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Are LENRS the Chicxulub Cretaceous extinction event for fossil fuels?

Or does it provide oil companies with a much greener pathway into the future?

"Total world proved oil reserves reached 1687.9 billion barrels at the end of 2013 - Sufficient to meet 53.3 years of global production"

BP Statistical Review of World Energy 2014

In a New World of much greener CO_2-free energy sources combustion of Carbon-based molecules with Oxygen is replaced with transmutation of Carbon by LENRs

Lewis Larsen

President and CEO
Lattice Energy LLC
October 6, 2014

Contact us directly for further details: 1-312-861-0115 lewisglarsen@gmail.com

http://www.slideshare.net/lewisglarsen/presentations

Painting by Mark Garlick

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Are LENRS the Chicxulub Cretaceous extinction event for fossil fuels?

**"The Stone Age came to an end,
but not for a lack of stones,
and the Oil Age will end,
but not for a lack of oil."**

H.E. Sheikh Ahmed Zaki Yamani
أحمد زكي يماني , who was formerly
Oil Minister of Saudi Arabia

Stated during a media interview (2000)

Painting by Mark Garlick

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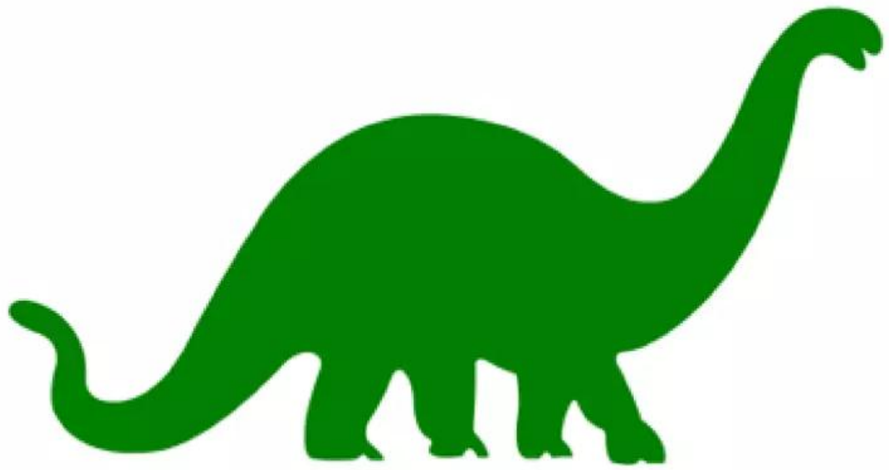
Sinclair



Registered trademark of Sinclair Oil Corporation

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Transformation of oil and coal into CO_2-free energy sources

Coal and oil crucial to the Industrial Revolution and modern society

LENRs enable oil and coal to become 21st century green energy sources

Today

Early 1800s in England

Today

"Clean coal is an attempt by the coal industry to try and make itself relevant in the age of renewables. Existing CCTs do nothing to mitigate the environmental effects of coal mining or the devastating effects of global warming. Coal is the dirtiest fuel there is and belongs in the past."

Greenpeace policy statement (2009)

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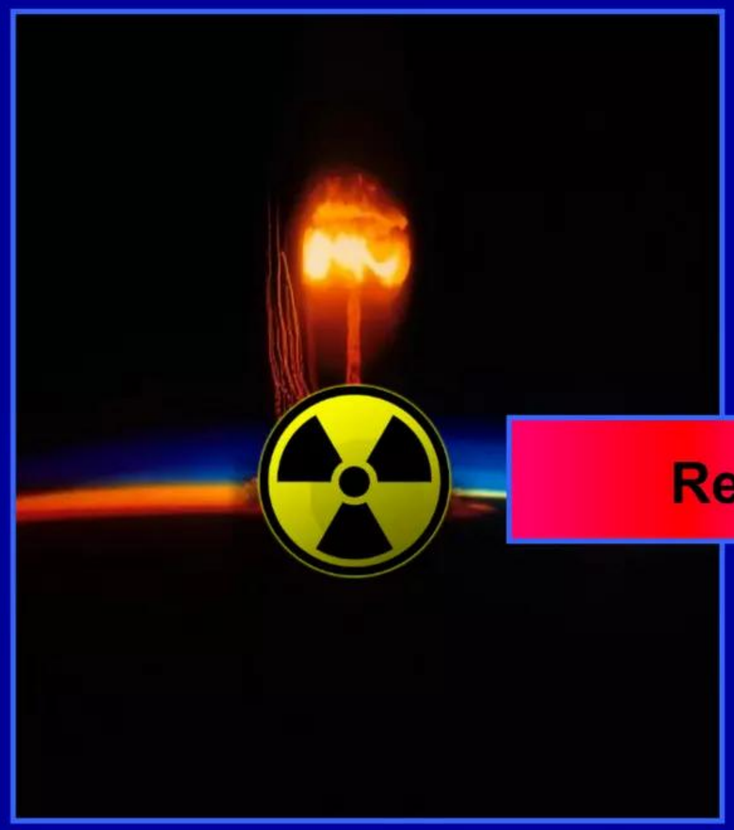
Transformation of oil and coal into CO_2-free energy sources

Coal and oil crucial to the Industrial Revolution and modern society

LENRs enable oil and coal to become 21st century green energy sources

Fission and Fusion

1945



2005

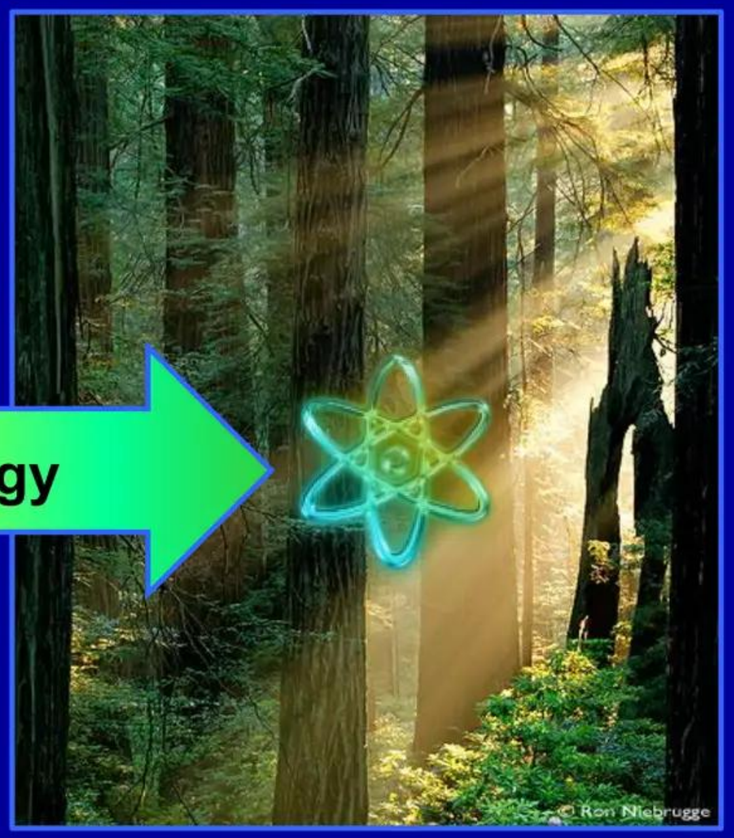
Widom-Larsen theory of LENRs is developed

Revolution in nuclear technology

LENRs are safe and benignly green

Low Energy Neutron Reactions

2014



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LENR technology can transform today's fossil fuels

Breakthroughs in physics and nanotechnology make this possible

Bitumen, heavy oil, and coal may be much more valuable as green LENR fuels

All of these natural hydrocarbons contain aromatic molecules that can be stripped-out

Canadian bitumen

Heavy viscous oil

Anthracite coal

Lattice has discovered that aromatic molecules can potentially be stripped-put and specially processed to be converted into green LENR fuels: no hard radiation emissions, no production of long-lived radioactive wastes or emission of gaseous CO_2 into the atmosphere but instead release 5 million times more thermal energy vs. combustion of Carbon-based molecules with Oxygen

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Nuclear energy density vastly >>> solar, wind, and batteries

Existing nuclear fission or fusion have radiation and waste problems

Low Energy Neutron Reactions (LENRs): no deadly radiation or wastes

- ✓ Beginning with Hans Bethe's landmark paper published back in in 1939, the Holy Grail and longstanding dream of contemporary nuclear science has been to commercialize cleaner (vs. fission) fusion reactions that power stars and our Sun
- ✓ Less technically difficult fission technology was first utilized and deployed in commercial nuclear reactors; it has been fraught with safety, cost, and serious proliferation issues that are well-known *a la* Dr. Evgeny Velikhov's "vital risks"
- ✓ Both fission and fusion rely primarily on the strong interaction, emit biologically deadly hard radiation, and produce long-lived hazardous radioactive wastes
- ✓ Up until the advent of the collective many-body Widom-Larsen theory in 2005, the weak interaction was thought to be useless for large-scale power generation
- ✓ Thanks to Widom-Larsen theory, now know that radiation-free, truly 'green' LENRs based on the weak interaction are enabled by many-body physics in condensed matter and can occur at very substantial rates under exactly the right conditions
- ✓ LENRs are a game-changing paradigm shift in evolution of nuclear technology

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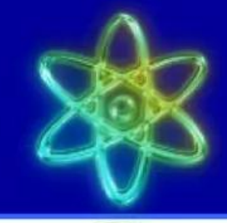
LENRs increase safety and shrink size of nuclear power

Lack of hard radiation obviates need for shielding and containment

Opportunity to develop safe, battery-like portable LENR power sources

Fission reactors need 1 foot of steel and 3 feet of concrete to protect humans from hard radiation and wastes emitted by reactor; makes systems intrinsically large and heavy

LENRs enable devices something like this: small, portable battery-like power sources that are safe and disposable



Evolution of nuclear technology

Much larger LENR devices based on dusty plasma embodiments can potentially scale-up to megawatts; akin to today's power plants

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Nuclear energy density is major competitive advantage

