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Clean and Abundant Energy for Sustainability



SAGA OF HYDROGEN CIVILIZATION

T. Nejat Veziroğlu

President

**International Association for Hydrogen Energy
Miami, Florida 33155, U.S.A.**

veziroglu@iahe.org



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Early Research Projects



1962-1967:
Instabilities in
nuclear hydrogen
rocket engines for
travel to Mars

1967-1972:
Fuels for
eliminating air
pollution





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1973 Energy Crisis

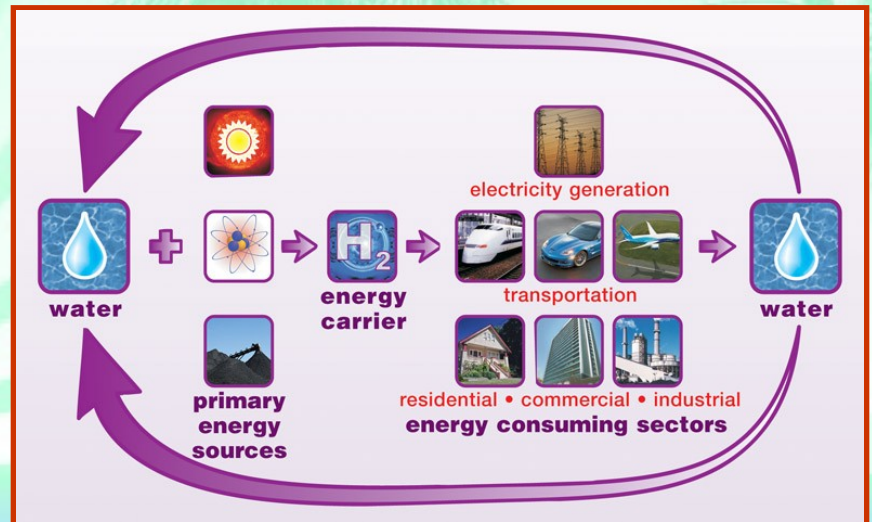


1973:

**Clean Energy Research
Institute, University of Miami**

1973:

