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# **Hydrogen As An Energy Carrier Technologies Systems Economy By Carl Jochen Winter Joachim Nitsch**

HYDROGEN FRAMES. H<sub>2</sub>B<sub>2</sub> SYSTEMS BASED ON  
ELECTROLYZERS FOR HYDROGEN PRODUCTION.

HYDROGEN AND ALTERNATIVE ENERGY VECTORS

EPSRC WEBSITE. HYDROGEN AS AN ENERGY CARRIER

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IS AN EARLY ADOPTER OF HYDROGEN ENERGY.  
HYDROGEN FUELS AMP TECHNOLOGIES IEA.  
HYDROGEN AS AN ENERGY CARRIER WHAT IT IS AND  
WHY IT. HYDROGEN AMP FUEL CELLS RENEWABLE  
ENERGY WORLD. HYDROGEN ENERGY SYSTEMS  
STUDIES JOAN M OGDEN ABSTRACT. SOLAR  
HYDROGEN ENERGY SYSTEM THE CHOICE OF THE  
FUTURE. HYDROGEN AS AN ENERGY CARRIER BOOK  
OSTI GOV. HYDROGEN FROM RENEWABLES IN AUSTRIA  
AN ENERGY CARRIER OF. FORMIC ACID AS A  
HYDROGEN ENERGY CARRIER ACS ENERGY LETTERS.  
HYDROGEN AS AN ENERGY CARRIER TECHNOLOGIES  
SYSTEMS. HYDROGEN THE ENERGY CARRIER OF THE  
FUTURE ENERGY. GENERATION OF THE ENERGY  
CARRIER HYDROGEN IN CONTEXT WITH. 3 7 HYDROGEN

CODES AND STANDARDS ENERGY GOV. THE

PROSPECTS FOR HYDROGEN AS AN ENERGY CARRIER

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WITH HYDROGEN AS AN. SMARTFUEL HYDROGEN  
ENERGY AIR PRODUCTS AMP CHEMICALS. HYDROGEN  
AS AN ENERGY CARRIER TECHNOLOGIES SYSTEMS.  
HYDROGEN STORAGE. SUSTAINABLE HYDROGEN  
PRODUCTION SCIENCE. PATHWAYS TO HYDROGEN AS  
AN ENERGY CARRIER PHILOSOPHICAL. REVIEW OF  
WATER ELECTROLYSIS TECHNOLOGIES AND DESIGN  
OF. PDF HYDROGEN ENERGY RESEARCHGATE.  
HYDROGEN AS AN ENERGY CARRIER TECHNOLOGIES  
SYSTEMS. HYDROGEN AS AN ENERGY CARRIER  
TECHNOLOGIES SYSTEMS. HYDROGENIOUS LOHC  
TECHNOLOGIES SCIENTIFIC RESEARCH ON LOHC.  
HYDROGENIOUS LOHC TECHNOLOGIES HANDLING  
HYDROGEN MADE EASY. HYDROGEN A CLEAN FLEXIBLE  
ENERGY CARRIER DEPARTMENT OF. ENERGY CARRIER

AN OVERVIEW SCIENCEDIRECT TOPICS. HYDROGEN

SCIENCE AND ENGINEERING MATERIALS PROCESSES.

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RENEWABLE HYDROGEN TECHNOLOGIES LTD. TRENDS  
IN DESIGN OF DISTRIBUTED ENERGY SYSTEMS USING.  
HYDROGEN RENEWABLE POWER OF THE FUTURE MIDA.  
HYDROGEN STORAGE TECHNOLOGIES FOR FUTURE  
ENERGY SYSTEMS. TECHNOLOGY HELBIO HYDROGEN  
AND ENERGY SYSTEMS. HYDROGEN ENERGY THE  
PERFECT ENERGY SOURCE FOR THE FUTURE.  
AMMONIA AS HYDROGEN CARRIER TO UNLOCK THE  
FULL POTENTIAL. DOE HYDROGEN AND FUEL CELLS  
PROGRAM ABOUT THE HYDROGEN. HYDROGEN  
ENERGY STORAGE A NEW SOLUTION TO THE  
RENEWABLE. H2 SCALE HYDROGEN INTEGRATING  
ENERGY SYSTEMS OSTI GOV. LIFECYCLE COST  
ANALYSIS OF TECHNICAL REPORT. RESILIENCE OF  
LIQUID ORGANIC HYDROGEN CARRIER BASED ENERGY.

