445,865 Balance: \$69,541
	920 Projects	PAC Hearing Loop and Installation	Funding for this project is allocated to install a new hearing loop sound system in the PAC Theater.	COMPLETED	October	Budget: \$11,552 Exp: \$11,552 Balance: \$0
	925 Projects	Senate Bill 326 Load Bearing Component Inspections	Funding for this program is allocated to conduct an assessment for inspection and testing of exterior elevated elements, defined as the load-bearing components and associated waterproofing systems in all buildings and facilities within the community.	COMPLETED Staff received correspondence from legal counsel indicating the inspection requirements outlined in the legislation are not applicable to GRF. Funding for this project may be returned to the Reserves Fund pending Board direction.	NA	Budget: \$50,000 Exp: \$0 Balance: \$50,000
	920 Projects	GRF Paving & Sealcoat Programs and Concrete Repairs	Funding for this project is allocated to asphalt paving overlay, sealcoat work and concrete repairs adjacent to the overlay work on selected GRF streets and/or parking lot areas.	COMPLETED	September 2021	Budget: \$879,069 Exp: \$661,007 Balance: \$18,062

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Do we Really Need Hydrogen?

Jack Brouwer

December 8, 2021



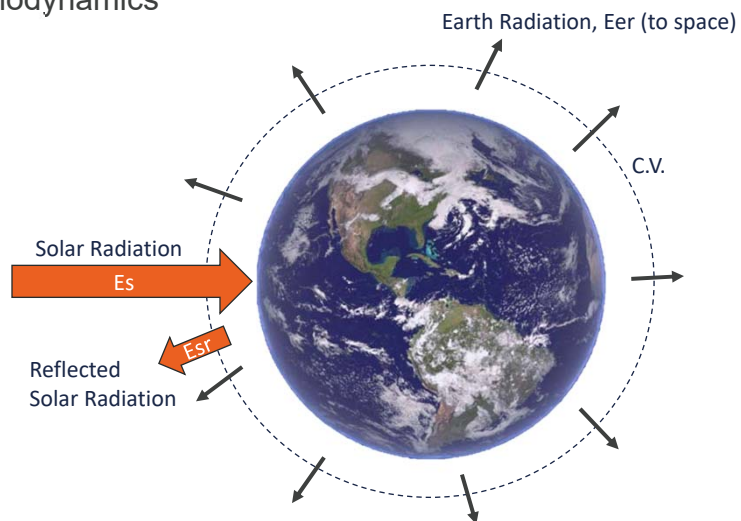
from: San Diego Union Tribune

Laguna Woods

1

Earth Energy Balance

- First Law of Thermodynamics



$$\Delta E_{\text{earth}} = E_s - E_{sr} - E_{er}$$

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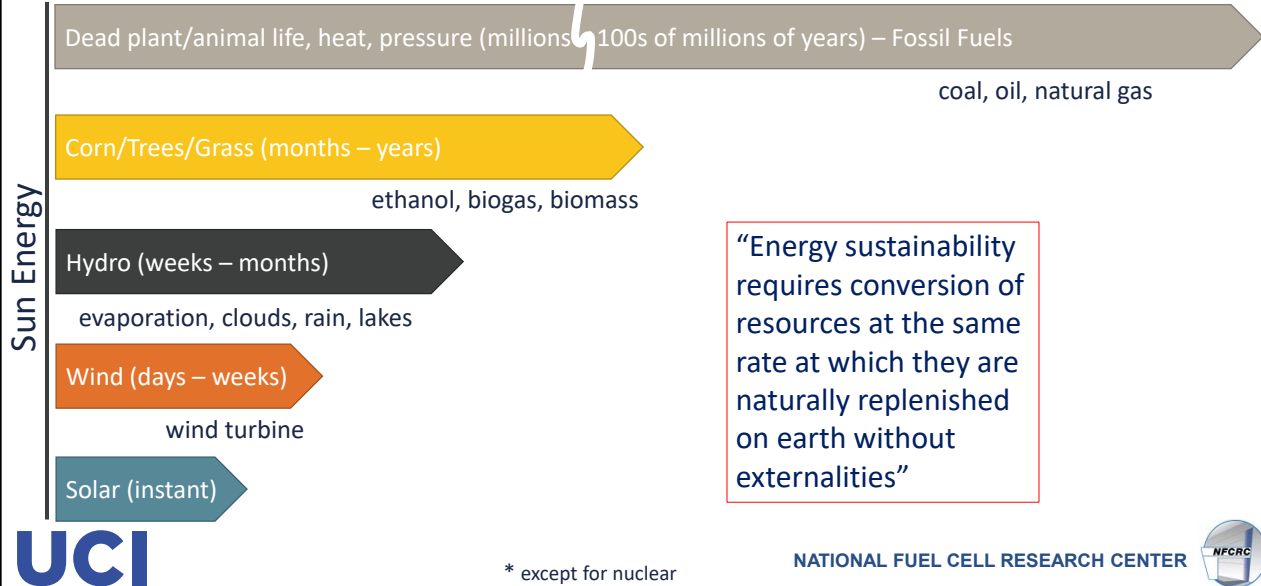


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2

Primary Energy on Earth

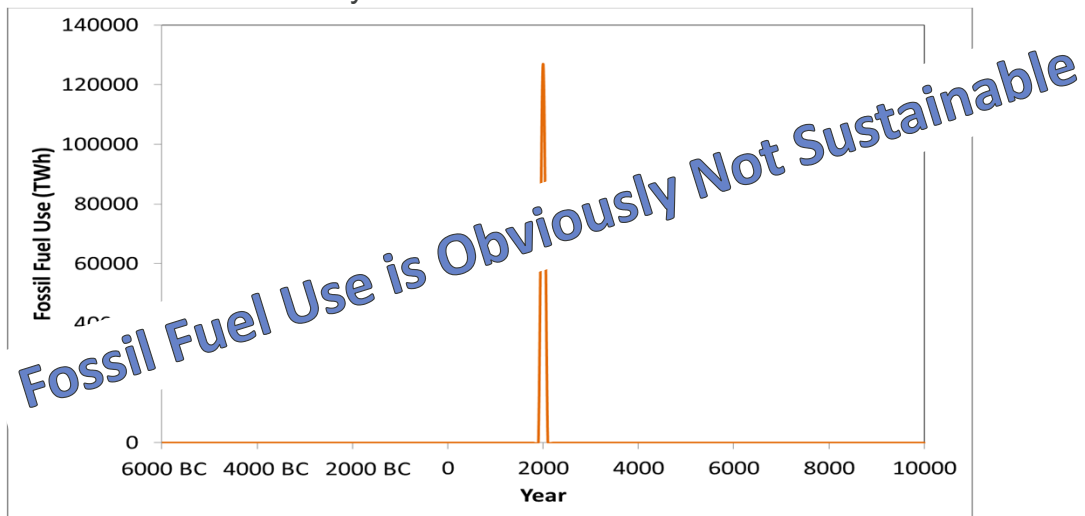
All from the Sun!*



3

Energy on Earth

Current Practices are Obviously not Sustainable



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4

Not Just Renewable – Zero Externalities

Energy Conversion has improved quality of life, but, unfortunately also is the most significant cause of environmental and geopolitical problems (externalities)