**Concept of hydrogen
energy system**



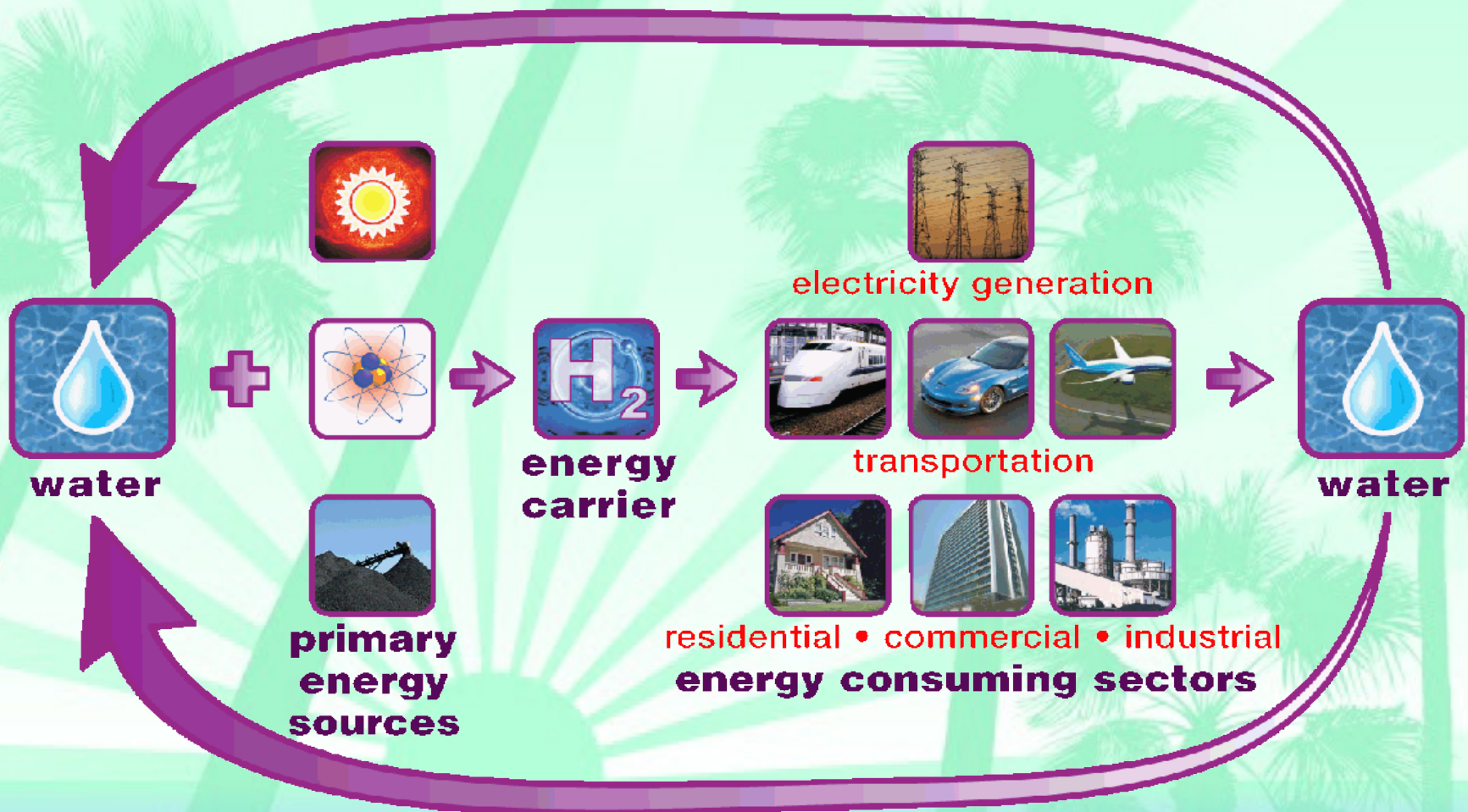


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Hydrogen Energy System





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The Hydrogen Economy Miami Energy (THEME) Conference, 18-20 March 1974, Miami Beach



1973:

**Funding from National
Science Foundation**

18 March 1974:

**Morning: THEME Opening
Evening: Playboy Plaza Hotel**

Penthouse Meeting



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Hydrogen Romantics

- Hussein K. Abdel-Al • Egypt and Saudi Arabia**
- John O'M Bockris • United Kingdom and Australia**
- William J. D. Escher • U.S.A.**
- Cesare Marchetti • Italy and Austria**
- Anibal R. Martinez • Venezuela**
- Tokio Ohta • Japan**
- Walter Seifritz • Switzerland**
- William D. Van Vorst • U.S.A.**
- T. Nejat Veziroglu • Turkey and U.S.A.**
- Kurt H. Weil • Germany and U.S.A.**
- Robert M. Zweig • U.S.A**

The eleven scientists, who represented almost all regions of the World!

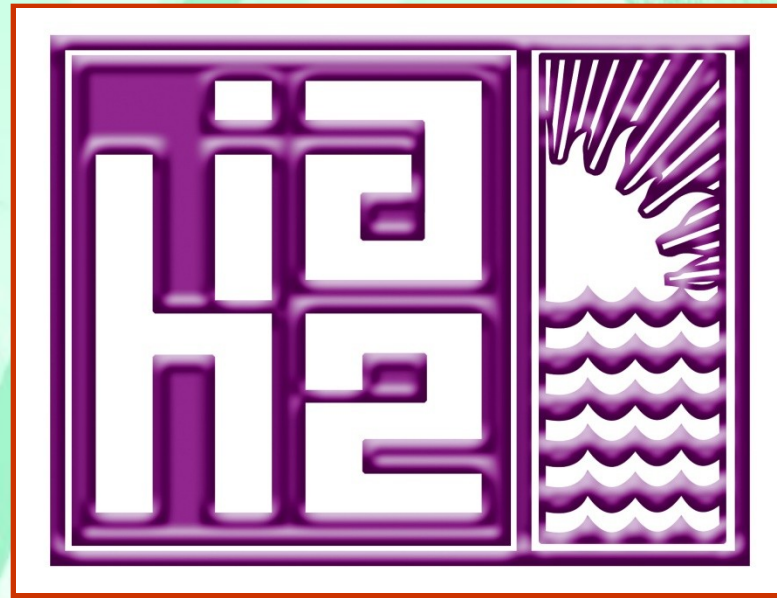


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International Association for Hydrogen Energy



