PLANETARY HYDROGEN ECONOMY

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Summary

A low cost planetary hydrogen economy is considered as substitutive of FDE economy (fossil derived energies) under exhaustion before the year 2100. In the study are analyzed the proved energetic options no carbon dioxide producers (atomic and full safe hard solar).
Hard solar is able to sustain for long time duration (more than 5000 centuries) the earth's hydrogen economy and to produce also planetary benefits, while the atomic option shows off insurmontable limits.
The planetary economic strategy is presented, it allows to build up the hydrogen planetary economy at low investments costs.

INTRODUCTION

At present the development on the earth (wars included) is sustained for 85% by the FDE consumed (fossil derived energies, oil, natural gas, coal). The contribution of the atomic energy is 5.2% of the FDE consumed, while the contribution of renewable hydroelectricity is 10% of the FDE consumed for a total of 16.53 billion TEP/year now consumed.
The world's population number will be 10 billion units in the year 2070 and the FDE consumed 20.4 billion TEP/year. In the years 2030-2050 a planetary energetic transition is foreseen due to the high prices of electricity and FDE derived fuels, as well as high cost of money. In addition a catastrophic geostorm is in charge and it could explode in the years 2040-2070 when the share of the infrared reflecting gases in the atmosphere will raise to 650-870 (it was 295 in the year 1956).
The exhaustion of FDE economy is foreseen around the year 2084, but the man-made global warming effect will continue up to the year 2150 when the share will be still greater than 700: the atmosphere memory of the infrared reflecting gases pumped in by the man-made global warming will produce a century (2050-2150) of geostorms and great climatic instability.
To sustain the development 14 billion TEP/year of FDE could be substituted before the end of the century 2000-2100.

The PLANETARY HYDROGEN ECONOMY

The planetary hydrogen economy can contribute to produce

- synthetic liquid fuels in susbstitution of under exhaustion more expensive oil derived fuels
- to save coal, for carbonium production and to sustitute it in all industrial applications, electricity production included
- to produce low price electricity by turbogas convertors hydrogen fueled and by hydrogen-air fuels cells
- to reduce the share of the infrared reflecting gases pumped in the atmosphere by reducing the consumptions of these gases burned

53843 billion NCM/year of electrolytic hydrogen have to be produced, which require 265461 billion KWhe/years *

* see Appendix

The energetic proved options now known are atomic fueled convertors and sylicates fueled hard solar convertors

ATOMIC OPTION

Productivity 40 KWhe/gr
Preasumed reserves of atomic fuel 20 x 10^{12} gr
Consumptions of atomic fuel 6636 billion gram/year (regime phase)
Regime phase time duration 3 years
Also greater productivity of not proved under study atomic convertors can offer a preasumed regime time duration not greater than 60 years.

A planetary atomic park of 51000000 MWe is not justified by a too short regime phase of max 60 years, which do not allows cost amortization and to produce planetary economic benefits.

HARD SOLAR OPTION

Total power 94772234 MWep
Preasumed sylicates earth's reserves 23 x 10^{24} gr
Sylicates consumed 116.5 x 10^{12} gr/year
Regime phase time duration 197 billion years (40 times the sun residual life)

The hard solar planetary park can certainly sustain a planetary hydrogen economy for half million years, by sustaining catastrophic vulcan explosions, geological earth' surface modifications, great meteorites impact on the earth' surface and so on by consuming, when necessary, the strategic FDE-atomic reserves saved by substitution.

THE PLANETARY ECONOMIC STRATEGY (PES)

The PES considers the decommission time D and assumes 1/D as the rate
- of industrial components production
- of the materials recycling
- renew the energetic system which has been already decommissioned.

PES foresees, also, to sell the energy produced during the construction-decommission-renew phases.
1/D for the planetary hydrogen economy hard solar sustained is 0.04.

PES is well tailored to the hard solar system, but it can be applied also to test other energetic options.
To built the PES scenario for hard solar-hydrogen are necessary two costs *

1 – C = 48777 billion USD, investment in 25 years for all the expenses necessary to the construction phase of 25% of the hydrogen economy
2 – D = 47441 billion USD, investment in 25 years for all the expenses of the regime phase (decommission-renew 4%/year) of 25% of the hydrogen economy, 100% operative

The whole hydrogen economy, made of 10000 modular hydrogen farms spread in southern and northern emisphere, is 100% operative after 100 years, but it sells hydrogen and oxygen gases from the first year. PES foresees that the hydrogen economy continue to be renewed at a rate of 4%/year indefinitely. In the hydrogen farm there are all the facilities to transform the stochastic electricity captured from the planetary H.V. grid lines, in gases (hydrogen-oxygen) on demand.