HYDROGEN AND FUEL CELL TECHNOLOGY BASICS

ENERGY GOV. HYDROGEN AS AN ENERGY CARRIER

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## **hydrogen frames**

June 5th, 2020 - hydrogen is the smallest and lightest molecule making storage and transport in gaseous form challenging due to the high pressures required frames provides liquid organic hydrogen carrier lohc systems to safely and efficiently store bulk hydrogen in an easy transportable liquid thus eliminating the need for pressurized hydrogen vessels'

## **'H2B2 SYSTEMS BASED ON ELECTROLYZERS FOR HYDROGEN PRODUCTION**

JUNE 4TH, 2020 - HYDROGEN CLEAN ENERGY CARRIER HYDROGEN IS ONE OF THE MOST PROMISING ENERGY CARRIERS IN ADDITION TO INDUSTRIAL APPLICATIONS IT CAN

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BE USED FOR CAR FUEL ENERGY  
STORAGE OR POWER GENERATION  
HYDROGEN PRODUCTION BY MEANS  
OF ELECTROLYSIS ALLOWS  
INTEGRATING 100 RENEWABLE

**ENERGY** hydrogen and alternative energy vectors  
epsrc website

May 27th, 2020 - the uk has strengths in very specific areas of

hydrogen and alternative energy vectors e g storage and

safety in bination with a strong gas infrastructure there is also

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electrolytic hydrogen production while the underpinning technology has a lot in common with fuel cells and redox flow batteries ideal for transport.

## **'hydrogen As An Energy Carrier Technologies Systems**

June 1st, 2020 - An Attempt Has Also Been Made To Prove That Hydrogen Safety Characteristics Indeed Permit Its Handling And Use As An Energy Carrier Hopefully All This Will Show That Hydrogen Together With Electricity Could Be The Universally Employable Energy Carrier Of A Future Non Fossil Energy Supply System'

## **'THE TRANSPORT INDUSTRY IS AN EARLY ADOPTER OF HYDROGEN ENERGY**

JUNE 1ST, 2020 - THE AAHE IS THE

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NATIONAL ASSOCIATION PROMOTING  
THE USE OF HYDROGEN AS AN  
ENERGY CARRIER ITS INTEGRATION  
IN THE AUSTRALIAN ENERGY  
ECONOMY AND THE DEVELOPMENT  
AND DEPLOYMENT OF HYDROGEN  
ENERGY TECHNOLOGIES SUCH AS  
FUEL CELLS'

**'hydrogen fuels amp technologies iea  
June 4th, 2020 - hydrogen hydrogen is  
a versatile energy carrier which can  
help to tackle various critical energy  
challenges hydrogen can be produced  
from almost all energy resources  
though today s use of hydrogen in oil  
refining and chemical production is  
mostly covered by hydrogenfrom**

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# **fossil fuels with significant associated co2 emissions'**

**hydrogen as an energy carrier what it is and why it**

May 31st, 2020 - hydrogen as an energy carrier what it is and

why it matters kareem chin last week the u s department of

energy announced it would make available up to 9 million in

new funding to accelerate the development of hydrogen and

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fuel cell technologies for use in vehicles backup power systems and hydrogen refueling ponents,

## **'hydrogen amp fuel cells renewable energy world**

October 29th, 2019 - hydrogen energy nasa uses hydrogen fuel to launch the space shuttles credit nasa hydrogen is the simplest element an atom of hydrogen consists of only one proton and one electron it s also the most plentiful element in the universe despite its simplicity and abundance hydrogen doesn t occur naturally as a gas on the earth'

## **'HYDROGEN ENERGY SYSTEMS STUDIES JOAN M OGDEN ABSTRACT**

MAY 25TH, 2020 - RESULTS FROM TECHNICAL AND ECONOMIC ASSESSMENTS OF HYDROGEN ENERGY

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SYSTEMS GENERALLY THE GOAL OF OUR RESEARCH IS TO ILLUMINATE POSSIBLE PATHWAYS LEADING FROM PRESENT HYDROGEN MARKETS AND TECHNOLOGIES TOWARD WIDE SCALE USE OF HYDROGEN AS AN ENERGY CARRIER HIGHLIGHTING IMPORTANT TECHNOLOGIES FOR RD AMP D THIS WORK WAS CARRIED OUT AS PART "