Fall 1974:
Application to
Florida State

Spring 1975:
Approval of
IAHE

Fall 1975:
IAHE
Elections



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International Journal of Hydrogen Energy



September 1974:

**Approach to Robert Miranda,
Pergamon Press, New York**

December 1974:

**Agreement to publish IJHE
with Robert Maxwell,
Chairman, Pergamon Press**



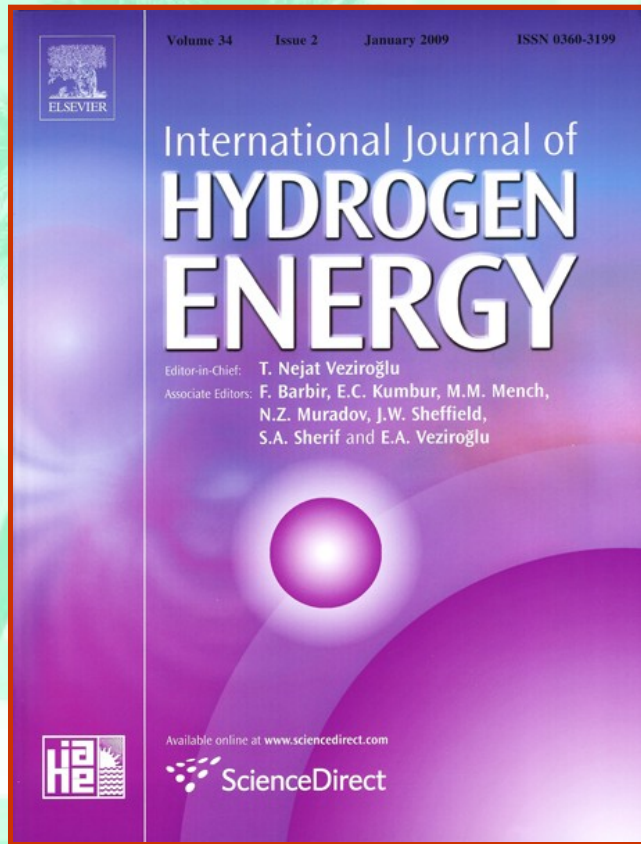


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International Journal of Hydrogen Energy



1975:
Preparation to get papers

Fall 1975:
**IAHE Board approves IJHE
as the official journal**

January 1976:
First issue of IJHE published



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1976 - :

International Journal of Hydrogen Energy

1976 – Quarterly

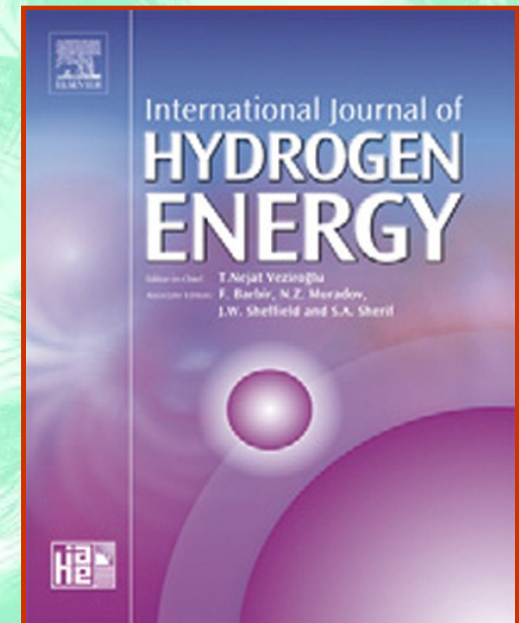
1979 – Bimonthly

1982 – Monthly

2002 – 15 Issues / Yr.

2007 – 18 Issues / Yr.

2008 – 24 Issues / Yr.





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World Hydrogen Energy Conferences

Fall 1975:

IAHE Board approves WHECs

1-3 March 1976:

1st WHEC, Miami Beach, FL, U.S.A.

