Power Conversion For LENR

NEW POSSIBILITIES

Disclaimer

- William Donovan is not Directly Affiliated With Andrea Rossi or Leonardo Corporation.
- Independent Investigator and Researcher on Alternative Energies and Propulsion.
- Chief Technical Advisor for www.E-catAustralia.com
- In partnership with Roger Green and Eco Global Fuels for R and D with desalination and heat to electricity conversion using e cat technology
- Contact: ecoglobalfuels@earthlink.net
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Research and Development

- Benchmarks for desalination and heat to electricity conversion are available by request
- Please email Roger Green
- ecoglobalfuels@earthlink.net
- www.breakthru-technologies.com
- We are seeking R and D investment
- In partnership with Roger Green and Eco Global Fuels for R and D with E cat Technology
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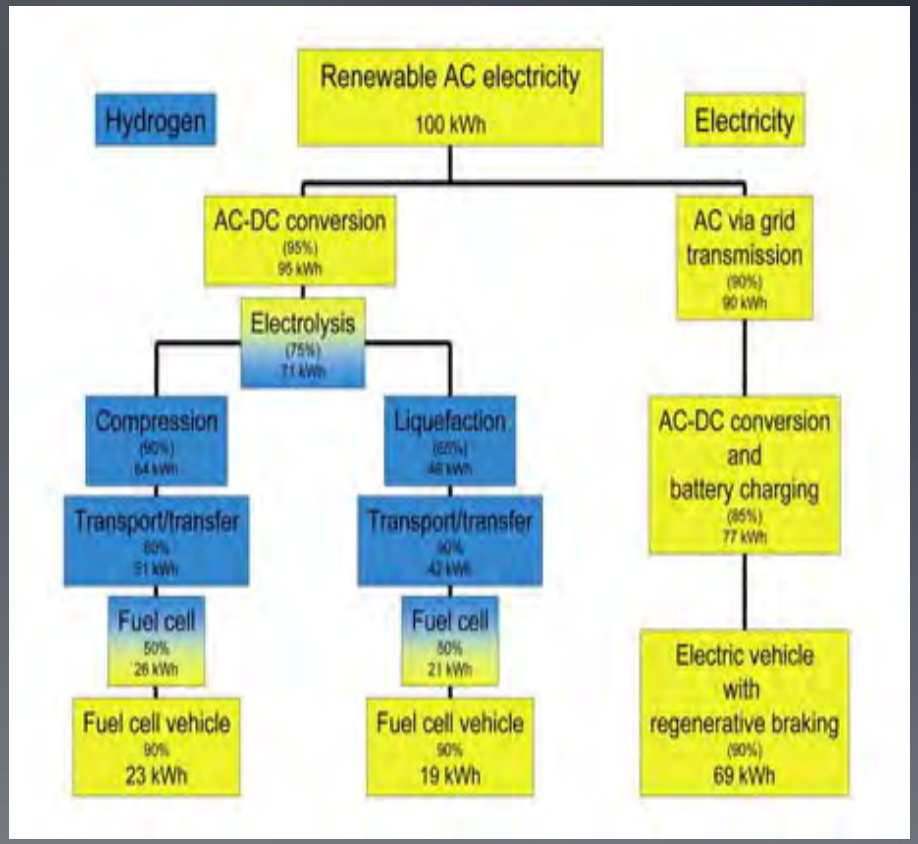
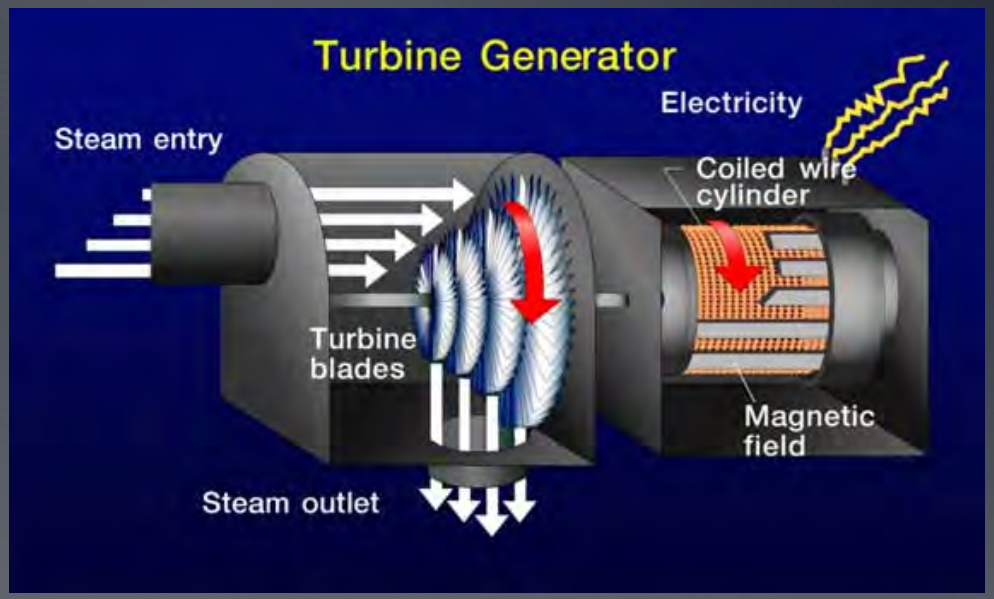
Conventional Turbine to Hydrogen and Then To Electricity