LENRs occupy sweet spot between fission and chemical power sources

Some LENRs release more energy than D+T fusion reactions

Less Energy Per Reaction

Reaction Type	Typical "Average" Energy Release		Relative Index of Energy Release	
U-235 Conventional Fission (1938)	220 MeV		1000	Fission-fusion
H+H Fusion in Stars (1939)	27 MeV	Nuclear: Strong Interaction	123	
D+T Fusion Reactors (1950s)	17. 6 MeV		80	
Light and Heavy Water LENRs (1989)	~ 22 MeV (high side)	Nuclear: Weak Interaction	91	LENRs
	~ 0.1 MeV (low side)		0.45	
Blacklight Power's "Hydrinos" (1991)	max 0.02 MeV	?	0.09	Chemical
Hydrogen Fuel Cells (1838)	0.0002 MeV	Chemical	0.0001	
Combustion of Gasoline (1876)	0.0001 MeV		0.00005	

Evolution of nuclear

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Nuclear energy density is major competitive advantage

Energy density of LENRs is ~5,000 times larger than that of gasoline

LENRs Versus Chemical Energy Sources: Batteries, Fuel Cells, and Microgenerators	
Source of Energy	**Approximate Energy Density (Watt*hours/kg)**
Alkaline Battery	**164**
Lithium Battery	**329**
Zinc-Air Battery	**460**
Direct Methanol Fuel Cell (35% efficient)	**1,680**
Gas Burning Microgenerator (20% efficient)	**2,300**
100% Efficient Combustion of Pure Methanol	**5,930**
100% Efficient Combustion of Pure Gasoline	**11,500**
LENRs (based on an assumption of an average of 0.5 MeV per nuclear reaction in an LENR system)	**57,500,000** (maximum theoretical energy density – only a fraction would be achievable in practice)

Chemical Energy Sources

LENRs

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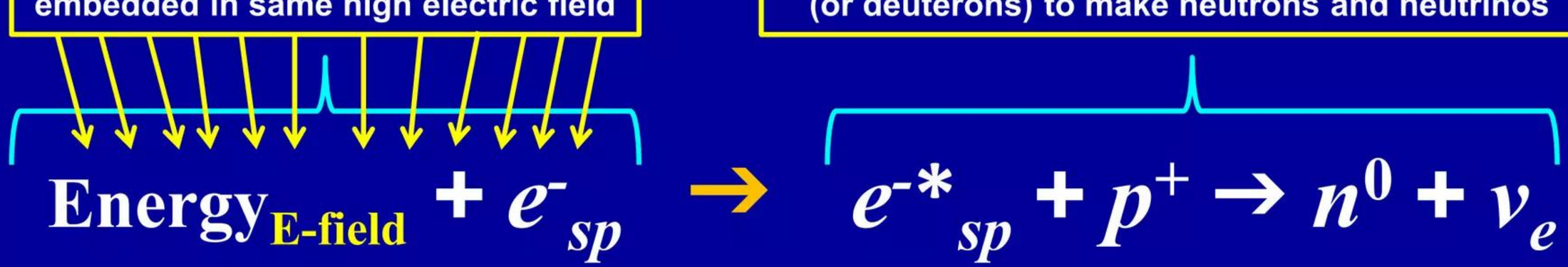
Basic reactions in Widom-Larsen theory are simple

Protons or deuterons react directly with electrons to make neutrons

Neutrons are then captured by other atoms → catalyze nuclear transmutations

Collective many-body quantum effects: many electrons each donate little bits of energy to a much smaller number of electrons that are also embedded in same high electric field

Quantum electrodynamics (QED): smaller number of electrons that absorb energy from electric field can increase their effective masses ($m = E/c^2$) to point where they can react directly with protons (or deuterons) to make neutrons and neutrinos



ν_e neutrinos: ghostly unreactive photons that fly-off into space; n^0 neutrons: capture on nearby atoms

Neutron-capture-catalyzed transmutations release energy stored in atoms:

Neutrons + atomic nuclei → heavier elements + decay products

Releases vast amounts of stored nuclear binding energy as energetic particles/photons that create heat

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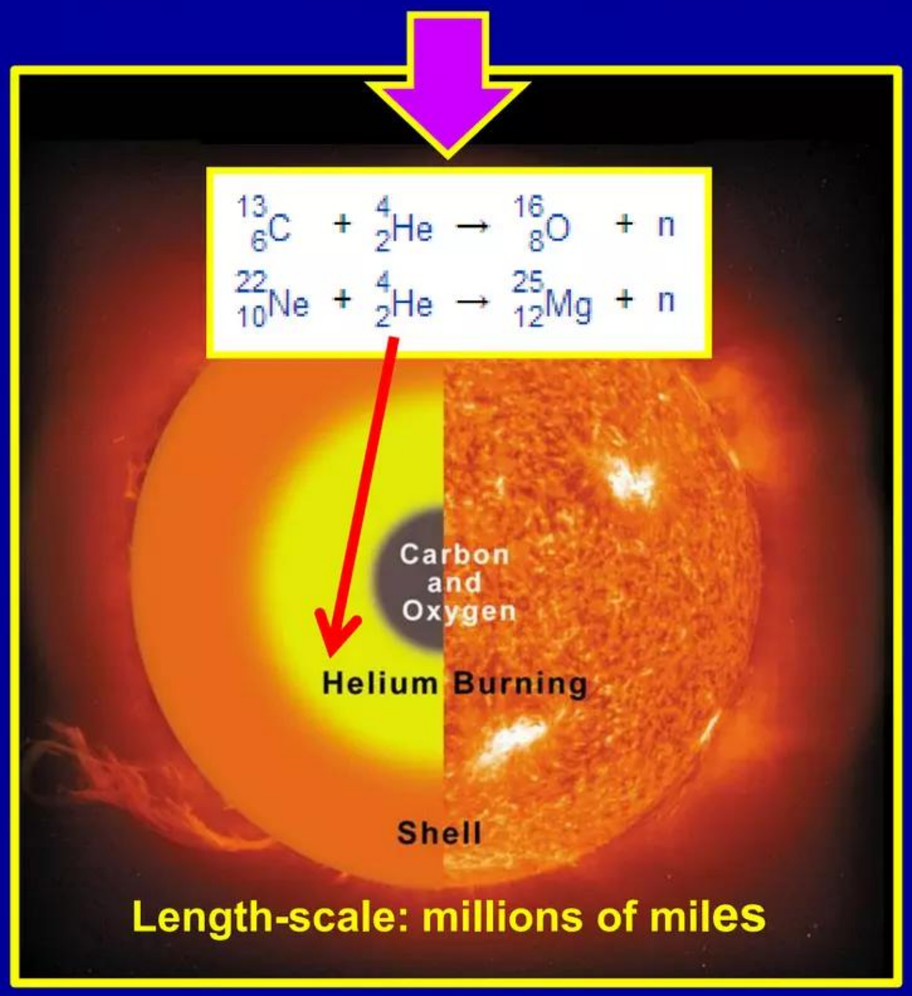
LENR ultra low-energy neutrons are extremely safe

Fission and fusion neutrons are energetic, deadly and need shielding

All of the nuclear reactions shown below create neutrons: only LENRs are safe

Stellar fusion reactions make MeV neutrons

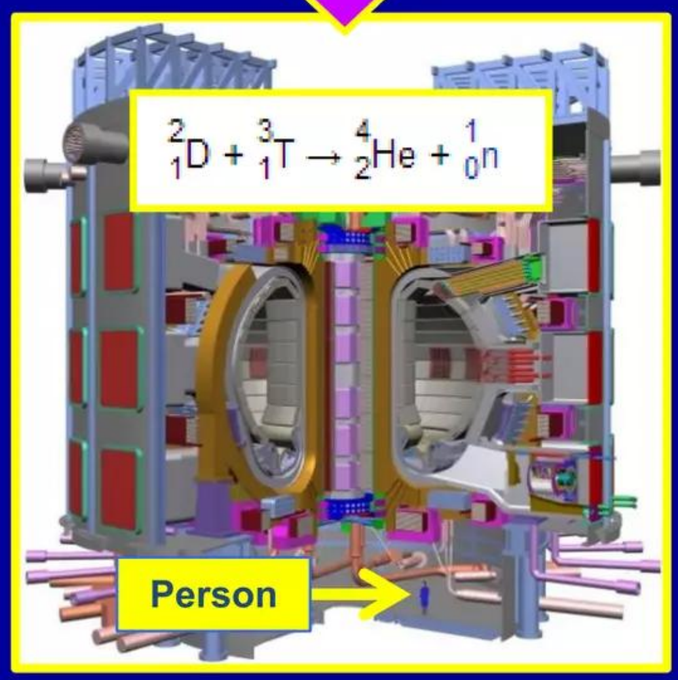


Length-scale: millions of miles

Temperatures: many millions of degrees

ITER: D+T fusion reactor

Dangerous 14.1 MeV neutrons



Length-scale: hundreds of feet

Temperatures: millions of degrees

Safe LENRs

Ultra low-energy

Hand-held device

Length-scale: inches

Temperatures: only thousands of degrees

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Are LENRS the Chicxulub Cretaceous extinction event for fossil fuels?

Catalytic ultra low energy neutrons trigger heat production

Release of nuclear binding energy creates vast amounts of usable heat

Neutron ‘match’

capture

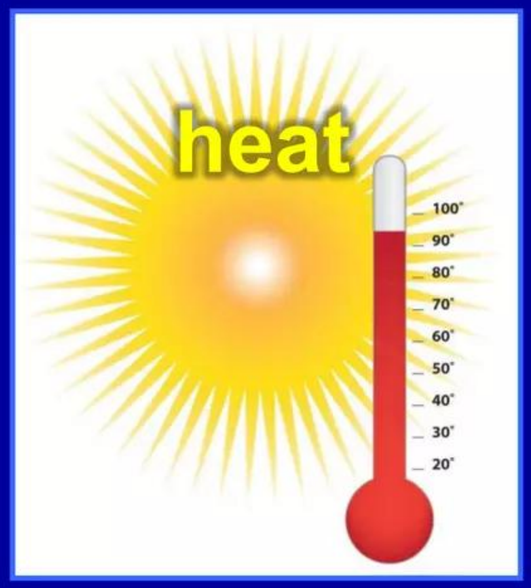
+

Neutrons are readily absorbed by LENR fuels such as inexpensive Nickel, Titanium, Lithium, or Carbon atoms

produces

→

Direct conversion of neutron capture and decay-related gammas to IR and beta/alpha particles create heat



Neutrons + target fuel atoms ⟶ heavier elements + decay products

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Are LENRS the Chicxulub Cretaceous extinction event for fossil fuels?