***solar Hydrogen Energy System The Choice Of The Future***

*May 23rd, 2020 - D Clean Coal Technologies Could Be Used For Thermal Energy Generation Satisfying Approximately 30 Of The World S Total Energy Needs Such A System Which Employs Coal For Thermal Energy Generation And Hydrogen From Renewable Energy Sources In Electricity Generation And Transportation Sectors Would Be The Least Cost Energy System For The Transition Period*

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**1**  
**HYDROGEN AS AN ENERGY CARRIER BOOK OSTI GOV**  
MAY 6TH, 2020 - THE STUDY EXAMINED THE POTENTIAL

FOR HYDROGEN PRODUCED FROM NONFOSSIL

ENERGY SOURCES AS AN ENERGY CARRIER ANALYSES

WERE MADE OF PROPOSED HYDROGEN PRODUCTION

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**'hydrogen from renewables in austria  
an energy carrier of**

*May 31st, 2020 - hydrogen can be used  
as energy carrier in many different ways  
hydrogen can be stored transported and  
used for the production of electricity heat  
and transportation services international r  
amp d activities are carried out to analyse  
hydrogen technologies for different  
applications cost potentials and market  
implementation strategies with the'*

**'formic acid as a hydrogen energy  
carrier acs energy letters**

*May 12th, 2020 - the high volumetric  
capacity 53 g h<sub>2</sub> l and its low toxicity and*

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*flammability under ambient conditions make formic acid a promising hydrogen energy carrier particularly in the past decade significant advancements have been achieved in catalyst development for selective hydrogen generation from formic acid this perspective highlights the advantages of this approach with*

**discussions focused"**  
**hydrogen As An Energy Carrier Technologies Systems**

May 11th, 2020 - The Technologies Of Hydrogen S Energetic Utilization Have Been Known For A Long Time But Aspects Of System Analysis Energy Economics And Ecology That Would E Into Play In Introducing It Into Energy Systems Nave Received Much Less Attention For Those Reasons This Book

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Attempts To Show The'

**'hydrogen the energy carrier of the future energy**

**June 2nd, 2020 - hydrogen fuel is considered a key ponent of an all of the above energy portfolio and one of the fastest growing clean energy technologies from zero emission fuel cell cars to clean distributed energy production hydrogen has a significant part to play in our secure and affordable energy future"**

**GENERATION OF THE ENERGY CARRIER HYDROGEN IN CONTEXT WITH MAY 22ND, 2020 - PRIORITY 6 1 SUSTAINABLE ENERGY**

**SYSTEMS AND MORE SPECIFICALLY SUB PRIORITY 6 1 3**

**2 5 SOCIO ECONOMIC TOOLS AND CONCEPTS FOR**

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ENERGY STRATEGY DELIVERABLE N 8 5 RS1A LIFE  
CYCLE APPROACHES TO ASSESS EMERGING ENERGY  
TECHNOLOGIES TECHNOLOGY SPECIFICATION  
GENERATION OF THE ENERGY CARRIER HYDROGEN IN,  
CONTEXT WITH ELECTRICITY BUFFERING GENERATION

### **'3 7 Hydrogen Codes And Standards Energy Gov**

*May 21st, 2020 - Early Mercialization And  
Market Entry Of Hydrogen Energy  
Technologies 3 7 2 Technical Approach  
The Hydrogen Program Recognizes That  
Domestic And International Codes And  
Standards Must Be Established Along  
With Affordable Hydrogen And Fuel Cell  
Technologies To Enable The Timely  
Mercialization And Safe Use Of Hydrogen  
As An Energy Carrier'*

**' the prospects for hydrogen as an energy carrier an**

may 14th, 2020 - hydrogen is expected to play a key role as an

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energy carrier in future energy systems of the world as fossil fuel supplies become scarcer and environmental concerns increase hydrogen is likely to become an increasingly important chemical energy carrier and eventually may become the principal chemical energy carrier when most of the world's energy sources become non fossil based hydrogen