- Worst Efficiency of All!
- 24% Eff. Power Generation into 20% Eff. Electrolysis Yields an Overall of 4.8%!!
- 95.2% of Heat is Wasted.
- So-Called "Hydrogen" Economy is Uneconomical.
- Politically Correct and Environmentally Disastrous.
- Only On-Site Generation is Practical.



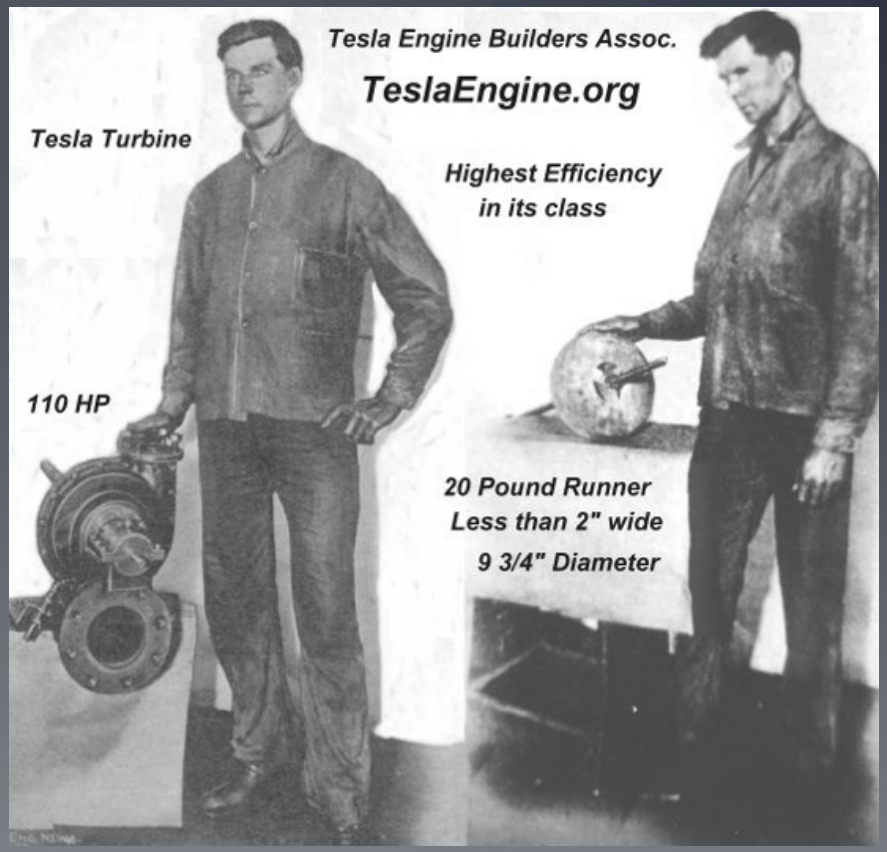
Conventional Turbine

- Low Efficiency – 30%.
- Overall Efficiency with 80% Efficient Alternator is Only 24%!
- 76% of Heat is Wasted.
- Only Feasible with Co-generation for Heat Recovery.
- This is How Conventional Power Plants Operate – as Environmental Heaters!