- Criteria Pollutant Emissions
 - Acid Rain
 - Particulate Matter
 - Volatile Organic Compounds
 - Nitrogen and Sulfur Oxides
 - Carbon Monoxide
 - ...
- Greenhouse Gas Emissions
 - Carbon dioxide, methane, nitrous oxide, ...
- Resource recovery damage (e.g., mines)
- Regional resource depletion – geopolitical dependencies
 - Energy & Environmental Justice not well served by current paradigm
- Overall primary energy resource depletion – not sustainable

Serious Health
and Air Quality
Consequences



Los Angeles



Beijing

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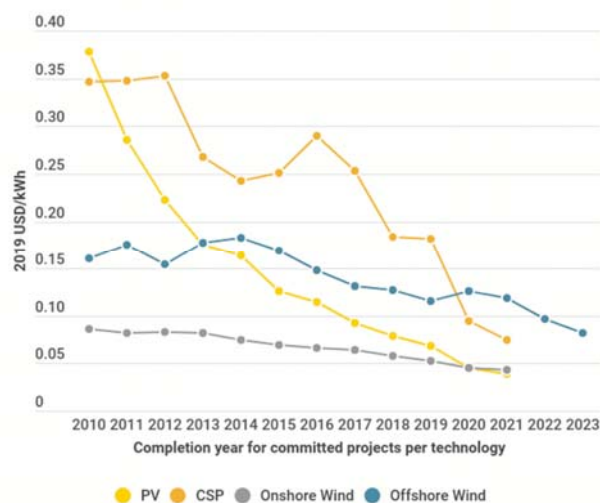
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Renewable Energy Conversion (Solar & Wind)

Good News! Solar & wind power, (and battery) costs have dramatically fallen



From: IRENA,
www.irena.org/newsroom/p/ressreleases/2020/Jun,
2020

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Popular Thinking & Arguments

Main Strategy:

- 100% renewable (solar, wind, geothermal, ...) power generation
- Electrify ~~all~~ end-uses **some**
- Use batteries to handle **some** intermittency on grid & for **some** end-uses



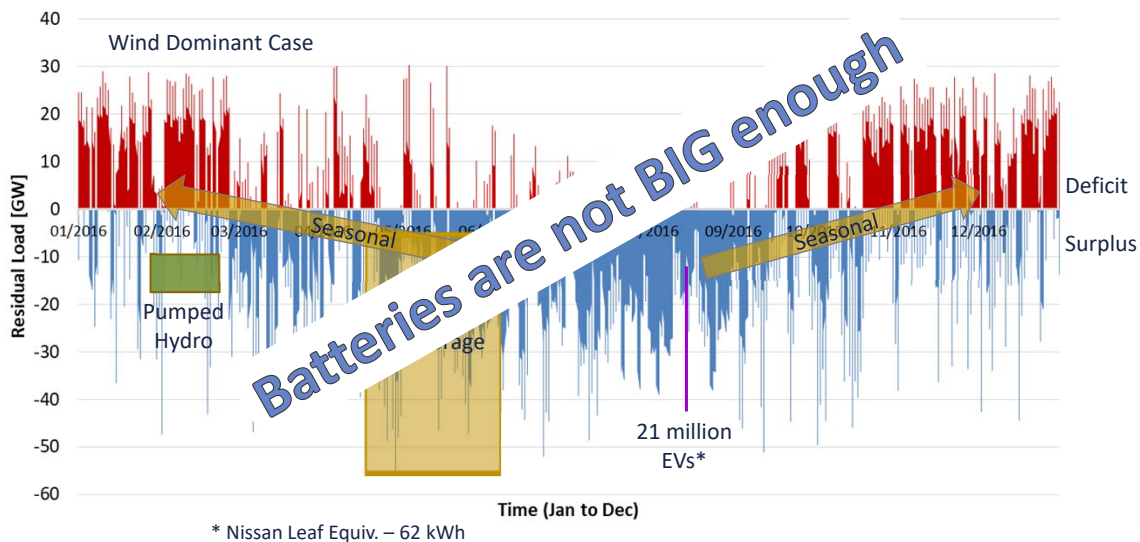
Arguments against hydrogen & fuel cells:

- Most hydrogen today is made from fossil fuels (natural gas)
- Making hydrogen from water & electricity is less efficient than charging a battery
- Making electricity from hydrogen in a fuel cell is less efficient than a battery (i.e., round-trip efficiency is lower than a battery **except for long duration storage!**)
- Hydrogen is difficult to store and move around in society **compared to fossil fuels!**

I agree with most of this!
Subtly untruthful - Not the whole story

7

Amount of Storage Required for 100% Renewable – CA



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Saeedmanesh, A. Mac Kinnon, M. Brouwer, J.,
 Current Opinion in Electrochemistry, Vol. 12,
 pp. 166-181, 2018

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8

Energy Storage Need - World

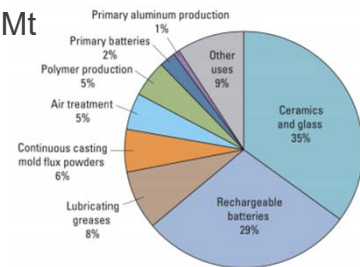
Simulate meeting of total world energy demand w/ Solar & Wind