**Dr. Podgorny, Dr. Stanford,
Senator Matsunaga and Dr. Takahashi**





World Hydrogen Energy Conferences

THEME & WHECs

1974	THEME		Miami Beach, FL, U.S.A.	1996	11 WHEC		Stuttgart, Germany
1976	1 WHEC		Miami Beach, FL, U.S.A.	1998	12 WHEC		Buenos Aires, Argentina
1978	2 WHEC		Zurich, Switzerland	2000	13 WHEC		Beijing, China
1980	3 WHEC		Tokyo, Japan	2002	14 WHEC		Montreal, Canada
1982	4 WHEC		Pasadena, CA, U.S.A.	2004	15 WHEC		Yokohama, Japan
1984	5 WHEC		Toronto, Canada	2006	16 WHEC		Lyon, France
1986	6 WHEC		Vienna, Austria	2008	17 WHEC		Brisbane, Australia
1988	7 WHEC		Moscow, Russia	2010	18 WHEC		Essen, Germany
1990	8 WHEC		Honolulu, HI, U.S.A.	2012	19 WHEC		Toronto, Canada
1992	9 WHEC		Paris, France	2014	20 WHEC		Kwangju City, Korea
1994	10 WHEC		Cocoa Beach, FL, U.S.A.	2016	21 WHEC		Zaragoza, Spain



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1982

National Hydrogen Association

4 WHEC (1982) – Pasadena, CA

Founders:

John Appleby, Texas A&M

Jeff Serfass, Esq., Washington, D. C.

T. Nejat Veziroglu, U. M.



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International Standards for Hydrogen Technologies

1988:

**Decision to approach ISO
(Gustav Grob of Switzerland)**

1990:

**Establishment of ISO-TC 197,
Zurich, Switzerland**





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International Standards



ISO/TC-197 Committee

- **Definitions**
- **Measurements**
- **Handling**
- **Safety**
- **Vehicles**
- **Aerospace**
- **Electro-Chemical Devices**
- **Hydrides**
- **Environment**
- **Applications**



World Hydrogen Technologies Convention WHTCs

2003 IAHE Board Approval

2005 WHTC '05  Singapore, Malaysia

2007 WHTC '07  Montecatini Terme, Italy

2009 WHTC '09  Delhi, India

2011 WHTC '11  Glasgow, U.K.

2013 WHTC '13  Shanghai, China

2015 WHTC '15  Sydney, Australia



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Hydrogen Energy & Industry

March 1974 - Present:

Strong interest from industry except petroleum companies



September 1997:

Letter to the Presidents of Major Petroleum Companies inviting to 12 WHEC (Dr. Juan Carlos Bolcich)

August 1998:

Shell Oil Co. establishes Hydrogen Division and leaves Anti-H₂ Consortium. Then BP leaves, and petroleum industry becomes Pro-H₂!



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**United Nations Industrial Development Organization
International Centre for Hydrogen Energy Technologies**



UNIDO-ICHET



1986-1992:

Consulting for UNIDO and Reports (Charles Bodwell of UNIDO)

1992-1996:

Visit to Ankara, Turkey; MOU; Lobbying (Dr. Venkataraman, Dr. Erdal İnönü, Charles Bodwell and Anthony Bromley)

Fall 1996:

UNIDO General Assembly approves Istanbul as UNIDO-ICHET home

1996-2003:

UNIDO and Turkish governments negotiate and sign the Hosting Agreement (Dr. Hilmi Güler and Dr. D. G. Magarinos)



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UNIDO-ICHET



Establishment & Mission

Founding Director: T. Nejat Veziroglu

May 2004 – May 2007:

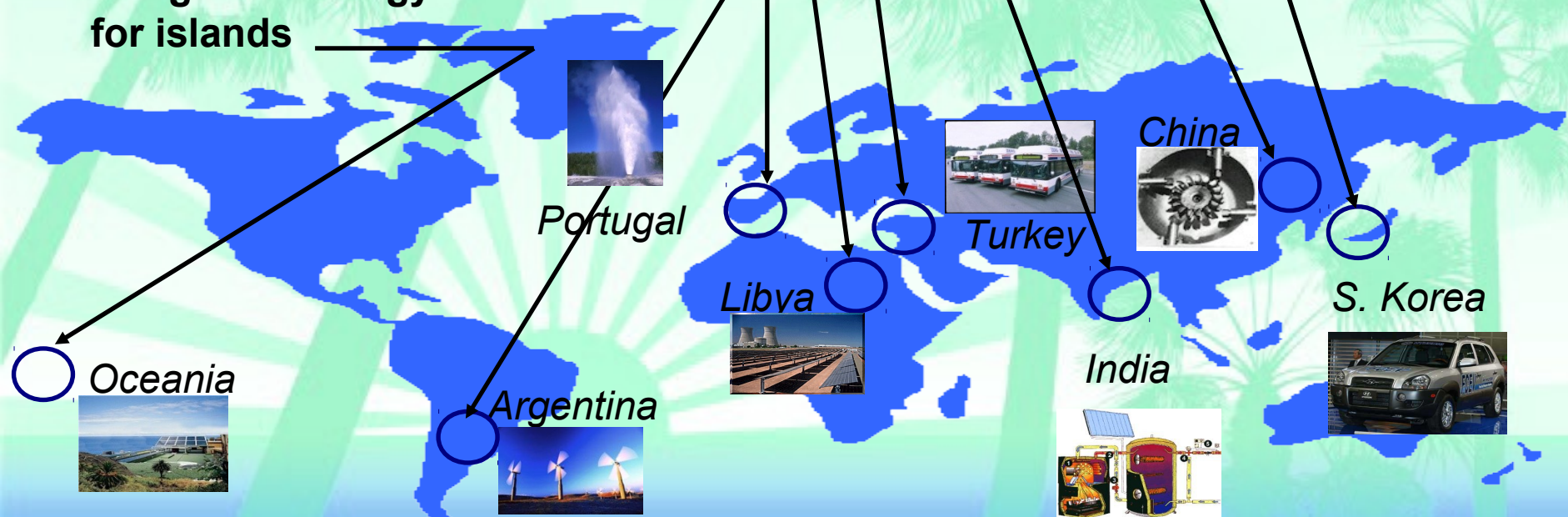
To help convert the world's countries to Hydrogen Economy through pilot projects, training courses, conferences and publications, and by cooperating with national and international organizations with similar objectives.



UNIDO-ICHET

Early Pilot Projects

- ◆ H2 Cars/Buses
- ◆ H2 from hydropower
- ◆ Biomass H2
- ◆ H2 buses
- ◆ H2 from solar energy
- ◆ Geothermal H2
- ◆ H2 from wind energy
- ◆ Integrated energy solutions for islands





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Economics of Hydrogen Energy



1995:

**Testimony to U.S. Congress Energy
& Environment Committee.**

Chairman: Hon. Brown of California



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IAHE Chapters & National Organizations



Australia



Brazil



Canada



China



European Union



France



Germany



Hungary



Iceland



Italy



Japan



Mexico



Netherlands



Norway



Pakistan



Spain



South Korea



Sweden



Switzerland



Taiwan



United Kingdom



United States



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Honda NG/H₂ (Solar H₂) System





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H₂ Infrastructure for Germany by 2015

H₂ Mobility (2009)

- **German NOW Organization**
- **Seven Industrial Companies**
- **Three Oil & Gas Companies**
- **One Industrial Gas Provider**
- **One Car Maker**





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H₂ Infrastructure for Japan by 2015

H₂ Supply Technologies Assoc. (2009)

- **Nippon Oil**
- **Tokyo Gas**
- **Idemitsu Kosan**
- **Showa Shell**
- **Osaka Gas**
- **Toho Gas**
- **Air Liquide Japan**





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H₂ Fuelled Cars by 2015

MoU by Manufactures (2009)

- General Motors
- Toyota
- Ford
- Honda
- Daimler
- Hyundai / Kia
- Renault / Nissan

- Hundreds of Thousands by 2015
- Millions by 2025

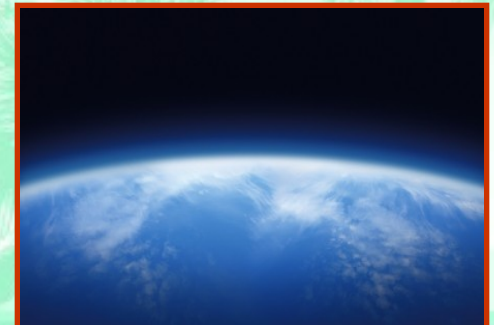




Benefits of Hydrogen Energy I



- **No Pollution**
- **No Acid Rains**
- **No Global Warming**
- **No Damage to Ozone Layer**
- **No Blackouts**