LENR technology could revolutionize the world of energy

Sustainable economic growth could be achieved if it is commercialized

- ✓ While solar PV and wind are CO_2-free and extremely biosafe, their intrinsic energy densities are much lower than today's fossil fuels and inherently intermittent - not continuous - sources of electrical and thermal power
- ✓ Nuclear fission power has high energy densities, does not produce CO_2 and operates continuously; but it emits huge quantities of deadly neutron and gamma radiation during operation and produces many long-lived radwastes
- ✓ D-T nuclear fusion, while better than fission in terms of producing much less radwaste, still emits very dangerous neutron and gamma radiation during operation; also, there is still no sign of it being commercialized after 60 years of huge effort and hundreds of billions of R&D $ spent worldwide. See July 31, 2014 *Nature* story on ITER by Elizabeth Gibney: http://tinyurl.com/mlk5d5k
- ✓ **Low energy neutron reactions (LENRs) are only primary energy technology on foreseeable horizon that can provide world with affordable dense green energy, connect the unconnected, and empower billions of powerless people**

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Additional information for those interested in learning more about LENRs

Document explains how LENRs could dramatically increase performance of large range of products:

"What happens to passenger aircraft, mobile vehicular platforms, UAVs, homes, powered exoskeletons, and autonomous robots if green, radiation-free LENRs someday achieve power densities > 10x chemical technologies? Revolution - here is how and why"
L. Larsen, Lattice Energy LLC, February 16, 2014 [99 slides] Updated through September 9, 2014
http://www.slideshare.net/lewisglarsen/lattice-energyllc-revolutionary-lenrs-could-power-future-aircraft-and-other-systems-feb16-2014

Index to large collection of documents about LENR theory, experimental data, and the technology:

"Index to key concepts and documents" v. #19
L. Larsen, Lattice Energy LLC, May 28, 2013 [119 slides] Updated and revised through August 19, 2014
http://www.slideshare.net/lewisglarsen/lattice-energy-llc-index-to-documents-re-widomlarsen-theory-of-lenrsmay-28-2013

Peer reviewed paper - covers all theoretical aspects of basic Widom-Larsen theory published to date:

"A primer for electro-weak induced low energy nuclear reactions"
Y. Srivastava, A. Widom, and L. Larsen, *Pramana - Journal of Physics* 75 pp. 617 - 637 (2010)

Abstract: "Under special circumstances, electromagnetic and weak interactions can induce low-energy nuclear reactions to occur with observable rates for a variety of processes. A common element in all these applications is that the electromagnetic energy stored in many relatively slow-moving electrons can (under appropriate circumstances) be collectively transferred into fewer, much faster electrons with energies sufficient for the latter to combine with protons (or deuterons, if present) to produce neutrons via weak interactions. The produced neutrons can then initiate low-energy nuclear reactions through further nuclear transmutations. The aim of this paper is to extend and enlarge upon various examples analyzed previously, present order of magnitude estimates for each and to illuminate a common unifying theme amongst all of them."

http://www.ias.ac.in/pramana/v75/p617/fulltext.pdf

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Are LENRS the Chicxulub Cretaceous extinction event for fossil fuels?

British Petroleum believes the Oil Age only has 53 years left

Published in *The Christian Science Monitor* on July 14, 2014

The Christian Science Monitor

How long will world's oil reserves last? 53 years, says BP

The world has 53.3 years left to find an alternative to oil before current proved reserves run dry, according to BP. Of course, nations are finding new oil – meaning that number is rising – but new extraction methods are costly and can pose environmental threats.

By Andy Tully, OilPrice.com ▼ | JULY 14, 2014

According to BP, drivers whose vehicles rely on burning oil have a little more than a half-century to find alternate sources of energy. Or walk.

http://www.csmonitor.com/Environment/Energy-Voices/2014/0714/How-long-will-world-s-oil-reserves-last-53-years-says-BP
http://oilprice.com/Energy/Energy-General/BPs-Latest-Estimate-Says-Worlds-Oil-Will-Last-53.3-Years.html
http://www.bp.com/en/global/corporate/about-bp/energy-economics/statistical-review-of-world-energy.html

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Are LENRS the Chicxulub Cretaceous extinction event for fossil fuels?

BP says only 14 years remain for Asia-Pacific oil reserves

Published in *The Christian Science Monitor* on July 14, 2014

The Christian Science Monitor

Such methods are helping the United States, for example, to achieve energy independence. But that won't apply to China, a huge customer for fossil fuels. BP says Asia-Pacific oil reserves will last only 14 years at current rates. That means China will have to keep importing oil, putting further strain on global reserves.

http://www.csmonitor.com/Environment/Energy-Voices/2014/0714/How-long-will-world-s-oil-reserves-last-53-years-says-BP
http://oilprice.com/Energy/Energy-General/BPs-Latest-Estimate-Says-Worlds-Oil-Will-Last-53.3-Years.html
http://www.bp.com/en/global/corporate/about-bp/energy-economics/statistical-review-of-world-energy.html

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Are LENRS the Chicxulub Cretaceous extinction event for fossil fuels?

BP says only 113 years remaining for global coal reserves

Published in BP's annual *Statistical Review of World Energy 2014*

Coal reserves

World proved coal reserves in 2013 were sufficient to meet 113 years of global production, by far the largest R/P ratio for any fossil fuel

The US, Russia and China hold the largest proved reserves. By region, Europe & Eurasia holds the largest proved reserves and has the highest R/P ratio 254 years, compared with 250 for North America.

http://www.bp.com/en/global/corporate/about-bp/energy-economics/statistical-review-of-world-energy/review-by-energy-type/coal/coal-reserves.html

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Future global demand for energy will be very strong

Real GDP growth and increased demand for energy highly correlated

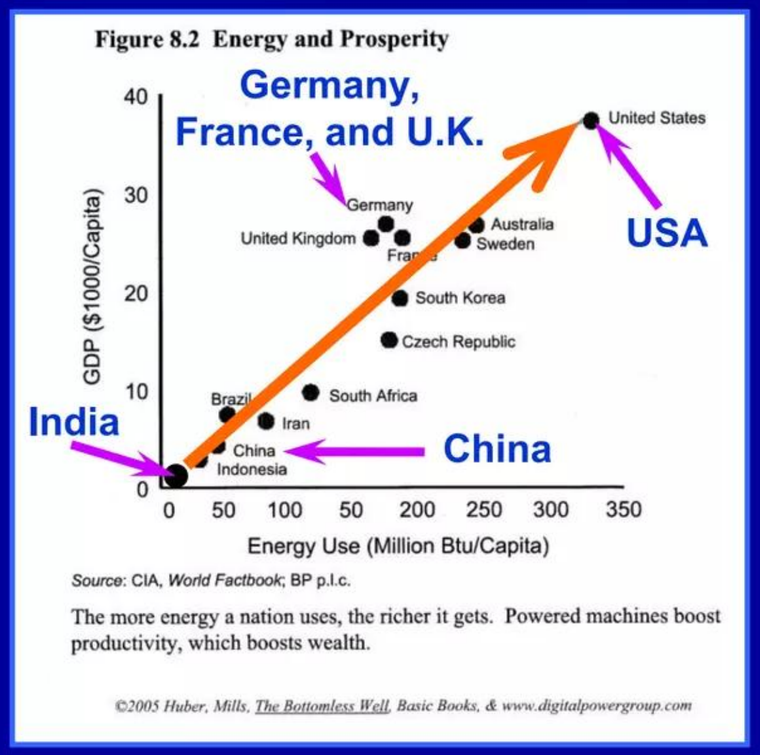
Future demand cannot be met without vast improvement in energy technologies

Empirical data presented below (Huber & Mills - 2005; Brown *et al.* - 2011) shows that growth in per capita GDP (which is what also reduces population growth rates) is highly correlated with corresponding increases in total energy demand; in today's modern energy-intensive societies, this determines the overall standard of living. Measured against finite fossil fuel supplies and other non-renewables, ratcheting increases in demand for energy could exacerbate energy supply issues as global real GDP growth continues into the future.

India & China now account for ~39% of the world's population

Note: in 2008 India (not shown in Huber-Mills' chart) had est. GDP ($1000/Capita) of 1.327 and Energy Use (Million Btu/Capita) of 12.6, placing it near origin of bold blue arrow in the lowermost corner of the left quadrant;

Upward progression of countries along the trajectory of blue arrow creates increases in total world energy demand. The faster GDP per capita rises in all countries, the faster total global energy demand increases.



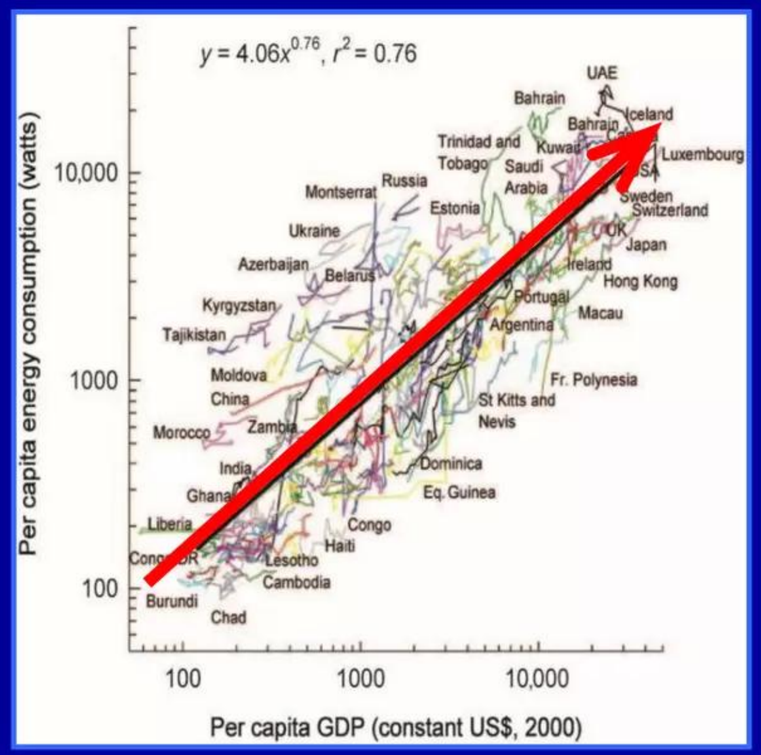


Fig. 1, pp. 20, Brown *et al.*, "The relationship between per capita energy use and per capita gross domestic product (GDP; in US dollars), plotted on logarithmic axes, from 1980 to 2003."