	Solar contribution	Wind contribution	Consumption and storage ratio	Consumption (TWh)	Storage (TWh)
Africa	0.70	0.30	8.39	9	1,088
America	0.45	0.55	7.83		4,919
Asia	0.50	0.50	7.95		10,178
Europe	0.30	0.70	7.50		3,592
Oceania	0.50	0.50			205
TOTAL					19,981 TWh

J. Thesis, 2018]

Co: 25,815 Mt

- To build one Li-ion battery
- World Li resources
- World Co resources (total), 120 Mt (ocean floor)
- > 60% of Co comes from Democratic Republic of Congo



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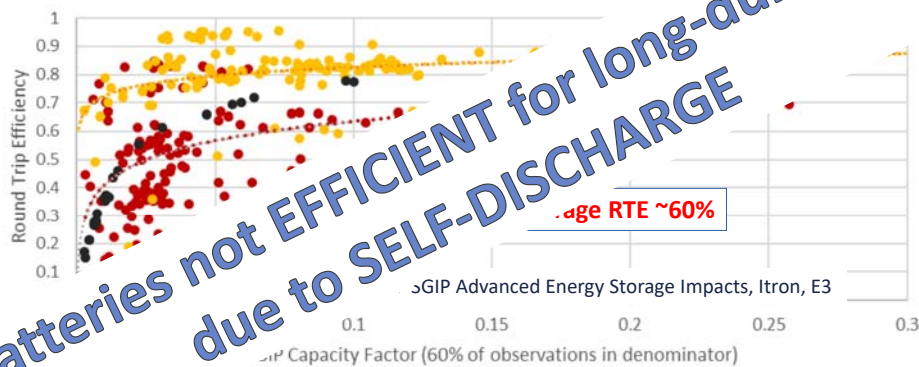
Source: U.S. Geological Survey, 2018

9

Lithium-Ion Battery Measured Performance

Round-Trip Efficiency (>90% in Laboratory Testing)

- Measured battery system performance in Utility Application



- Self-Discharge (the main culprit), plus cooling, transforming, inverting/converting, ...

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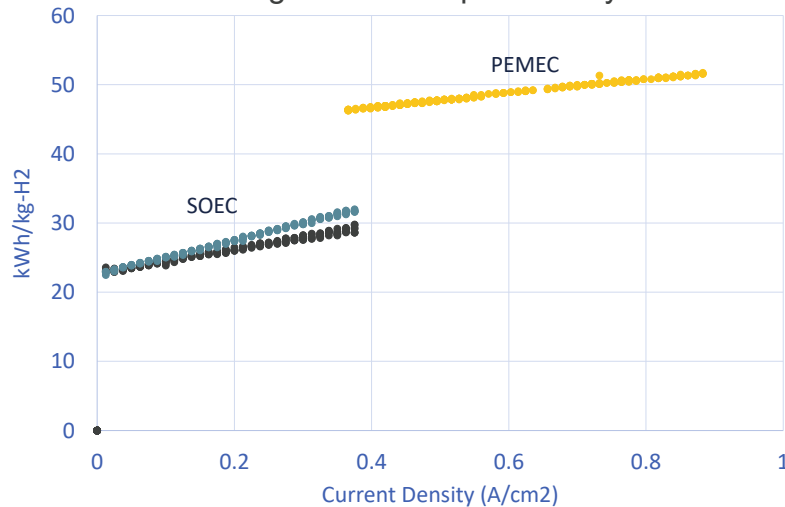
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Solid Oxide Electrolyzers & Fuel Cells

- Can achieve much higher round-trip efficiency



- 0% CO₂ - 10% H₂
- 60% CO₂ - 10% H₂
- PEMEC



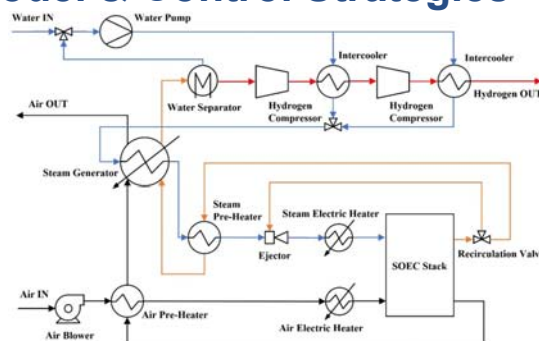
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- Future round trip efficiency of hydrogen energy storage will be higher



11

SOEC System Model & Control Strategies



Controlled Parameter	Manipulated Variable	Controller Type
Stack Average Temperature	Air Electric Heater Power	PI Feedback Loop Controller
Stack Temperature Gradient	Blower Power	PI Feedback Loop Controller
H ₂ at Cathode Inlet	Valve Position	PI Feedback Loop Controller
Steam Utilization	Water Pump power	Feedforward Controller
Power Demand	Current	Feedforward Controller

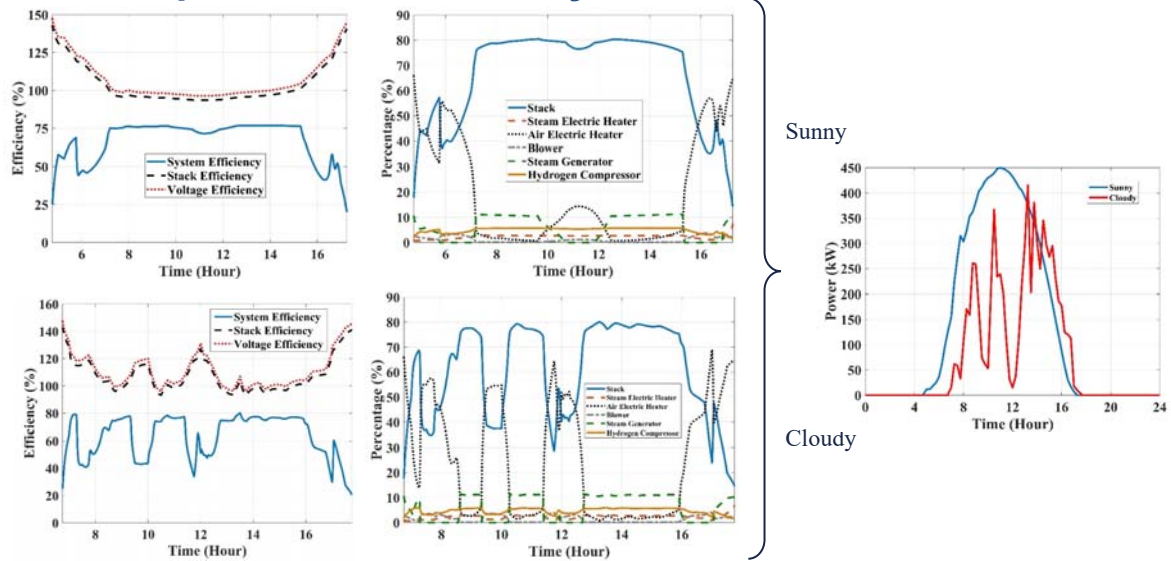
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Saeedmanesh, A., Colombo, P., McLarty, D. and Brouwer, J., *Journal of Electrochemical Energy Conversion and Storage*, 2019.