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Benefits of Hydrogen Energy II



- Higher conversion efficiency
- Quiet transportation / Power plants
- Conserving landscape
- Savings in environmental / Health expenditures



Benefits of Hydrogen Energy III

Sustainable System

Energy Source

- Fossil Fuels
- Nuclear
- Thermonuclear
- Renewable
Hydrogen

Lifetime (Years)

- Two Hundreds
- Thousands
- Tens of Thousands
- Five Billions

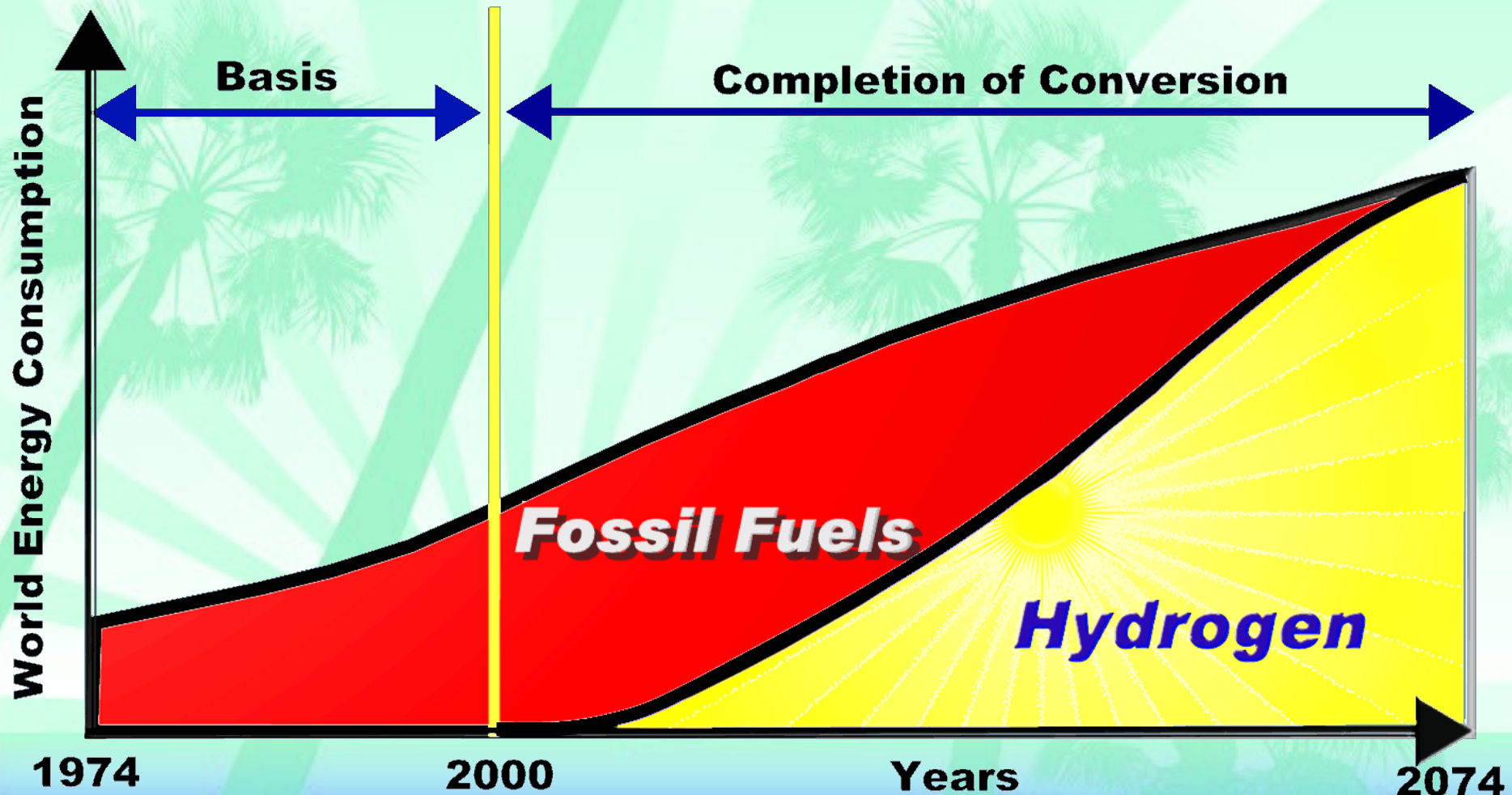


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Building Hydrogen Economy



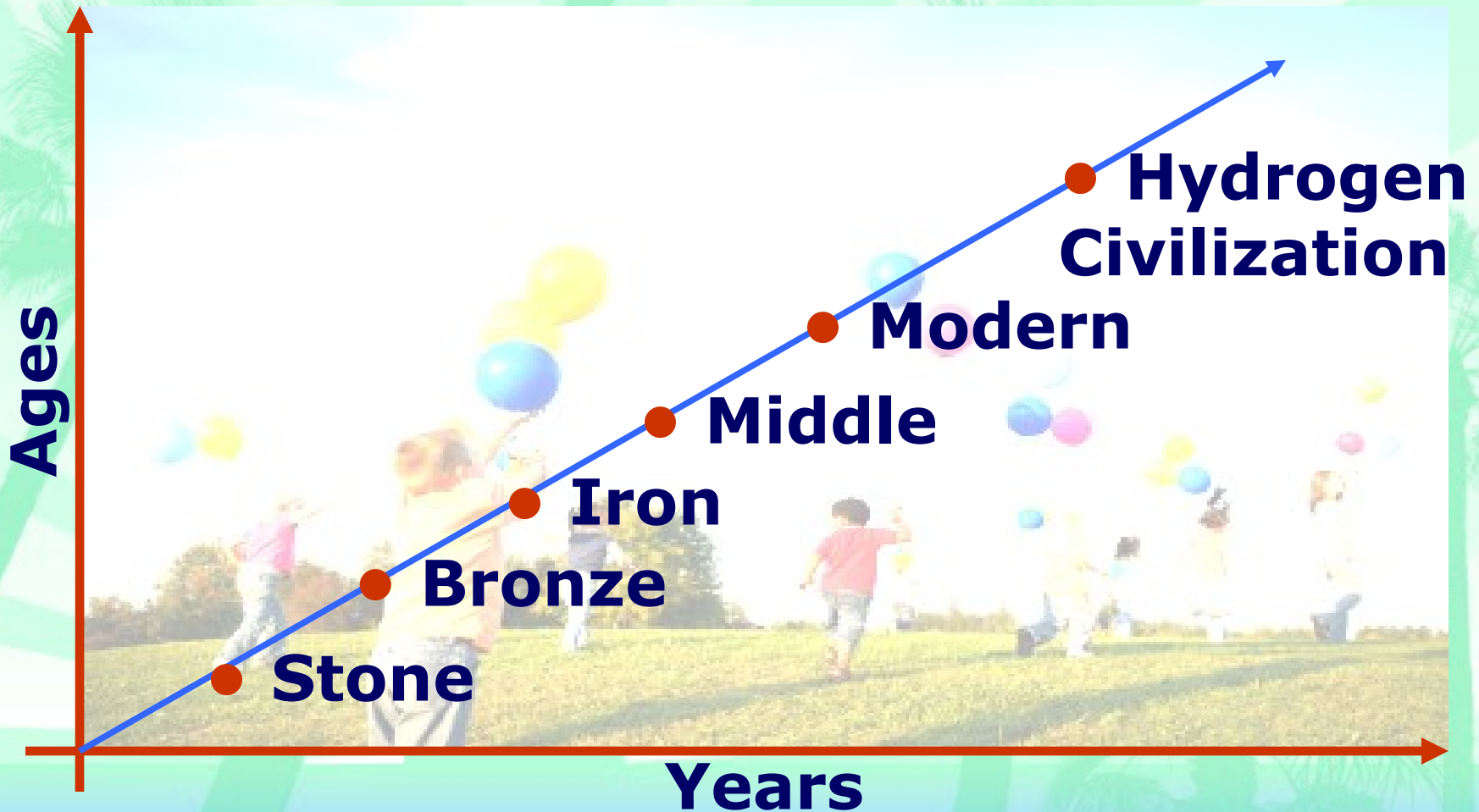


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Human Civilizations