From: "Energetic Limits to Economic Growth" J. Brown *et al.* *BioScience* 61 pp. 19 - 26 (2011)

http://sev.lternet.edu/~jnekola/nekola%20pdf/bs-61-19-26.pdf

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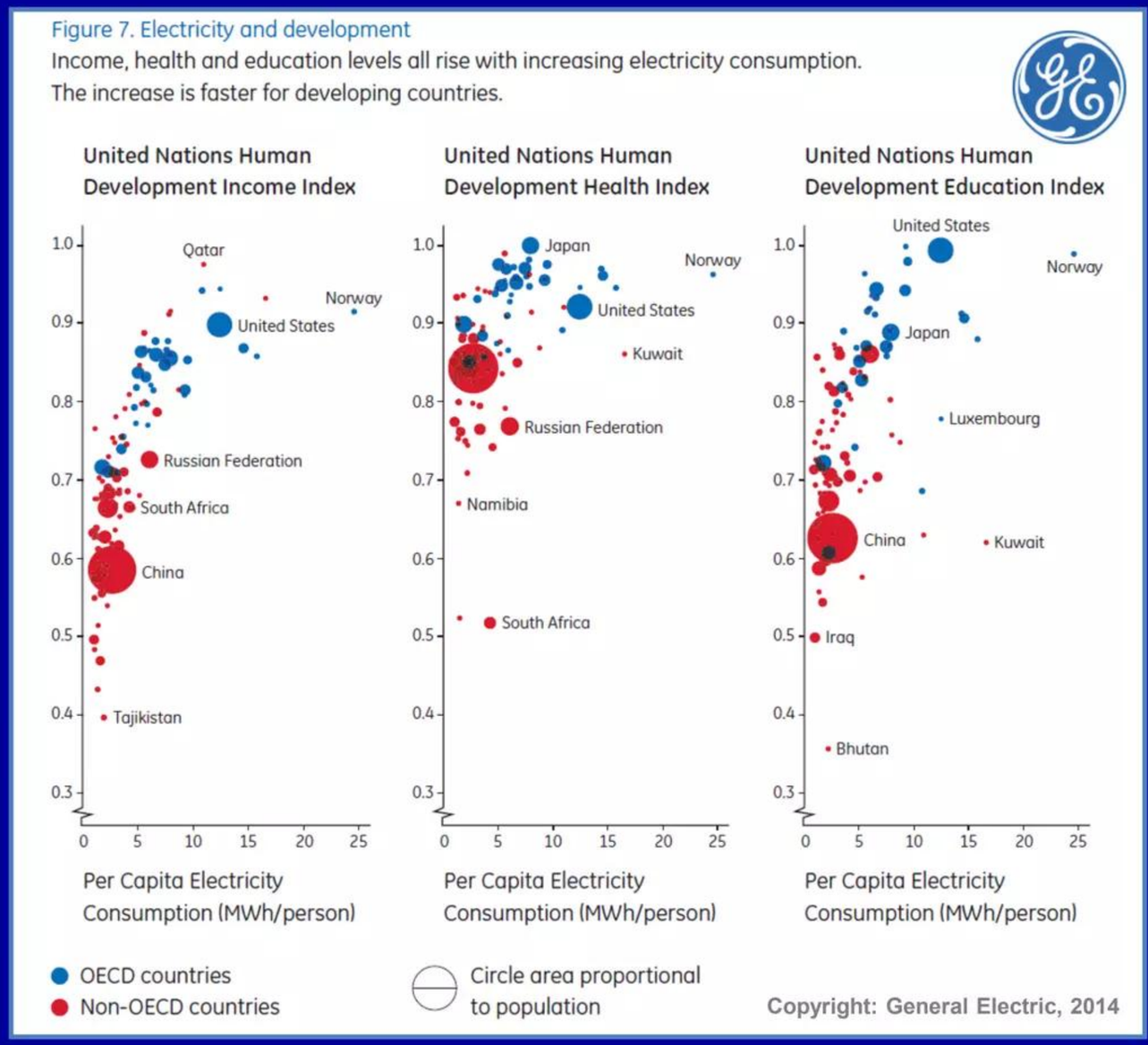
Quality of life clearly better with increased use of energy

This relationship contributes to strong underlying global energy demand

Data source: United Nations Development Programme Human Development Report 2013 and US Energy Information Administration



"The rise of distributed power" see Fig. 7 on page 32
B. Owens, General Electric - Ecomagination (February 2014)
http://www.eenews.net/assets/2014/02/25/document_gw_02.pdf

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Recent increases in U.S. oil production have been huge

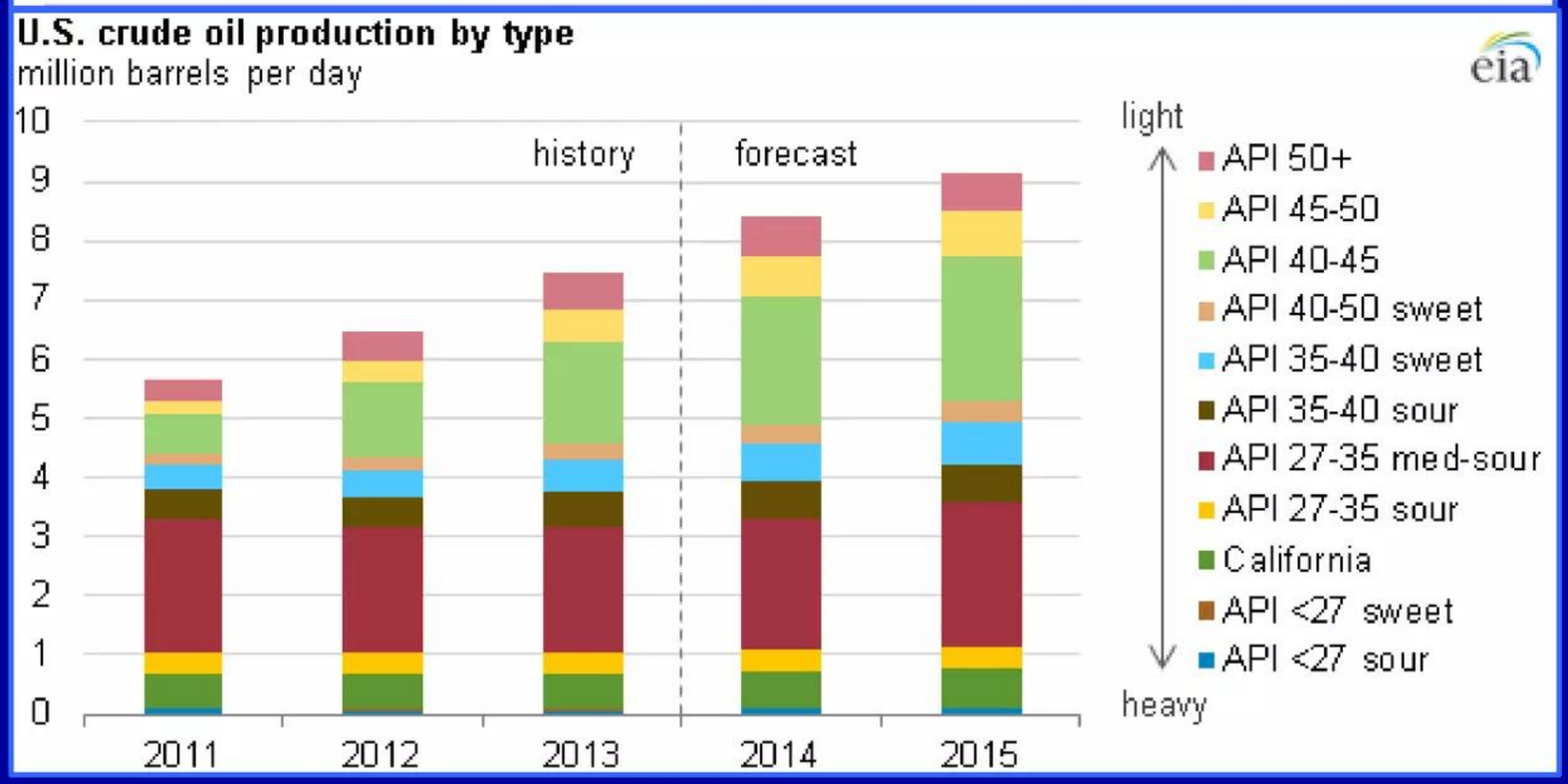
Much of this results from fracking that unlocks oil in tight formations

In parallel the U.S. economy is reaccelerating as it pulls-out of Great Recession

eia Independent Statistics & Analysis
U.S. Energy Information Administration

JUNE 6, 2014

Increases in U.S. crude oil production come from light, sweet crude from tight formations



Source: http://www.eia.gov/todayinenergy/detail.cfm?id=16591

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Oil price resilient despite massive supply increases

Most likely caused by strong underlying global demand for energy

Big surprise here is that oil price has stayed very steady rather than declining

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Fossil fuel reserves will be exhausted within ~150 years

Solar PV/wind power: insufficient energy density to replace fossil fuels

World will still require dense energy sources for transportation & portable power

Comparison of intrinsic energy densities

Table 1 Energy density

Source	Joules per cubic meter
Solar	0.0000015
Geothermal	0.05
Wind at 10 mph (5m/s)	7
Tidal water	0.5–50
Human	1,000
Oil	45,000,000,000
Gasoline	10,000,000,000
Automobile occupied (5800 lbs)	40,000,000
Automobile unoccupied (5000 lbs)	40,000,000
Natural gas	40,000,000
Fat (food)	30,000,000

Petroleum energy density:
"A single gallon of gasoline contains approximately forty (40) megajoules of chemical energy. Dividing energy by volume yields an energy density of ten billion joules per cubic meter. Gasoline is ten quadrillion times more energy-dense than solar radiation and one billion times more energy-dense than wind and water power."