12

Dynamic Operation of SOEC System



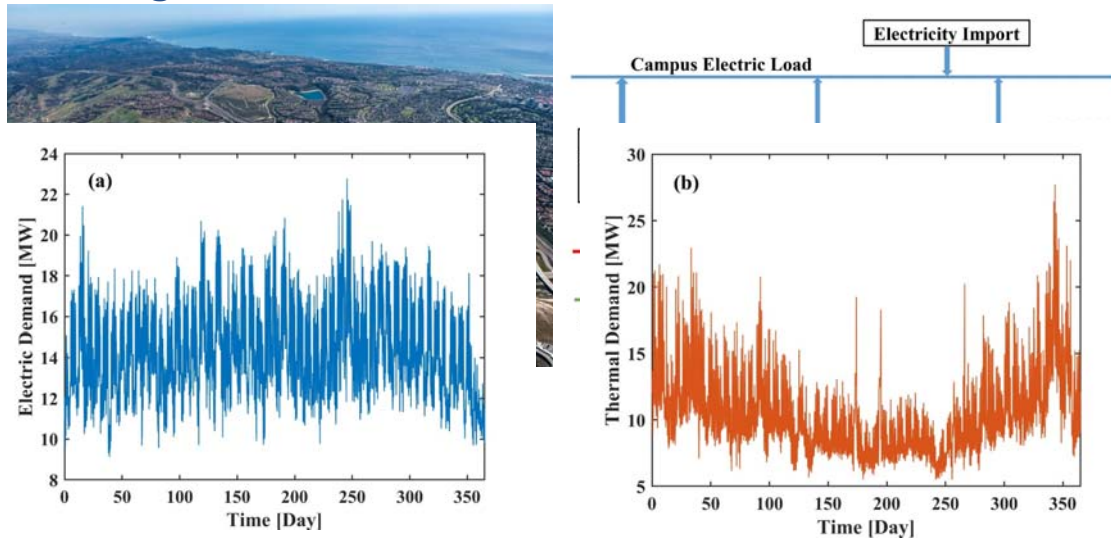
UCI

Saeedmanesh, A., Colombo, P., McLarty, D. and Brouwer, J., *Journal of Electrochemical Energy Conversion and Storage*, 2019.



13

UCI Microgrid Simulation



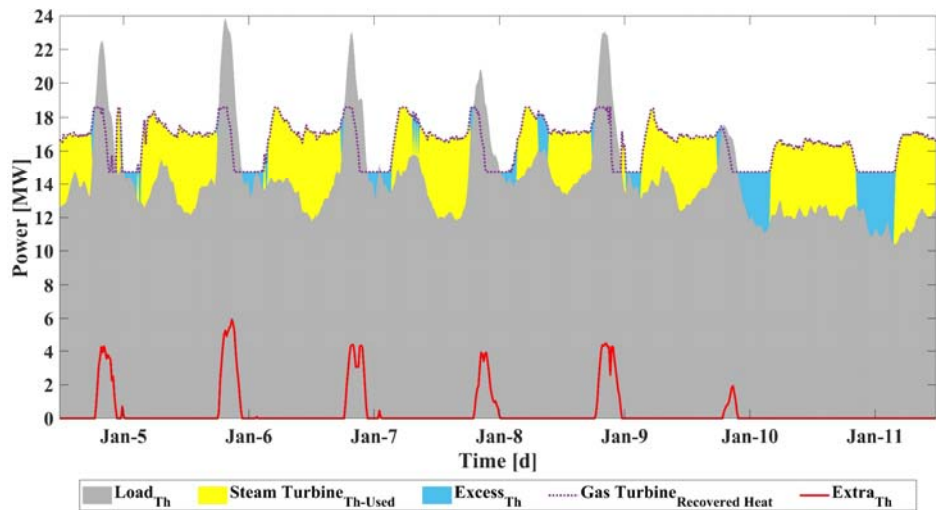
UCI

Colombo, P., Saeedmanesh, A., Santarelli, M. and Brouwer, J., *Energy Conversion and Management*, 2019.



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UCI Microgrid Results in High Renewable Use Cases



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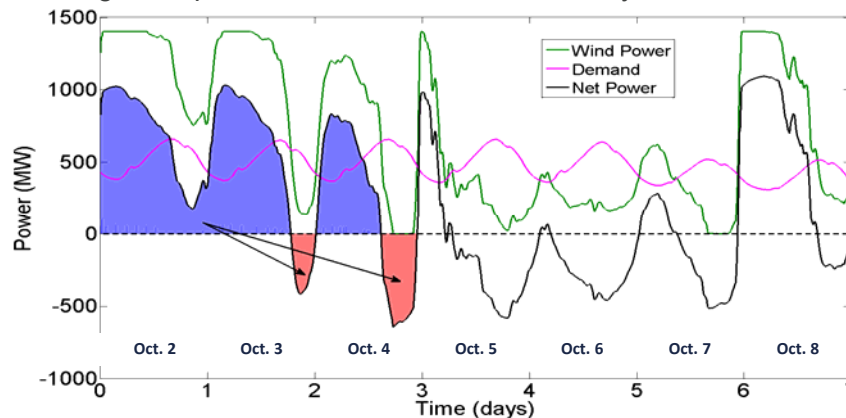
Colombo, P., Saeedmanesh, A., Santarelli, M. and Brouwer, J., *Energy Conversion and Management*, 2019.