Tesla Turbine

- High Efficiency – 50-80%.
- Lowest Efficiency with 80% Efficient Alternator is 40%!
- 50% of Heat is Wasted in 50% Eff. Turbine, However that Number Drops to 36% With 80% Eff.
- Co-generation for Heat Recovery Still Preferable.
- Mature Technology – Proven in 1911!



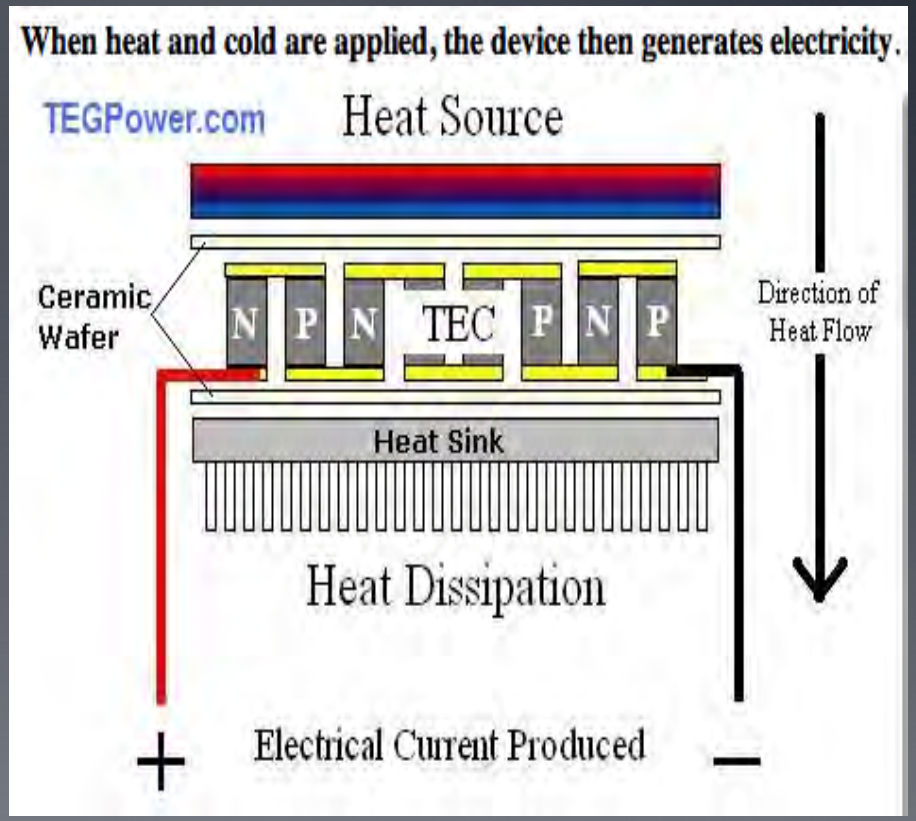
Thermoelectrics

- Comparable Efficiency to Photovoltaics (Solar).
- 10 Dollars Per Watt. 200 Watt Units are $1919.00
- Solid State – No Parts to Wear Out. Can Work by Convection.
- Can be used for Co-Generation. Temps over 270 Deg. Celsius are Typical.
- Available Now through TEG Power