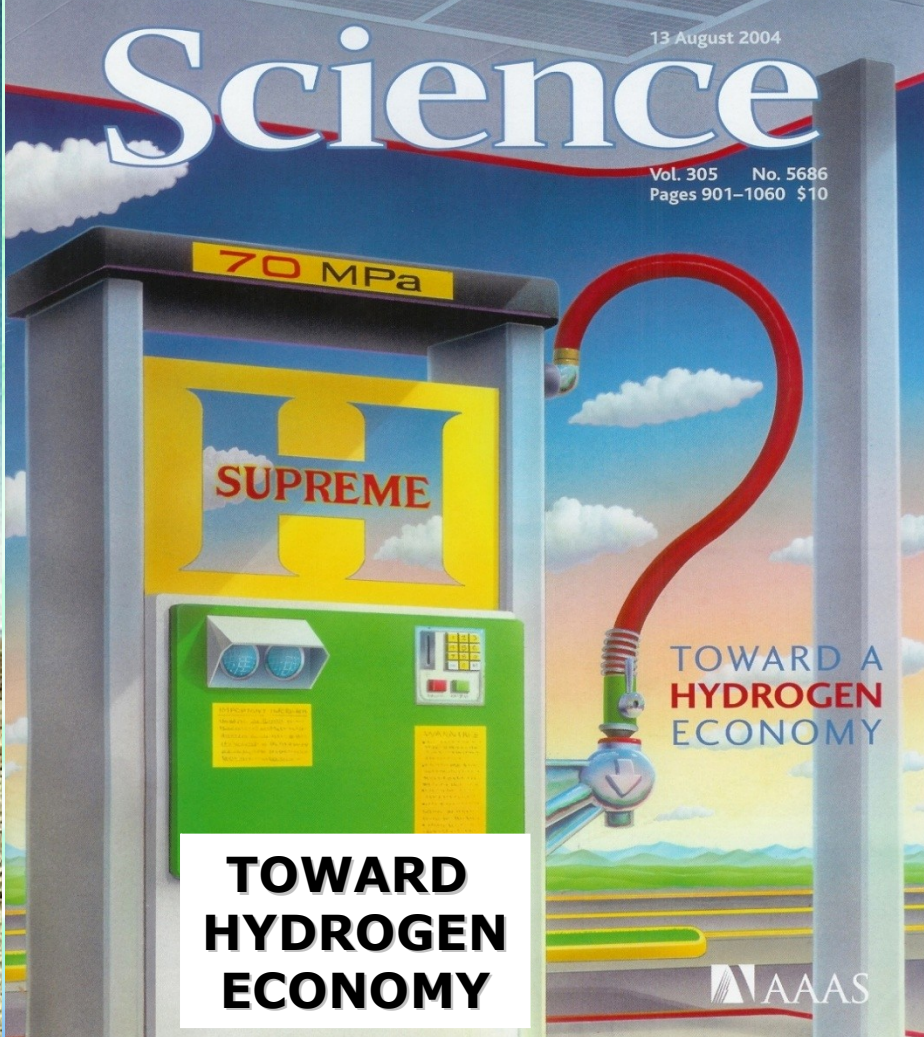


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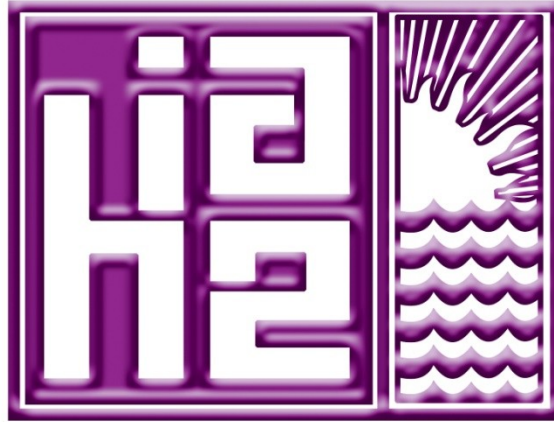
Dawn of Hydrogen Civilization





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IAHE

International Association for Hydrogen Energy

**5794 SW 40 St. #303
Miami, FL 33155, USA**

info@iahe.org • www.iahe.org