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Hydrogen Energy Storage Dynamics

- Hydrogen Storage complements Texas Wind & Power Dynamics



- Load shifting from high wind days to low wind days
- Hydrogen stored in adjacent salt cavern

Maton, J.P., Zhao, L., Brouwer, J., *Int'l Journal of Hydrogen Energy*, Vol. 38, pp. 7867-7880, 2013

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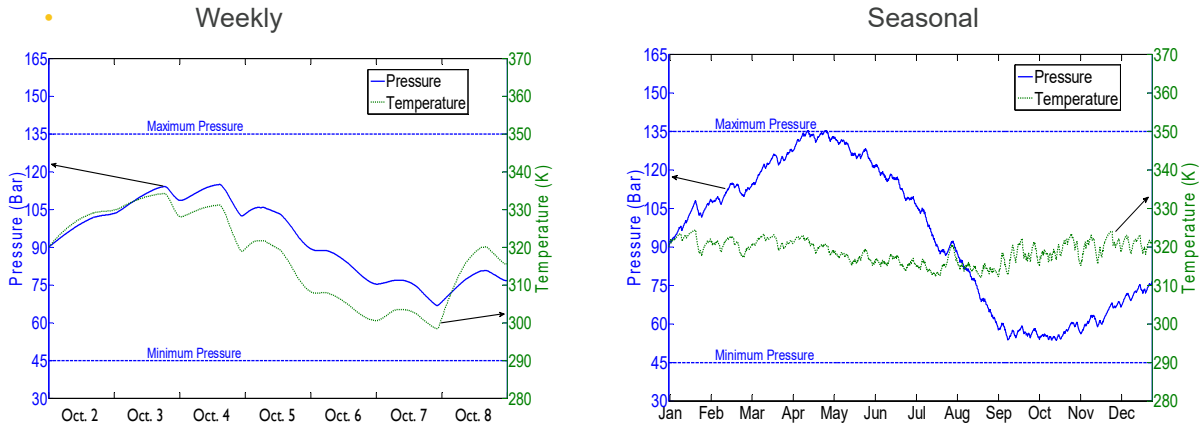
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Hydrogen Energy Storage Dynamics

- Weekly and seasonal storage w/ H₂, fuel cells, electrolyzers



But what can we do if we don't have a salt cavern?

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Maton, J.P., Zhao, L., Brouwer, J., *Int'l Journal of Hydrogen Energy*, Vol. 38, pp. 7867-7880, 2013

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17

Resilient Storage & Transmission/Distribution

- Natural Gas Transmission, Distribution & Storage System

> 99.999% available

Gas Technology Institute, Assessment of Natural Gas ... Service Reliability, 2018.

	Annual Tuition & Fees	Total OC Population	4 years for entire population
U.C. Irvine	\$ 17,331	2,246,000	\$39 billion

	Average Annual Tuition & Fees	Total Student Population	4 years for entire population
All University of California Schools	\$ 17,800	265,000	\$4.7 billion

Carmona, Adrian, M.S. Thesis Project, UC Irvine, J. Brouwer advisor, 2014.

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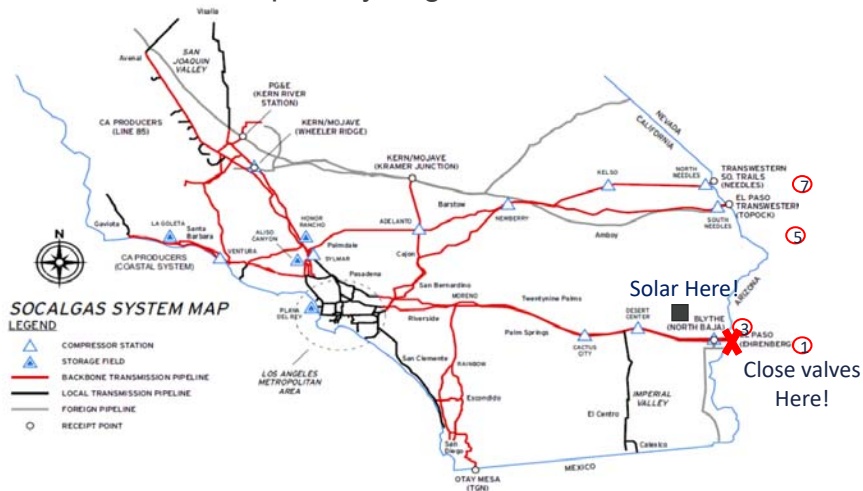
Demonstrated Resilience of Fuel Cells and Gas System



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Gas System – MASSIVE Resource for Zero Emissions

- First mix up to X% – ADD grid renewables & transportation electrification
- Then piecewise conversion to pure hydrogen



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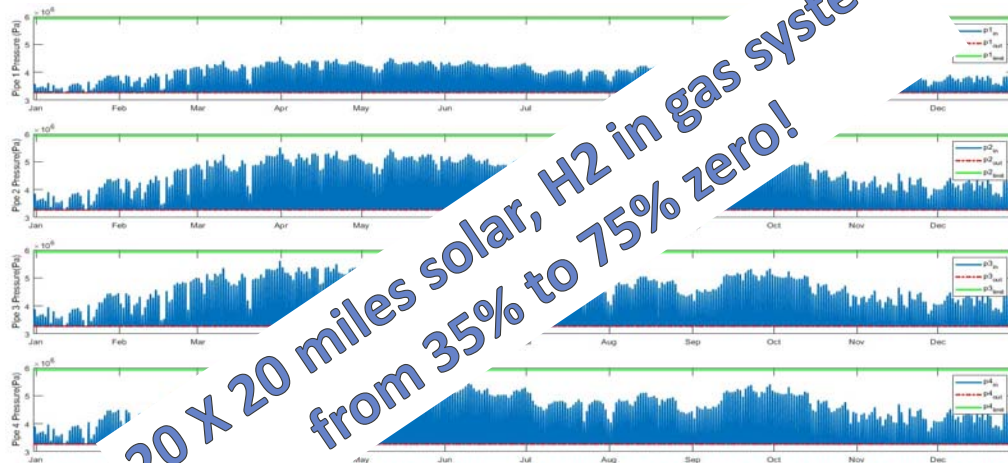
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Gas System – MASSIVE Resource for Zero Emissions

- 40% of all electric demand – 20 sq. miles of solar, only gas system use for H₂ storage AND all T&D