Reference: B.E. Layton, *International Journal of Green Energy* 5 pp. 438 - 455 (2008)

Source: http://www.drexel.edu/~/media/Files/greatworks/pdf_sum10/WK8_Layton_EnergyDensities.ash

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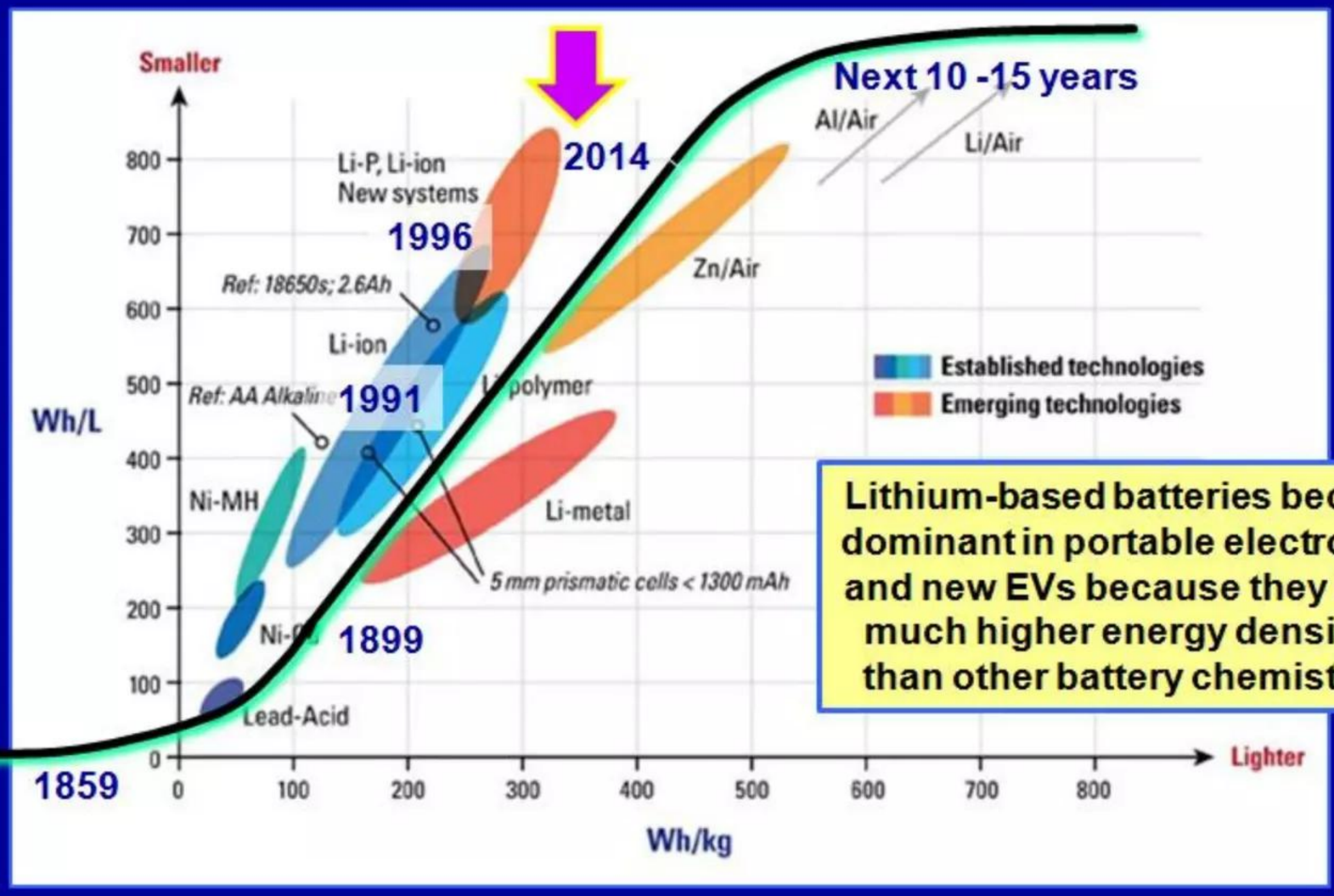
Batteries cannot stopgap limitations of solar and wind

Batteries' energy densities limited and the technology now maturing

World will still require dense energy sources for transportation & portable power



Source: http://www.estquality.com/technology Note: superimposed S-curve and dates were added by Lattice

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Are LENRS the Chicxulub Cretaceous extinction event for fossil fuels?

“Make no mistake: Rising powers/shrinking planet is a dangerous formula. Addressing the interlocking challenges of resource competition, energy shortages, and climate change will be among the most difficult problems facing the human community. If we continue to extract and consume the planet's vital resources in the same improvident fashion as in the past, we will, sooner rather than later, transform the earth into a barely habitable scene of desolation. And if the leaders of today's Great Powers behave like those of previous epochs - relying on military instruments to achieve their primary objectives - we will witness unending crisis and conflict over what remains of value on our barren wasteland.”

Michael Klare, “Rising Powers, Shrinking Planet: The New Geopolitics of Energy” page 261

Credit: Aral Sea Foundation

ARAL SEA FOUNDATION

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Oil companies are between a rock and a hard place

Strategic problem: one way or another oil supplies gone in ~50 years

Can adapt/evolve to become agents of historical change rather than victims of it

- ✓ **Many oil companies have existed and conducted business for more than 100 years: Arco (1866); Mobil (1866); Conoco (1875); Standard Oil of New York (now Exxon - 1882); Standard Oil of Indiana (1889); Royal Dutch Shell (1890); etc.**
- ✓ **Putting aside issues of possible CO_2 emission-related climate change (which could further hasten the end of the Age of Oil via government regulation), when supplies clearly begin 'running on empty' large oil companies will be forced to diversify out of oil, exit the fossil energy business, and/or simply cease to exist**
- ✓ **So petroleum companies are facing the Scylla rock shoal of diminishing oil supplies and the hard Charybdis whirlpool of CO_2-related climate change issues**

There is an adaptive evolutionary pathway for oil companies that may help them successfully traverse these treacherous, turbulent waters: thanks to experiments conducted at Hokkaido Univ. (Japan - 2008), Lattice has discovered that LENRs can be triggered on hydrocarbon aromatic (6-Carbon benzene) rings. In this new process safe low energy neutrons capture on ring Carbon atoms, release heat, and transmute Carbon into other elements, e.g. Nitrogen and Oxygen --- no CO_2

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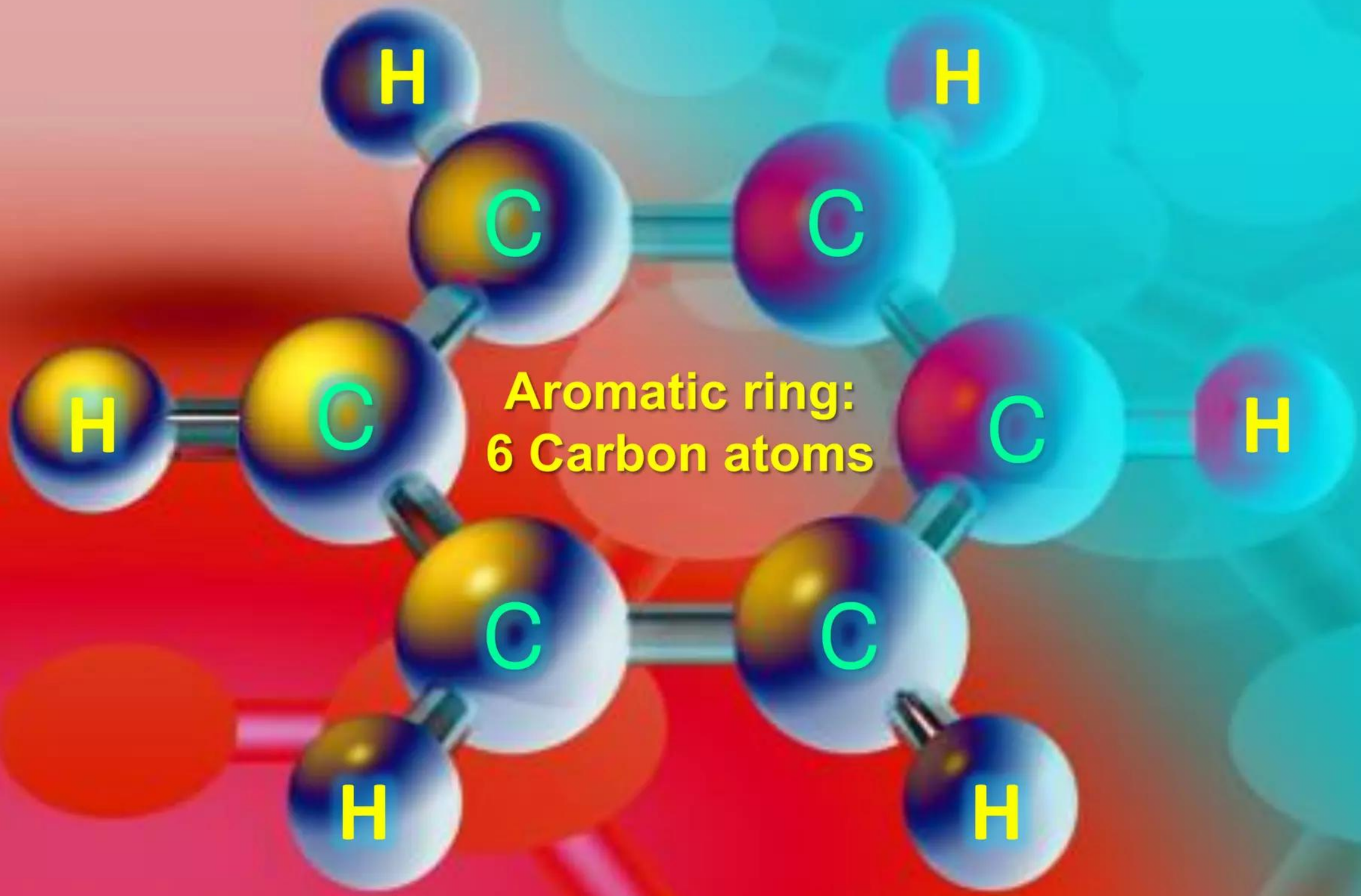