* see Appendix

The planetary economic scenario 2022-2122*

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
25	48777	174993	3500	1757	875	868	0.24	-5910
50	96218	511597	10230	3517	2557	4157	0.19	+5910
75	143659	848043	16960	5271	4240	7449	0.16	-
100	191100	1184569	23691	7043	5923	10725	0.15	-
125	189764	1242072	24841	8791	6210	12840	0.14	-

Column 1 Time (years)
Column 2 Investment x 10^9 USD
Column 3 Hydrogen produced x 10^9 NCM
Column 4 Oxygen credit: 40% sold at 0.1 USD/NCM, 60% dispersed in the atmosphere - x 10^9 USD
Column 5 Added jobs cost (Art. Nat. Intellig.) x 10^9 USD
Column 6 Assistance to electrolitic production-distribution (0.005 USD/NCM) x 10^9 USD
Column 7 Column 4 – Column 5 – Column 6 x 10^9 USD
Column 8 Industrial hydrogen cost (Column 2 – Column 7 + Column 9)/Column 3 USD-NCM
Column 9 Financial support (- from the fin. Market + returned to fin. market)

THE EFFECT OF PES

- Hydrogen cost decreasing
- All the investments (Column 2) payed by the hydrogen sold at the prices of Column 8

CONCLUSIONS

This work faces on the numbers of the next global energetic transition and try to find a proposal of long duration safe and able to offer planetary benefits.
Sylicates derived materials are consumed from more than 3000 years to built streets, bridges, buildings, monuments, walls, towns and so on and in the year 2008 the sylicates derived materials were consumed at a rate of 1 billion TON/year.
The relative abundance of earth' sylicates reserves allows to consider the hydrogen planetary economy – hard solar sustained, which consumes 116.5 x 10^{12} gr/year, together the sylicates consumed for all the other forementioned activities that is 400 x 10^{12} gr/year.
The 77% of the earth' sylicates reserves erosion is due to no hydrogen hard solar energetic consumptions.

* see Appendix

APPENDIX

- NCM = Normal Cubic Meter
- with reference to the diagram of Figure 1, the electricity to perform the production of 1 NCM of hydrogen is 4.93 KWhe/NCM
- the planetary economic scenario

25 25% of the whole economy is built on at a rate of 4%/year at the end of the 25 years the 25% of the whole economy is 100% operative, C1

50 another 25% is built on at a rate of 4%/year, C2, while the C1 is renewed 4%/year its production is 100%/year the expenses are C2+D1

75 another 25% is built on at a rate of 4%/year, C3, while the C1 and C2, in their regime phase, are renewed 4%/year and their production is 100%/year the total expenses are C3+D1+D2

and so on

100-125 the hydrogen economy is 100% operative, the total expenses are D1+D2+D3+D4

COST assumed

Electric power 1.725 million USD/MWep
Electric trasmission 500000 USD/Km
Electrolysis facilities 0.025 USD/NCM (ammortization 10 years)
Assistance 0.005 USD/NCM (NCM produced)
Added job costs (Nat. Art. Intellig.) 15000 USD/year x unit
Oxygen price 0.1 USD/NCM
Concrete 130 USD/TON
Brick 80 USD/TON
Iron 51 USD/TON
Steel 340 USD/TON
Inox steel 3710 USD/TON
Aluminum 3490 USD/TON
Copper 6900 USD/TON
Cave excavation 30 USD/TON + 8% to perfect inner cavern surface

Figure 1 – Schematic diagram of the Planetary Hydrogen Economy

Figure 2 – Wind and light parks. Wind parks: Sites of the earth where the winds blow as a mean 8-12 metres/sec for 3500 hours/year. Light parks: Sites of the earth where sunlight received by a flat orizonthal surface is 2000 KWh/m^2.

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Acknowledgements

I mention Marta Visentin and Alfonso Verrillo for their indispensable cooperation to built this work.