http://tegpower.com/pro7.htm

Thermoelectrics- Down Side

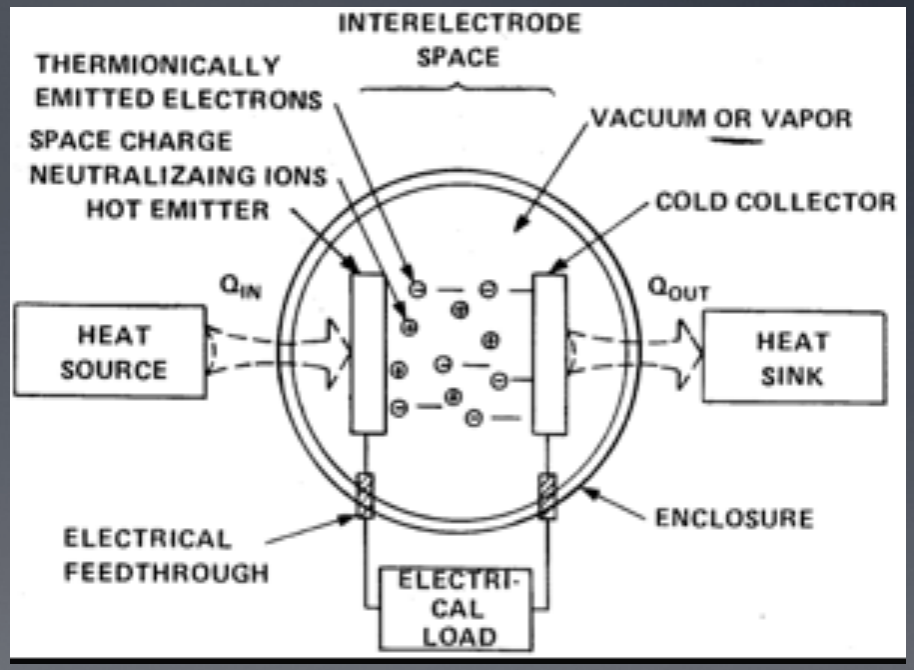
- Less Price Competitive Than Turbine & Alternator Derived.
- True Life Expectancy Has Yet to be Determined.
- Needs Inverter to Turn Output Into AC.



http://tegpower.com/pro7.htm

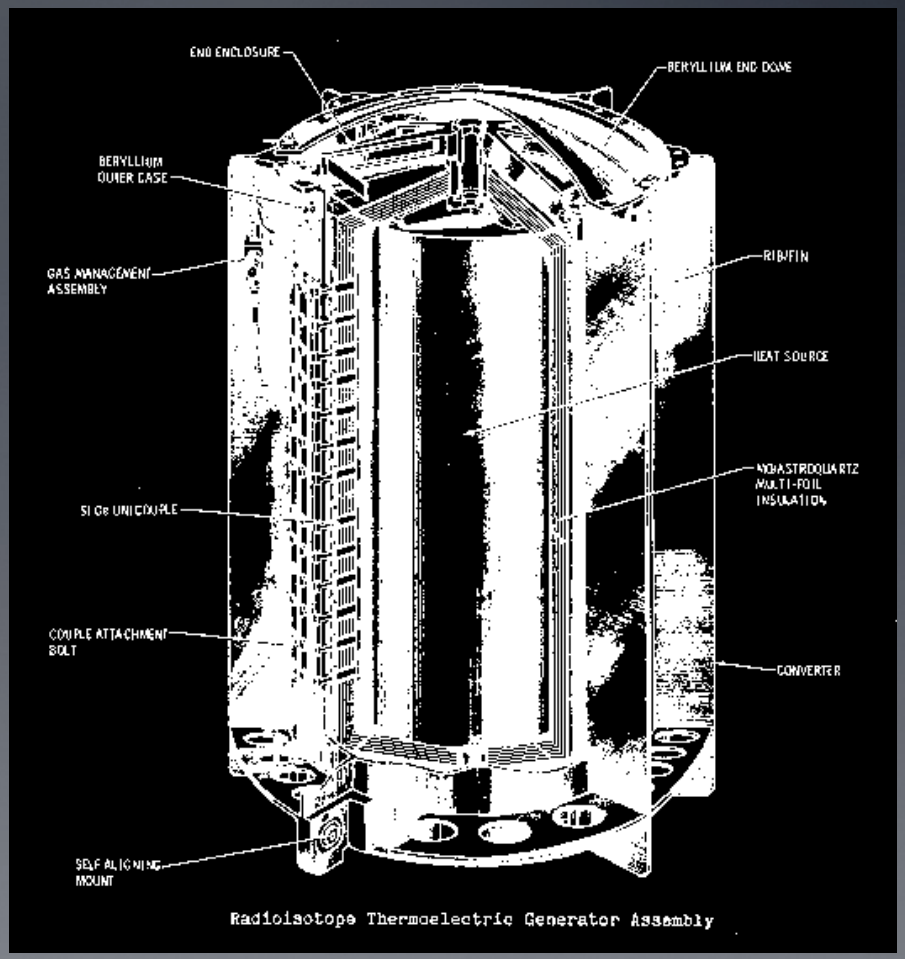
Thermionic Converter – Up Side

- Robust & Mature Technology – Has Been Known Since the 1950s
- Has Been Used In Space Applications as RTG.
- High Current Capacity: Several Amperes Per Square Centimeter
- Highly Adaptable to LENR