Aromatic ring:
6 Carbon atoms

Six Carbon atoms are arranged in hexagonal ring bonded to six Hydrogen atoms

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LENRs have been triggered on aromatic rings in laboratory

Widom-Larsen theory explains such anomalous experimental results

- ✓ Experiments conducted at Hokkaido Univ. (Japan) in 2008 first demonstrated that production of LENR neutrons and transmutation of Carbon can be triggered on aromatic rings at very modest temperatures and pressures; these seemingly anomalous results of Mizuno *et al*. are explained by the Widom-Larsen theory
- ✓ Per Widom-Larsen, delocalized π (Pi) electrons e^-_π found on aromatic (benzene-like) rings are quantum mechanically entangled and behave like collectively oscillating surface plasmon electrons found on metallic surfaces and interfaces; similarly, protons p^+ (Hydrogen atoms) attached to ring Carbon atoms oscillate collectively and are also quantum mechanically entangled with each other
- ✓ Per Widom-Larsen, Born-Oppenheimer Approximation breaks-down on aromatic rings which enables local nuclear-strength electric fields that increase effective masses of some π electrons so that they can then react with one of the ring's protons to convert it into an ultra low energy neutron which is captured by a nearby ring Carbon atom. This begins the LENR Carbon transmutation process
- ✓ Series of successive neutron captures and decays make Nitrogen, then Oxygen

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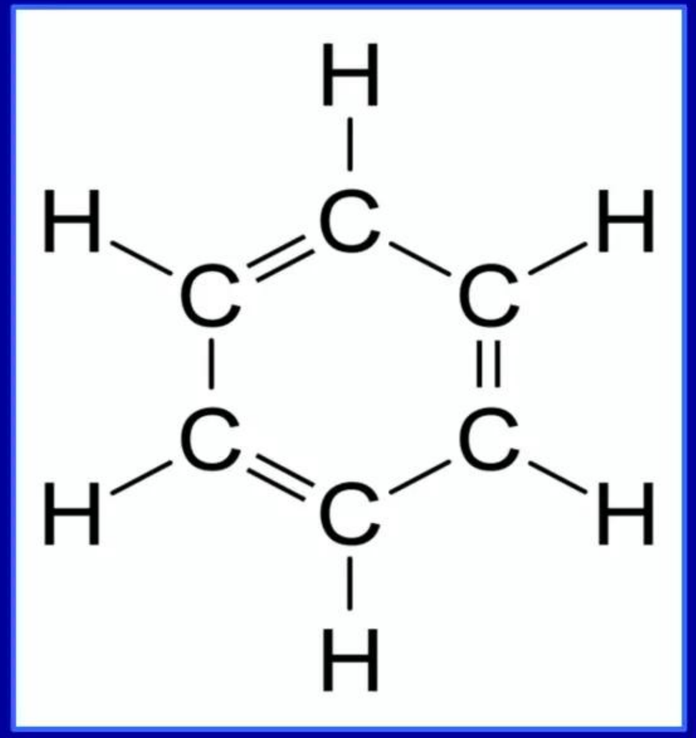
Convert ring Hydrogen atoms (protons) into safe neutrons

Ultra low energy neutrons created collectively in an electroweak reaction

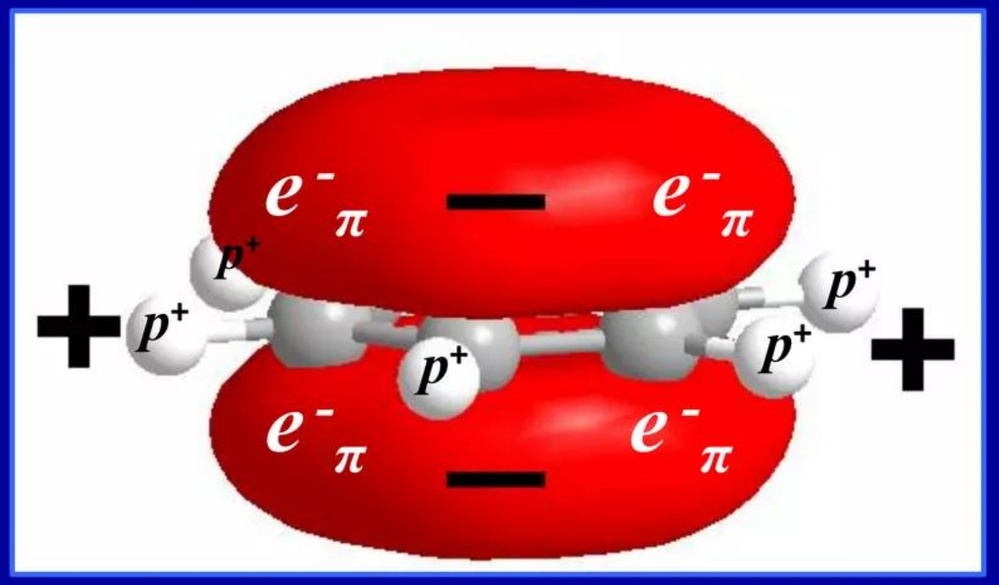
$$\text{Input energy}_{\text{electromagnetic field}} + e^-_\pi \rightarrow e^{-*}_\pi + p^+ \rightarrow n^0 + \nu_e$$

Each Hydrogen atom contains a single proton that is bound to the 6-Carbon ring



Benzene's 6-Carbon ring

Only handful of total number of π electrons are shown



Red indicates π (Pi) many-electron clouds on both sides of Benzene ring

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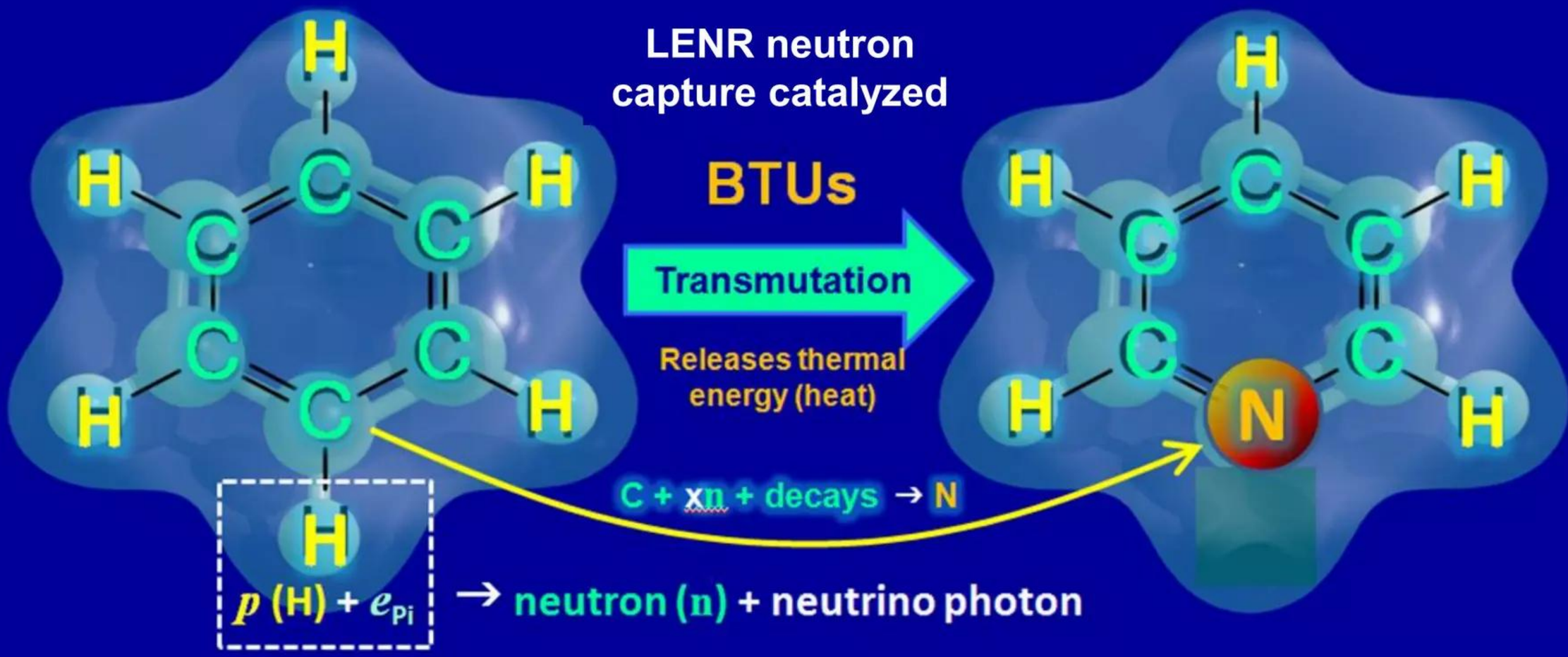
Convert ring Hydrogen atoms (protons) into safe neutrons