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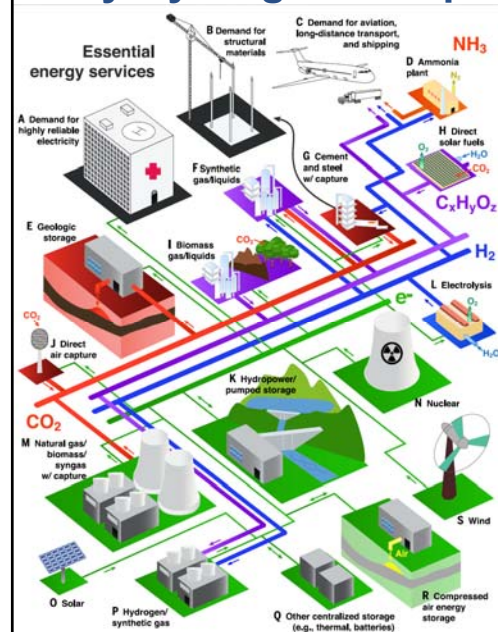
Heydarzadeh, Zahra, PhD Dissertation,
UC Irvine, J. Brouwer advisor, 2020.

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21

Why Hydrogen? Required for completely zero emissions



REVIEW SUMMARY

ENERGY

Net-zero emissions energy systems

Steven J. Davis*, Nathan S. Lewis*, Matthew Shaner, Sonia Aggarwal, Doug Arent, Inês L. Azevedo, Sally M. Benson, Thomas Bradley, Jack Brouwer, Yet-Ming Chiang, Christopher T. M. Clack, Armond Cohen, Stephen Doig, Jae Edmonds, Paul Fennell, Christopher B. Field, Bryan Hannegan, Bri-Mathias Hodge, Martin I. Hoffert, Eric Ingersoll, Paulina Jaramillo, Klaus S. Lackner, Katharine J. Mach, Michael Mastrandrea, Joan Ogden, Per F. Peterson, Daniel L. Sanchez, Daniel Sperling, Joseph Stagner, Jessika E. Trancik, Chi-Jen Yang, Ken Caldeira*

Davis et al., *Science* **360**, 1419 (2018) 29 June 2018

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Why Hydrogen? Zero Emission Fuels Required

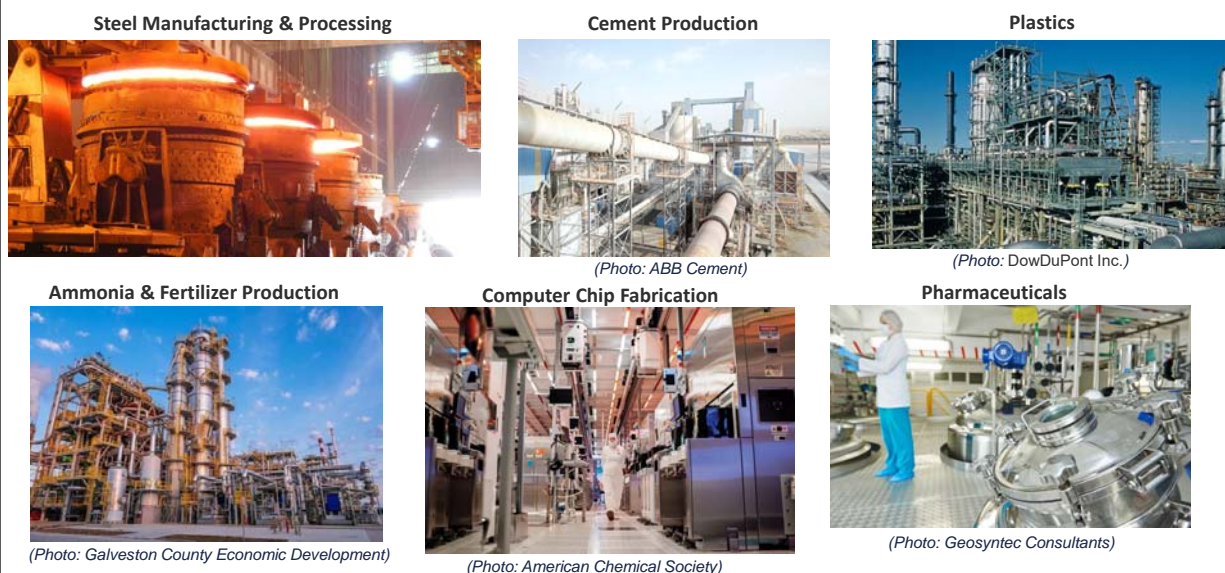
- Provide zero emissions fuel to difficult end-uses



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Why Hydrogen? Industry Requirements for Heat, Feedstock,

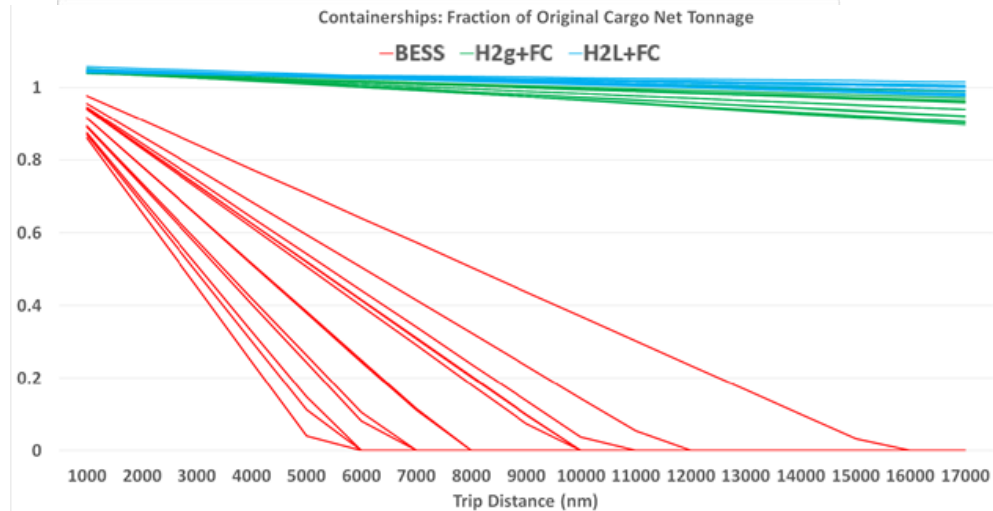
- Many examples of applications that cannot be electrified



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Gedanken Exp.: Can LA/LB Port become Zero Emissions?