**transition To  
Renewable Energy Systems With  
Hydrogen As An  
May 25th, 2020 - Transition To  
Renewable Energy Systems With  
Hydrogen As An Energy Carrier Article  
In Energy 34 3 3 308 312 March 2009  
With 61 Reads How We Measure  
Reads'**

**'SMARTFUEL HYDROGEN ENERGY  
AIR PRODUCTS AMP CHEMICALS  
JUNE 3RD, 2020 - THESE ARE THE  
REASONS WHY HYDROGEN IS BEING  
USED IN A BROAD ARRAY OF**

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APPLICATIONS AS A PRIMARY  
ENERGY CARRIER SIGNIFICANT  
ADVANCES HAVE BEEN MADE IN THE  
USE OF HYDROGEN AS A  
TRANSPORTATION FUEL AND A FUEL  
FOR POWER GENERATION  
HYDROGEN CAN BE USED IN AN  
INTERNAL BUSTION ENGINE OR A  
FUEL CELL TO GENERATE

**POWER"hydrogen As An Energy  
Carrier Technologies Systems**

**June 4th, 2020 - Winter C J Amp Nitsch**

**J 1988 Hydrogen As An Energy Carrier**

**Technologies Systems Economy Carl**

**Jochen Winter Joachim Nitsch Eds**

**Springer Verlag Berlin New York**

**Citation Please See S Template**

**Documentation For Further Citation**

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## **Fields That May Be Required" *hydrogen storage***

*June 5th, 2020 - hydrogen storage is a term used for any of several methods for storing hydrogen for later use these methods encompass mechanical approaches such as high pressures and low temperatures or chemical pounds that release  $H_2$  upon demand while large amounts of hydrogen is produced it is mostly consumed at the site of production notably for the synthesis of ammonia'*

**sustainable Hydrogen Production Science**

May 8th, 2020 - Hydrogen As An Energy Carrier Primarily

Derived From Water Can Address Issues Of Sustainability

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To Hydrogen Production Pathways Are Addressed Here  
Future Energy Systems Require Money And Energy To Build,

## **'pathways To Hydrogen As An Energy Carrier Philosophical**

June 3rd, 2020 – When Hydrogen Is Used As An Alternative Energy Carrier It Is Very Important To Understand The Pathway From The Primary Energy Source To The Final Use Of The Carrier This Involves For Example The Understanding Of Greenhouse Gas Emissions Associated With The Production Of Hydrogen And Throughout The Lifecycle Of A Given Utilization Pathway As Well As Various Energy Or Exergy 1 Efficiencies'

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## ~~'review Of Water Electrolysis Technologies And Design Of~~

~~May 22nd, 2020 - Volumetric Energy Density Of Hydrogen Is Low And Pressurized Tanks Are Efficient And Affordable When The Cycling Rate Is High Pressurized Hydrogen Enables Energy Storage In Larger Capacities Pared To Battery Technologies And Additionally The Energy Can Be Stored For Longer Periods Of Time On A Time Scale Of Months"~~ **pdf hydrogen energy**

**researchgate**

*June 4th, 2020 - hydrogen has the potential to provide for energy in transportation distributed heat and power generation and energy storage systems with little or no impact on the environment*

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*both locally and*

**hydrogen as an energy carrier technologies systems**

May 21st, 2020 - hydrogen in a future energy economy 11 1

hydrogen production with large solar and wind stations 11 2

development strategy and expenditures for the production of

large amounts of hydrogen 11 3 long distance transport

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systems 11 4 nuclear energy and the production of large amounts of hydrogen 11 5 characteristics of an energy system with a large hydrogen share,

## **'hydrogen As An Energy Carrier Technologies Systems**

**April 28th, 2020 - Get This From A Library Hydrogen As An Energy Carrier Technologies Systems Economy C J Winter J Nitsch The Book Deals With Physics Systems Technology Expenditure And The Ecological Significance Of The Utilisation Of Hydrogen As An Energy Carrier The Main Emphasis Is On Solar Hydrogen Systems Whose'**

***'hydrogenious Lohc Technologies Scientific Research On Lohc***

*June 3rd, 2020 - Hydrogenious Lohc*

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*Technology Is Based On Years Of Thorough Research In The Area Of Liquid Organic Hydrogen Carriers Lohc As A University Spin Off And A Pany Of Scientists Engineers And Entrepreneurs Hydrogenious Lohc Technologies Focuses On The Mercialization Of The Lohc Technology And Optimizes Catalysts Reactor Technology And System Integration'*