Neutrons are captured by ring Carbon atoms that are then transmuted



In this example Carbon is transmuted into Nitrogen by LENR processes

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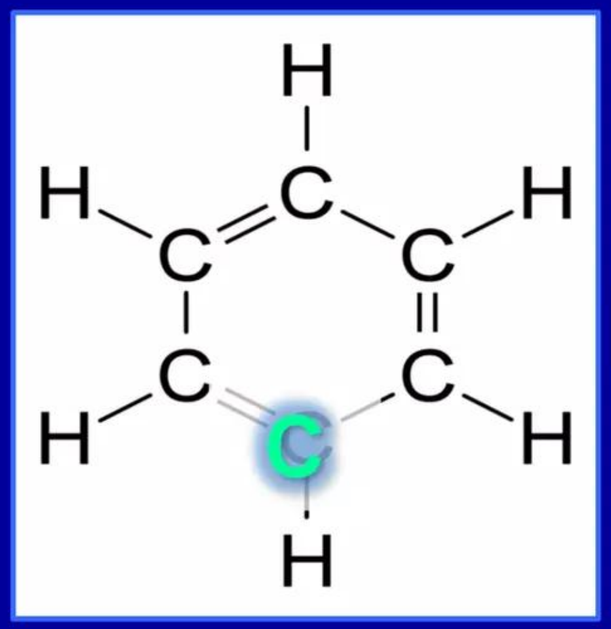
‘Green’ LENR transmutation of Carbon→Nitrogen→Oxygen

Similar to CNO cycle in stars but doesn’t require star-like conditions

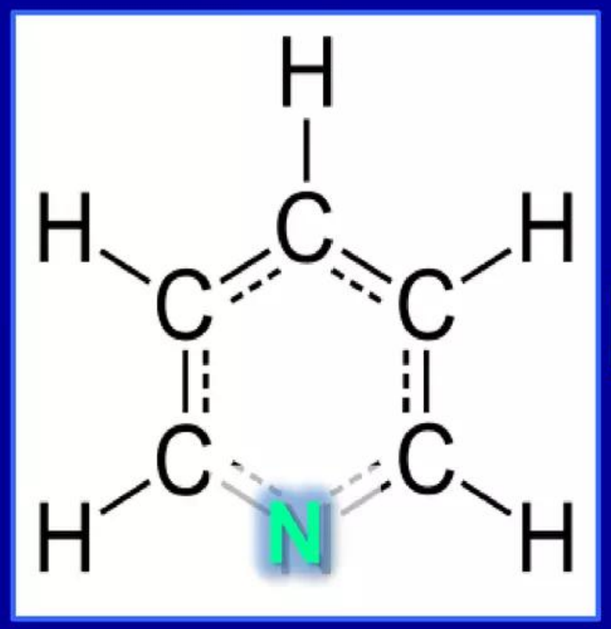
Process releases much heat without producing deadly radiation or wastes

Aromatic molecules’ chemistry changes in parallel with Carbon transmutation

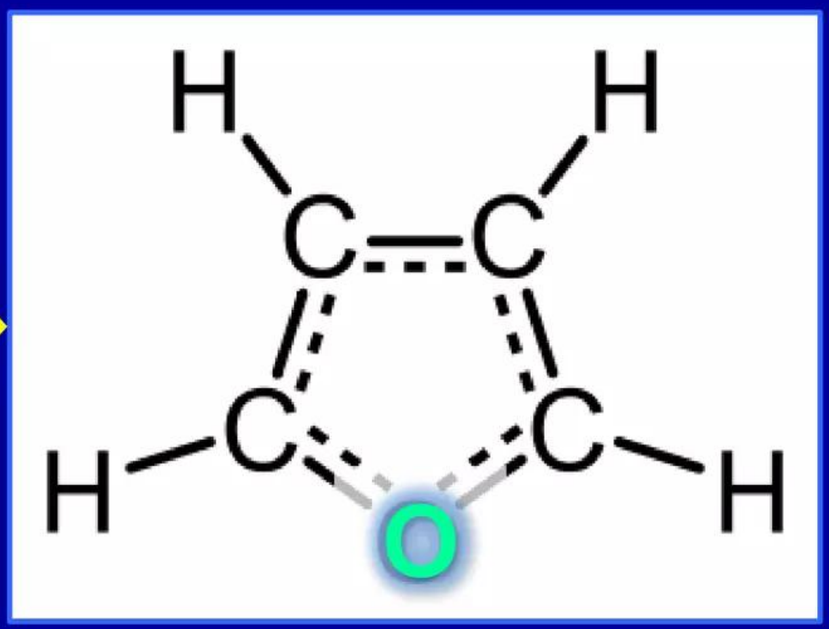
Benzene



Pyridine



Furan



LENRs routinely interoperate with ordinary chemical reactions on surfaces

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Carbon transmutation releases > 1 million x more BTUs

Oil and coal can both potentially be processed into CO_2-free LENR fuels

LENRs used to transmute Carbon fuels rather than combusting them with Oxygen

- ✓ What we will refer to as target fuel atoms are simply stable elements (which are themselves initially comprised of some number of natural isotopes) that serve as initial starting points for complex, neutron-capture-driven LENR transmutation reaction networks; unlike fission, LENR target fuels like Carbon aromatics are cheap
- ✓ What engineers call a "fuel cycle" in nuclear fission power industry is essentially the same as what we call an LENR network. Major difference is that there are only very limited number of fuel cycles used in today's commercial fission reactors and they are based on Uranium isotopes (less problematic Thorium fuel cycles are still under development). By contrast, the possibilities for LENR fuel cycles are almost limitless --- literally any target element that will capture neutrons might be used but some are much better than others; for example, Carbon and Lithium atoms are good targets
- ✓ We will now show a segment of a hypothetical Carbon-target LENR fuel pathway that should be commercially usable if presently troublesome aromatic hydrocarbons found naturally in heavy oils and coal can be cost-effectively processed into nanoparticulate forms in which LENRs can be triggered. In Lattice's new concept, Carbon atoms present in oil and coal would be transmuted rather than oxidized

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Carbon transmutation releases > 1 million x more BTUs

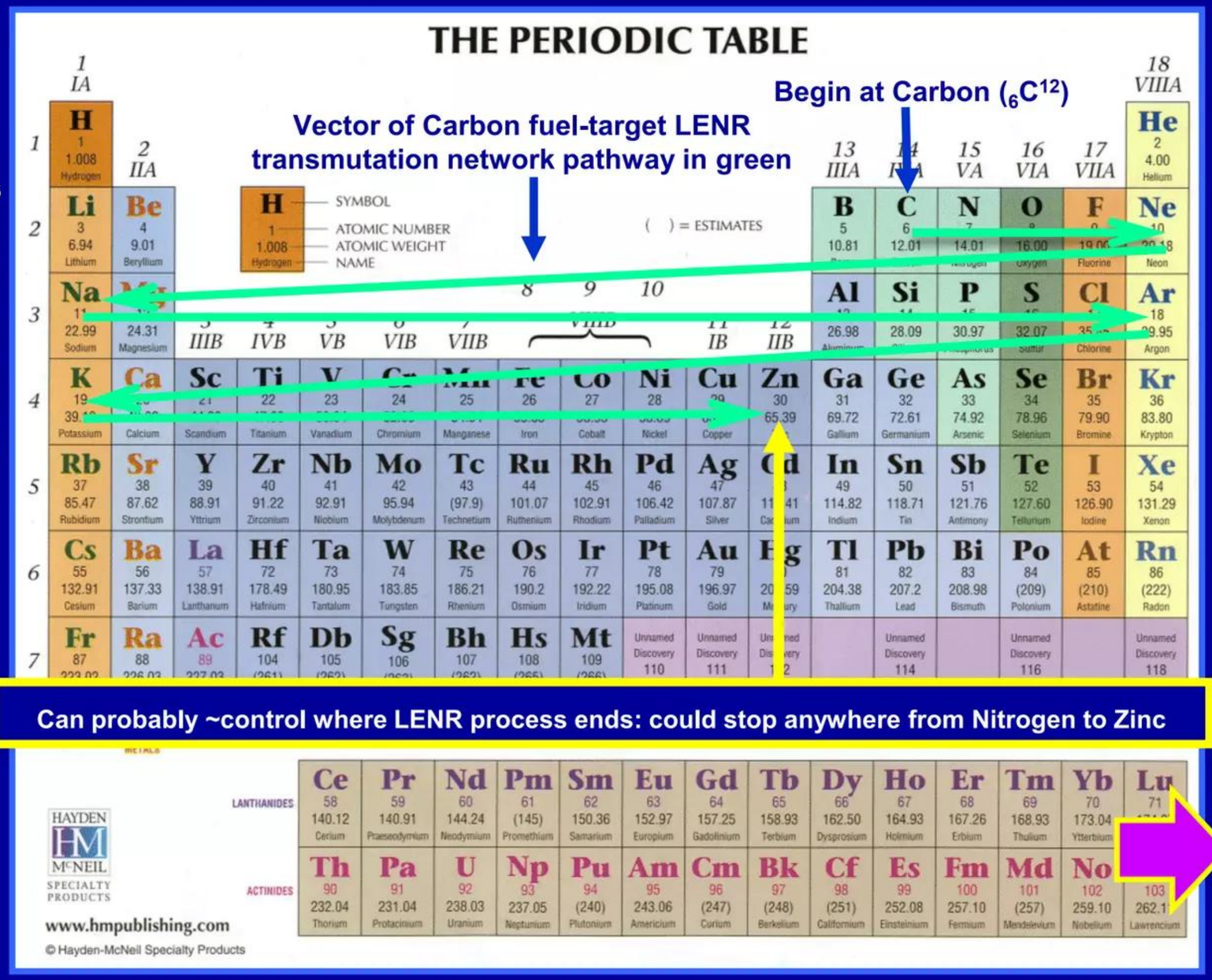
LENR transmutation pathways tend to follow rows of Periodic Table

Stable elements produced by this LENR network path can go all the way to Zinc

Combustion of Carbon atoms in fossil fuels with Oxygen O_2 produces CO_2 and H_2O; CO_2 gas emissions are a problem, which has led to schemes like Carbon capture and sequestration (CCS)

Additional issues with coal's varied trace elements

Scale of energy release from chemical reaction combustion processes are on the order of eVs



Can probably ~control where LENR process ends: could stop anywhere from Nitrogen to Zinc

Depending on where nuclear process was stopped, LENR transmutation of Carbon atoms in oil and coal could produce a wide variety of stable elements up through Zinc; gaseous emissions might be limited to Neon, Argon, Nitrogen and/or preferably Oxygen

Scale of energy release is in MeV; or >10^6 larger than chemical reactions

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Extract oil/coal aromatics then convert them into LENR fuels

Release millions of x more BTUs from same barrel of oil or ton of coal

- ✓ Tar-like bitumen such as Canadian oil sands, heavy viscous oils, and high-grade coking coal all naturally contain varying % of aromatic ring molecules; these include simple molecules like Benzene and more complex, multi-ring aromatics such as polycyclic aromatic hydrocarbons (PAHs). One example of a PAH is Phenanthrene, which is comprised of three bonded Benzene rings
- ✓ Using a mixture of traditional and recently developed chemical techniques, oil and coal can be processed to extract desired aromatic fractions; in theory, it should be possible to further process these aromatics into LENR fuels that would be 'burned' in new, proprietary types of radiation-free transmutation reactors that would not require shielding, containment, or radwaste disposal
- ✓ Compared to combusting Carbon with Oxygen, using LENRs to instead *transmute* Carbon into other stable, non-toxic elements can produce 5 million times more BTUs of thermal energy without emitting any CO_2 into atmosphere
- ✓ Opportunity for oil and coal companies selling BTUs to customers to vastly increase revenues/profits by engaging in production and sale of LENR fuels

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Are LENRS the Chicxulub Cretaceous extinction event for fossil fuels?