Batteries compared to Hydrogen & Fuel Cells for Container Ships



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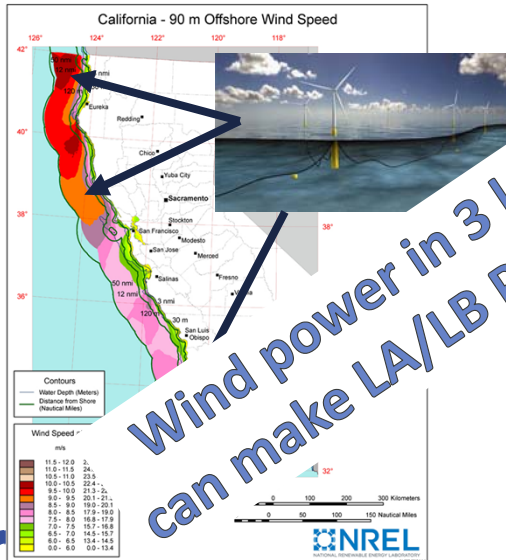
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Gedanken Exp.: Can LA/LB Port become Zero Emissions?

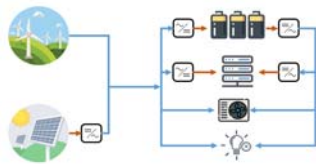
All ships, trains, & trucks through LA/LB Port: 8.89M tons



Gedanken Exp.: Can Data Centers become Zero Emissions?

Data Center Configurations/Locations Modeled

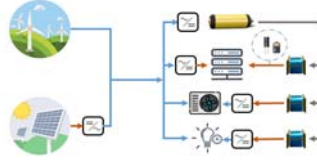
Battery - Central Storage



Data Center powered directly from renewable generators when available. Excess of electricity stored in batteries.

Wyoming
Iowa
Virginia
Texas

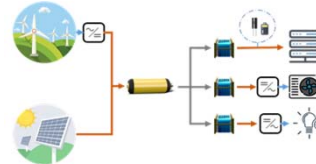
Excess power to gas



Data Center powered directly from renewable generators when available. Excess of electricity converted to hydrogen and used when required.

Wyoming
Iowa
Virginia
Texas

Power to gas



All renewable electricity generation converted to hydrogen. Data Center powered from hydrogen.

Wyoming
Iowa
Virginia
Texas

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Gedanken Exp.: Can Data Centers become Zero Emissions?

Excess P2G & Battery Cases – Wyoming (optimal wind)

	Hydrogen Case					Battery Case		
	Wind Onshore	Solar PV	Electrolysis	Compressor	Storage	Wind onshore	Solar PV	Battery
Wind Onshore	48	271				31	177	21,781
Solar PV								
Electrolysis								
Compressor								
Storage								
Wind Onshore	0.43					0.28	0.78	306.5
Solar PV								
Electrolysis								
Compressor								
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Hydrogen is Essential for Sustainability

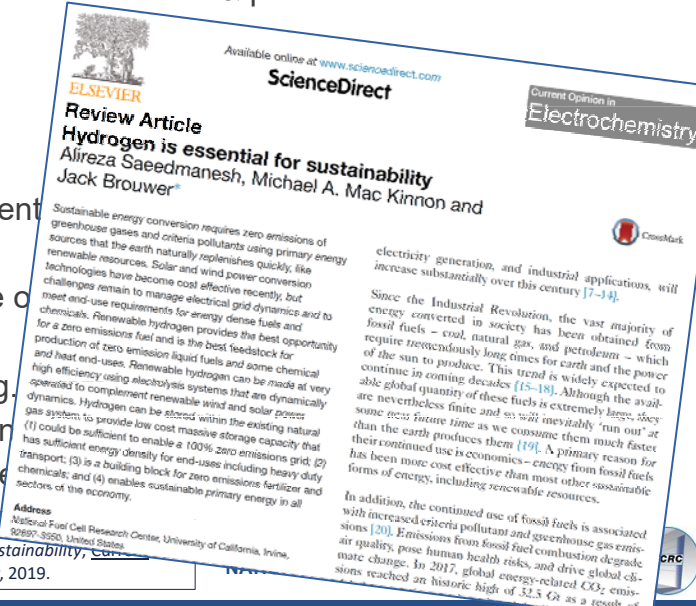
Hydrogen: 11 features required for 100% zero carbon & pollutant emissions

- Massive energy storage potential
- Rapid vehicle fueling
- Long vehicle range
- Heavy vehicle/ship/train payload
- Seasonal (long duration) storage potential
- Sufficient raw materials on earth
- Water naturally recycled in short time
- Feedstock for industry heat
- Feedstock for industry chemicals (e.g. ammonia)
- Pre-cursor for high energy density renewable fuels
- Re-use of existing infrastructure (low cost)

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Saeedmanesh, A., Mac Kinnon

Hydrogen is Essential for Sustainability, *Current Opinion in Electrochemistry*, 2019.



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Europe, China, Japan, Australia, ... ahead of U.S. (for now)

- Example: German National Hydrogen Strategy
- Announced: June, 2020

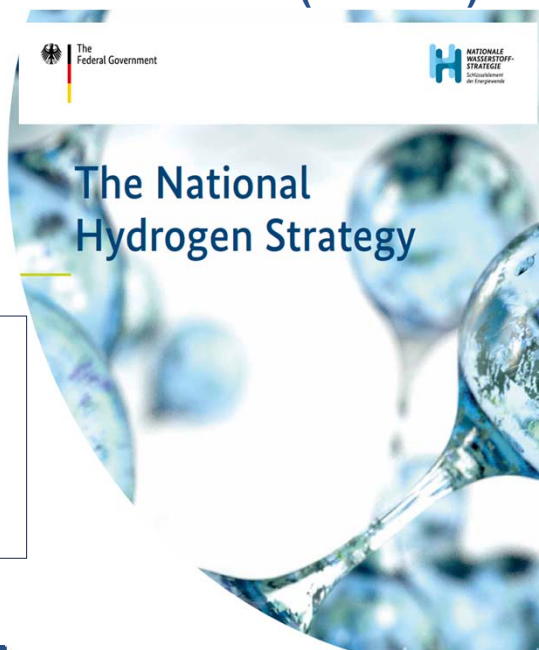
Description:

- German Government will invest 9 billion euros
- National strategy will invest in 38 specific measures in 10 hydrogen topics