' **hydrogenious lohc technologies handling hydrogen made easy**

June 4th, 2020 - hydrogenious lohc technologies develops

applications for easy efficient amp safe hydrogen transport and

storage using liquid organic hydrogen carrier

lohc **"hydrogen A Clean Flexible Energy**



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**Carrier Department Of**

**May 22nd, 2020 - Hydrogen Is An  
Energy Carrier Not An Energy Source  
And Can Deliver Or Store A**

**Tremendous Amount Of Energy**

**Hydrogen Can Be Used In Fuel Cells**

**To Generate Electricity Or Power And**

**Heat Today Hydrogen Is Most Monly**

**Used In Petroleum Refining And**

**Fertilizer Production While**

**Transportation And Utilities Are**

**Emerging Markets"ENERGY CARRIER**

**AN OVERVIEW SCIENCEDIRECT**

**TOPICS**

**JUNE 5TH, 2020 - HYDROGEN IS AN**

**ENERGY CARRIER 42 43 IN OTHER**

**WORDS IT IS AN INTERMEDIATE**

**MEDIUM FOR ENERGY STORAGE AND**

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CARRIAGE HYDROGEN IS THE MOST ABUNDANT ELEMENT OF THE EARTH APPROXIMATELY CORRESPONDING 75 OF THE ELEMENTAL MASS OF THE UNIVERSE 44 AND IT IS THE SIMPLEST AND LIGHTEST ELEMENT OF ALL CHEMICAL ELEMENTS WITH AN ATOMIC NUMBER OF 1" **hydrogen science and engineering materials processes**

*April 30th, 2020 - in so doing it also discusses such broader topics as the environmental impact education safety and regulatory developments the text is all encompassing covering a wide range that includes hydrogen as an energy carrier hydrogen for storage of renewable energy and incorporating hydrogen technologies*

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*into existing technologies'*

**'vision Hydro Corr 13 10 03 16 22 Page 1**

*June 1st, 2020 - Vision Hydro Corr 13 10 03 16 22 Page 1 On The Technology Front Hydrogen A Clean Energy Carrier That Can Be Produced From Any Hydrogen Based Energy Systems Can Build Bridges To The Future But Planning A Cost Effective And Efficient Transition Is Hugely Plex'*

**'renewable Hydrogen Technologies Ltd**  
May 29th, 2020 - Renewable Hydrogen Technologies Ltd A Consultancy Focused On The Delivery Of Multi Discipline Whole Energy Systems Solutions Based On Hydrogen With Its Partners And Associates Rhtl Bines Research And

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Development In'

**'trends in design of distributed energy systems using**

**May 26th, 2020 - distributed energy systems including hydrogen as energy carrier were studied the identification of hydrogen related technologies and uses was done different application scales of decentralized energy systems were included baselines to early stage design of distributed energy systems are**

**proposed"HYDROGEN RENEWABLE POWER OF THE FUTURE MIDA**

**JUNE 3RD, 2020 - IN THE FUTURE HYDROGEN WILL BE AN ESSENTIAL ENERGY CARRIER MADE SAFELY FROM RENEWABLE ENERGY**

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SOURCES WITH VIRTUALLY NO POLLUTION HOWEVER BEFORE IT CAN ASSUME A MORE SIGNIFICANT ENERGY ROLE AND BE A WIDELY USED ALTERNATIVE TO GASOLINE NEW FACILITIES AND SYSTEMS MUST BE BUILT TO ACCOMMODATE THE WIDESPREAD USE OF HYDROGEN"

**hydrogen storage technologies for future energy systems**

June 1st, 2020 - future energy systems will be determined by

the increasing relevance of solar and wind energy crude oil

and gas prices are expected to increase in the long run and

penalties for CO<sub>2</sub> emissions will be a relevant economic

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factor solar and wind powered electricity will be significantly cheaper such that hydrogen produced from electrolysis will be competitively priced against

## **'technology helps hydrogen and energy systems**

June 3rd, 2020 - Prof. Vaynskiy's research on pollution abatement technologies provided the inspiration for the development of more environment friendly energy technologies. By this time, in the mid-1980s, hydrogen was discussed as the energy carrier of the future, combining the two concepts of green hydrogen was born. **"hydrogen energy: the perfect energy source for the future"**