By the world very gradually switching power generation technologies from presently dominant chemical combustion processes to instead using transmutation of LENR Carbon-based fuels derived directly from petroleum and coal, oil companies have an opportunity to dramatically extend the effective longevity of today's remaining in-ground supplies of fossil fuels.

Achieving this goal could postpone mankind's day of reckoning on energy for thousands of years, enable high rates of sustainable global economic growth, and allow future consumers to enjoy abundant supplies of affordable, nonpolluting, CO_2-free energy

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LENRs are not Chicxulub extinction event for fossil fuels

Rather an opportunity to extend their usefulness by thousands of years

Oil companies do not have to be aging corporate dinosaurs.

They can seize the LENR opportunity to adapt and evolve

into vibrant green energy companies of the future.

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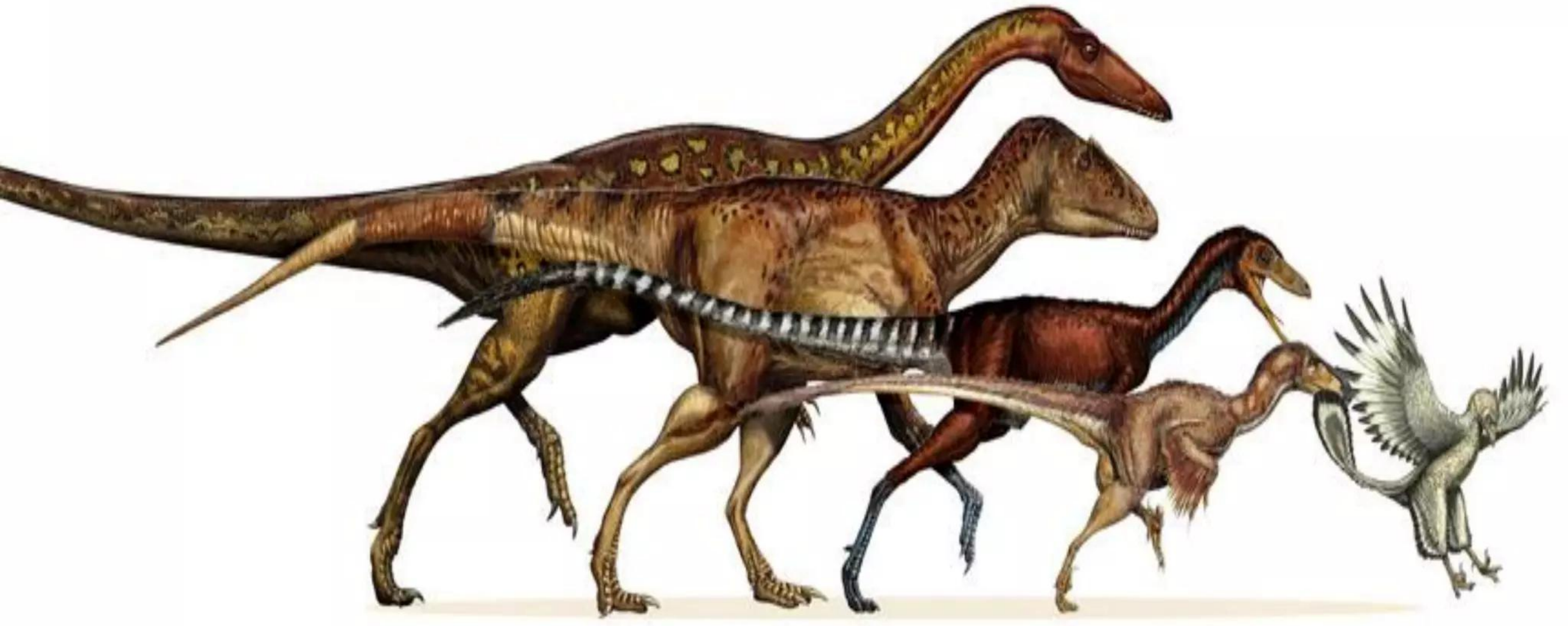
Are LENRS the Chicxulub Cretaceous extinction event for fossil fuels?

Dinosauria survived Chicxulub event by evolving into birds



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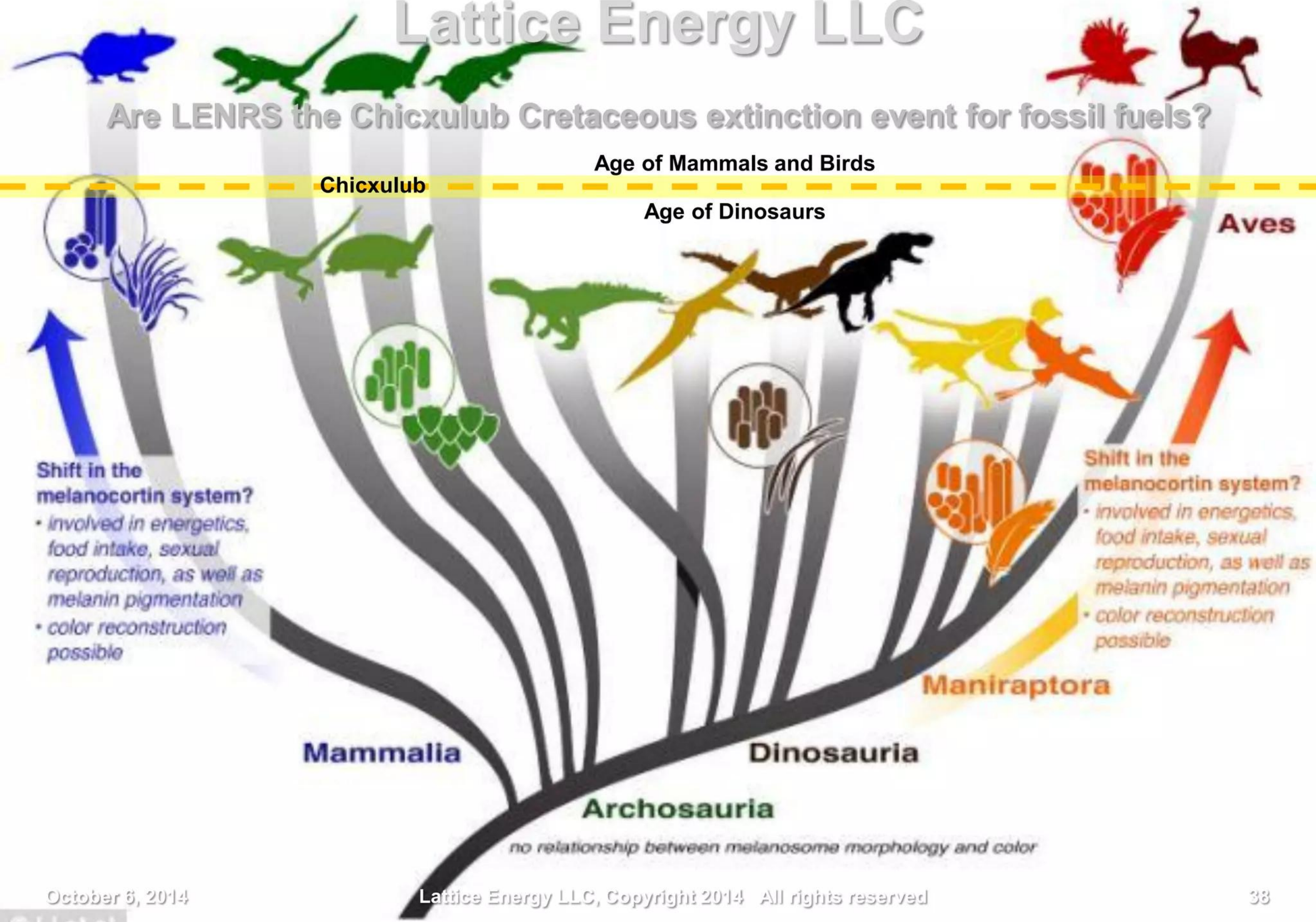

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Are LENRS the Chicxulub Cretaceous extinction event for fossil fuels?

Oil and coal companies can become eagles in the New World

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“From the age of the dinosaurs, cars have run on gasoline. Where, where have they gone? Now, it's nothing but flowers.”

Lyrics quoted from song "Nothing but flowers" written and performed by David Byrne and Talking Heads; released on their final "Naked" album (Warner Bros.,1988)
Running time 4:15

https://www.youtube.com/watch?v=c3t5nmqRVMs

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LENRS don't have to be a Chicxulub extinction event for fossil fuels

"Widespread global deployment of cost-effective LENR technologies, in parallel with broad deployment of synergistic large- and small-scale photovoltaic and wind-power systems, could create an energy-rich, greener energy future for humanity. Importantly, LENRs and the portfolio of Carbon-free energy technologies have the potential to democratize access to affordable energy for every inhabitant of this planet."

"So there it is. Not to decide is to decide. Sooner or later, we must all place our bets on the future."

Lattice White Paper, April 12, 2010

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