Hydrogen Economy as part of European Union Recovery and Stability Plan, "Green Deal", and "Just Transition"

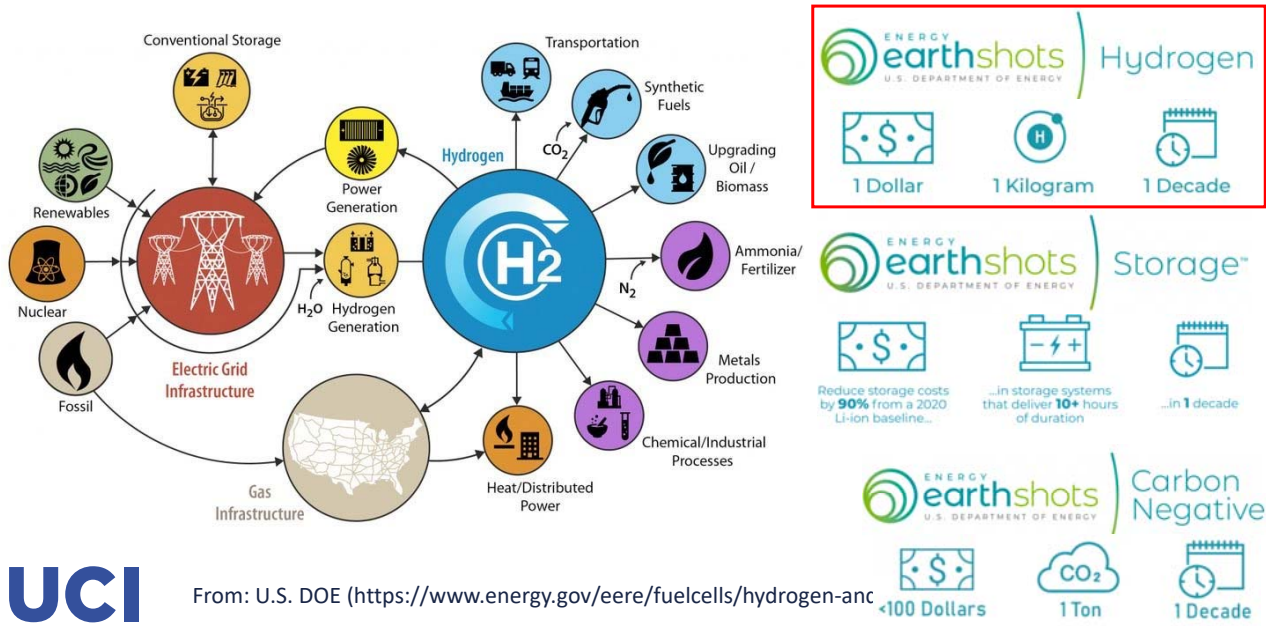
- 34 billion euros committed in "Recovery" plan
- Expected to double with "Green Deal" and "Just Transition" finalization

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U.S. DOE's H2@Scale & Hydrogen Energy Earthshot



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Infrastructure Bill Language on Hydrogen Hubs – Subtitle B:

23 "SEC. 818. REGIONAL CLEAN HYDROGEN HUBS.

24 "(a) DEFINITION OF REGIONAL CLEAN HYDROGEN

25 HUB.—In this section, the term 'regional clean hydrogen

1 hub' means a network of clean hydrogen producers, poten-

2 tial clean hydrogen consumers, and connective infrastruc-

3 ture located in close proximity.

4 "(b) ESTABLISHMENT OF PROGRAM.—The Secretary

5 shall establish a program to support the development of at

6 least 4 regional clean hydrogen hubs that—

7 "(1) demonstrably aid the achievement of the

8 clean hydrogen production standard developed under

9 section 822(a);

10 "(2) demonstrate the production, processing, de-

11 livery, storage, and end-use of clean hydrogen; and

12 "(3) can be developed into a national clean hy-

13 drogen network to facilitate a clean hydrogen econ-

14 omy.

15 "(c) SELECTION OF REGIONAL CLEAN HYDROGEN

16 HUBS.—

17 "(1) SOLICITATION OF PROPOSALS.—Not later

18 than 180 days after the date of enactment of the In-

19 frastructure Investment and Jobs Act, the Secretary

20 shall solicit proposals for regional clean hydrogen

21 hubs.

22 "(2) SELECTION OF HUBS.—Not later than 1

23 year after the deadline for the submission of proposals

24 under paragraph (1), the Secretary shall select at

1 least 4 regional clean hydrogen hubs to be developed

2 under subsection (b).

(4) FUNDING OF REGIONAL CLEAN HYDROGEN HUBS.—The Secretary may make grants to each regional clean hydrogen hub selected under paragraph (2) to accelerate commercialization of, and demonstrate the production, processing, delivery, storage, and end-use of, clean hydrogen.

(d) AUTHORIZATION OF APPROPRIATIONS.—There is authorized to be appropriated to the Secretary to carry out this section \$8,000,000,000 for the period of fiscal years 2022 through 2026.

"At least 4 hubs" – rumor is that 3 are probably "already promised" (to WV, TX, CA).

It might be even 6-8 hubs. Funding is \$8,000,000,000 (a.k.a. billion) over a 5-year period.

Geographic diversity is an important criteria: understanding of what is "regional" vary.

DOE is likely to choose National Laboratories to lead (NETL, INL, NREL, probably LBL).

Strong role for the industry; public/private partnerships.

Industry/consortia lead is not excluded. University lead is unlikely.

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Summary


- We must and will inevitably increasingly depend upon solar power and its more direct derivatives (e.g., wind)
 - Air quality
 - Greenhouse gas emissions & climate
 - Energy, environment, & geopolitical sustainability
 - Environmental Justice
- The DYNAMICS of such a future are challenging – require complementary dispatch, massive storage, and seasonal storage
 - Batteries, hydro, power-to-gas (P2G), hydrogen energy storage (HES)
- P2G & HES will become the indispensable zero emissions fuel and energy storage medium to enable this future
 - Long duration energy storage
 - Massive energy storage amount
 - Hydrogen & its derivative fuels
 - Will be lower cost (separate power/energy scaling)
 - High round-trip efficiency possible



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Jack Brouwer

December 8, 2021

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Do we Really Need Hydrogen?



from: San Diego Union Tribune

Laguna Woods

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