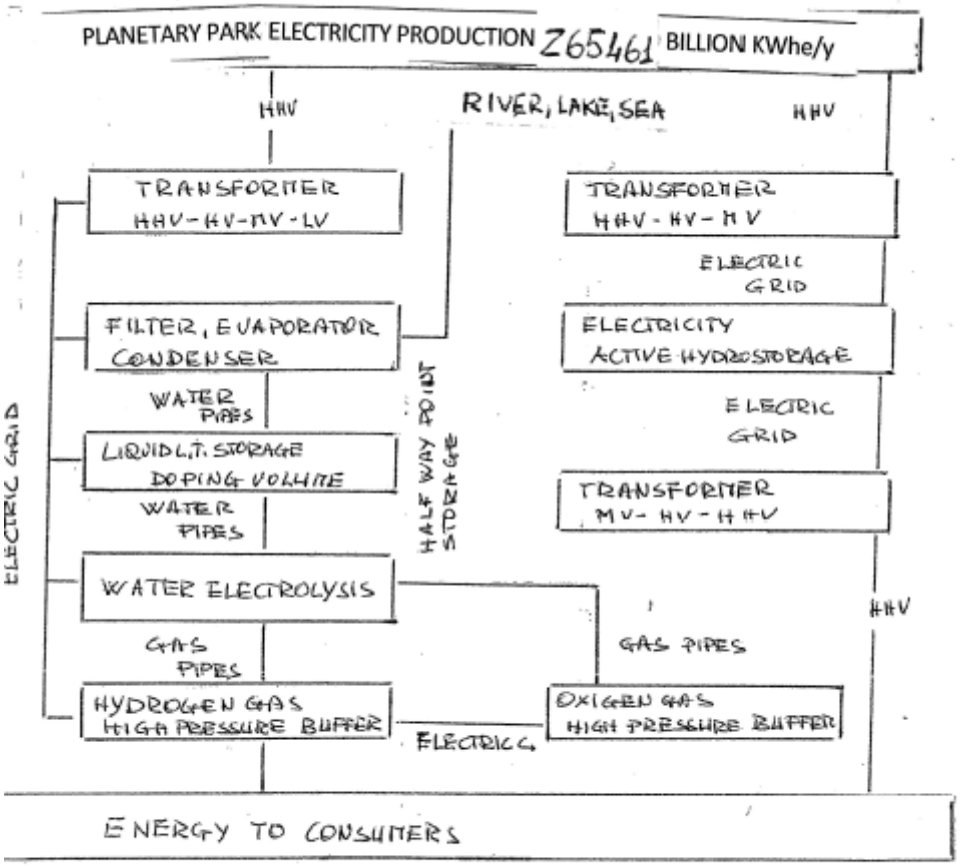
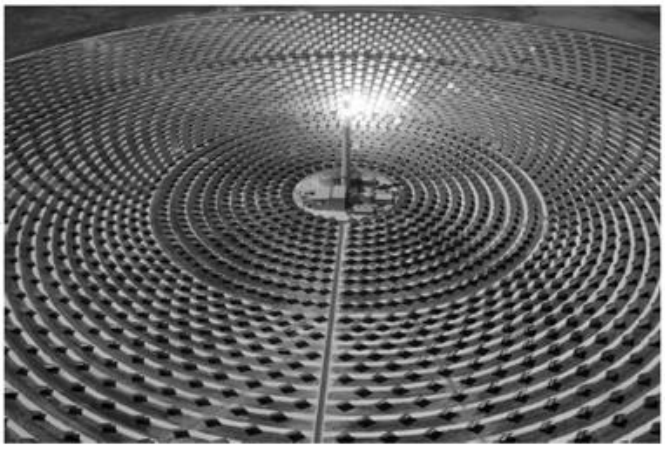


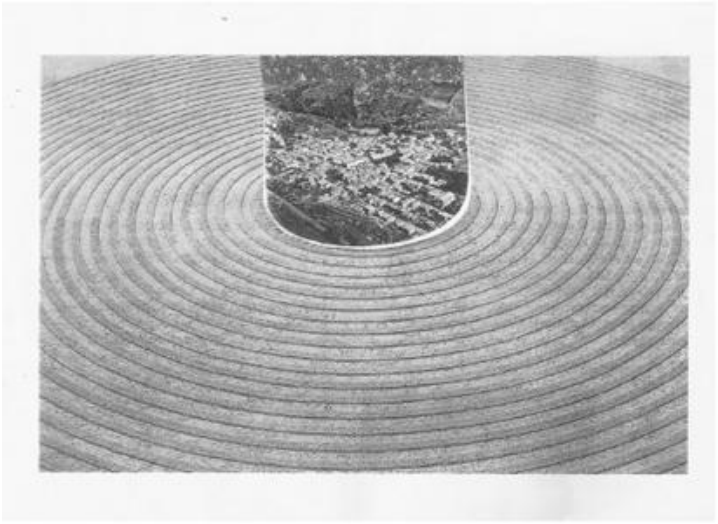
FIG. 1

Wind turbines –
Middelgrunden Wind Park –
Copenhagen – Denmark

Gansu Wind Farm – China

Gemasolar – Fuentes de Andalucia – Spain





Multimegawatt photovoltaic ring
convertor – Hypothetic Image
Roberto Visentin Patent

Figure 2