June 4th, 2020 - Hydrogen has the highest energy content of any monofuel by weight. On the other hand, hydrogen has the lowest energy content by volume; it is the

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lightest element and it is a gas at normal temperature and pressure hydrogen as an energy carrier hydrogen is considered as a secondary source of energy mostly referred to as an energy carrier'

**'ammonia as hydrogen carrier to unlock the full potential**

**May 24th, 2020 - if battery systems reveals to be decisive ponents of the energy management system especially for fast response services hydrogen based energy carriers appear as one of the only solution when it es to seasonal energy storage of large energy quantity and more specifically for all situation dealing with a large energy to power ratio situation"doe**

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## **hydrogen and fuel cells program about the hydrogen**

June 5th, 2020 - the u s department of energy hydrogen and fuel cells program conducts research and development in hydrogen production delivery storage and fuel cells as well as activities in technology validation manufacturing systems analysis and integration safety codes and standards and education'

## **'hydrogen energy storage a new solution to the renewable**

june 4th, 2020 - developed in a partnership with xcel energy the national renewable energy laboratory s nrel wind to hydrogen project serves as a working model of such a scenario housed at the national wind technology center near

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boulder colorado this demonstration project integrates wind turbines and photovoltaic arrays with electrolyzer systems to produce hydrogen'

**'h2 scale hydrogen integrating energy systems osti gov**

**may 31st, 2020 - a technoeconomic analysis of photoelectrochemical pec and photovoltaic electrolytic pv e solar hydrogen production of 10 000 kg h<sub>2</sub> day 1 3 65 kilotons per year was performed to assess the economics of each technology and to provide a basis for parison between these technologies as well as within the broader energy landscape two pec systems differentiated primarily by the**

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**extent'**

**'LIFECYCLE COST ANALYSIS OF  
TECHNICAL REPORT**

*JUNE 1ST, 2020 - LIFECYCLE COST  
ANALYSIS OF HYDROGEN VERSUS  
OTHER TECHNOLOGIES FOR  
ELECTRICAL ENERGY STORAGE D  
STEWART STORAGE TECHNOLOGIES  
AND PARE THEM WITH SEVERAL  
CONFIGURATIONS EMPLOYING  
HYDROGEN AS THE ENERGY  
CARRIER AND BULK ENERGY  
STORAGE SYSTEMS EMPLOYING  
OTHER BATTERY TECHNOLOGIES  
ARE NOW BEING BUILT SCHOENUNG  
AND HASSENZAHN 2003'*

**'resilience of liquid organic hydrogen**

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## **carrier based energy**

may 10th, 2020 - li et al 19 studied the resilience of various energy systems including hydrogen technologies in the case of natural disasters and outlined the tradeoff between resilience and costs  
esteban and portugal pereira 20 evaluated resilience for a potential energy system for japan pletely based on renewable energies'

## **'hydrogen and fuel cell technology basics energy gov**

May 28th, 2020 - in a fuel cell hydrogen energy is converted directly into electricity with high efficiency and low power losses  
hydrogen therefore is an energy carrier which is used to move store and deliver

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energy produced from other sources learn more about hydrogen fuel fuel cells or read more about eere s hydrogen technologies research"***HYDROGEN AS AN ENERGY CARRIER SPRINGERLINK***

*MAY 21ST, 2020 - THE TECHNOLOGIES OF HYDROGEN S ENERGETIC UTILIZATION HAVE BEEN KNOWN FOR A LONG TIME BUT ASPECTS OF SYSTEM ANALYSIS ENERGY ECONOMICS AND ECOLOGY THAT WOULD E INTO PLAY IN INTRODUCING IT INTO ENERGY SYSTEMS HAVE RECEIVED MUCH LESS ATTENTION*<sup>hydrogen storage hydrogen</sup>

June 4th, 2020 - as an energy carrier lh2 has a higher energy

density than gaseous hydrogen but it requires liquefaction at

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253 c which involves a plex technical plant and an extra economic cost when storing liquid hydrogen the tanks and storage facilities have to be insulated in order to keep in check the evaporation that occurs if heat is carried over into the stored content due to conduction,

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