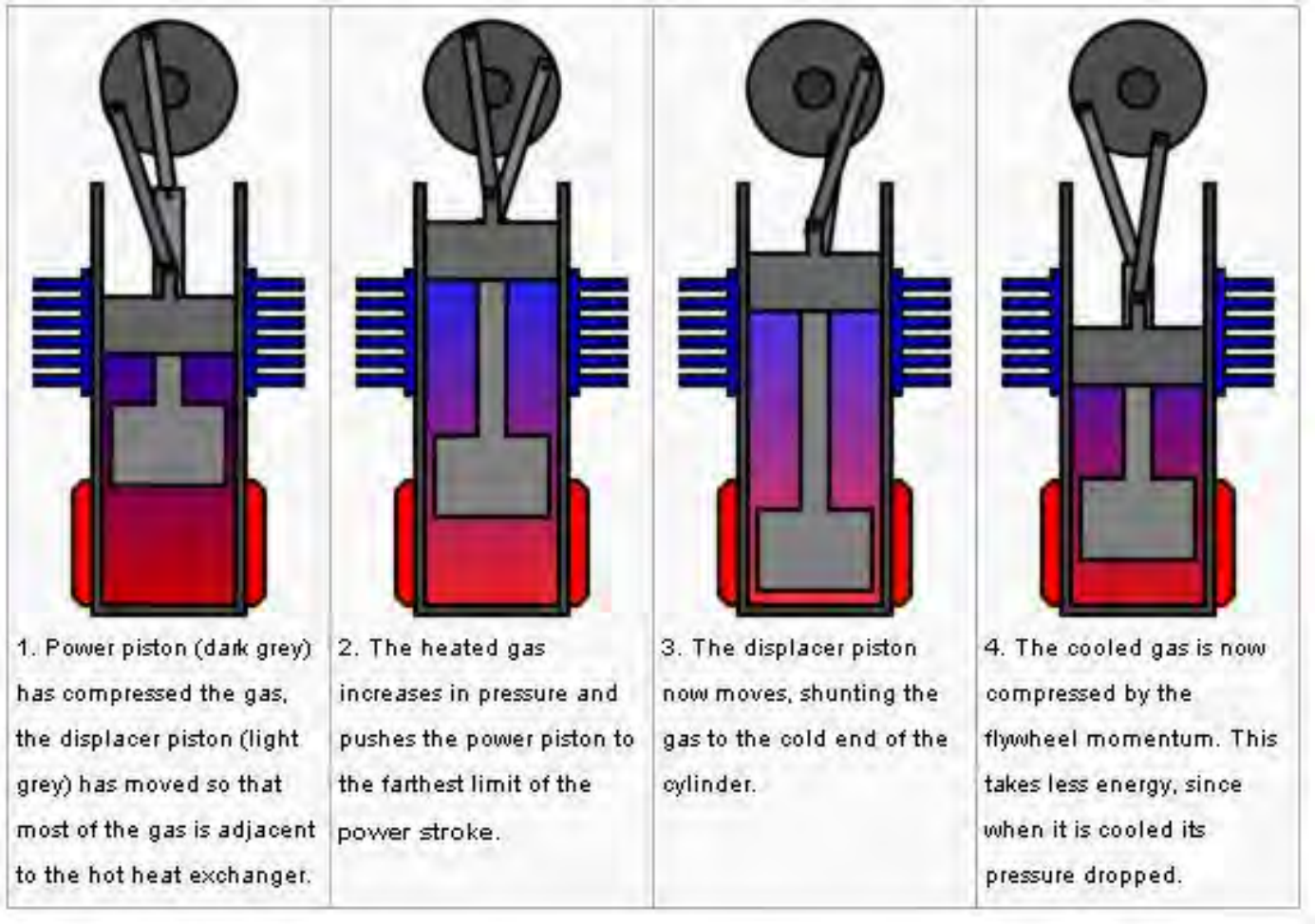


Thermionic Converter – Down Side

- Low Voltage – 1-1.2 Volts Typical. Elements Need to Be Connected in Series.
- Low Efficiency – 5-20%.
- Cesium Vapor Used as Exciter – Requires Specialized Manufacturing.
- High Temperatures Required: 1500-2000 Deg. K. (1226-1726 Deg. Celsius)

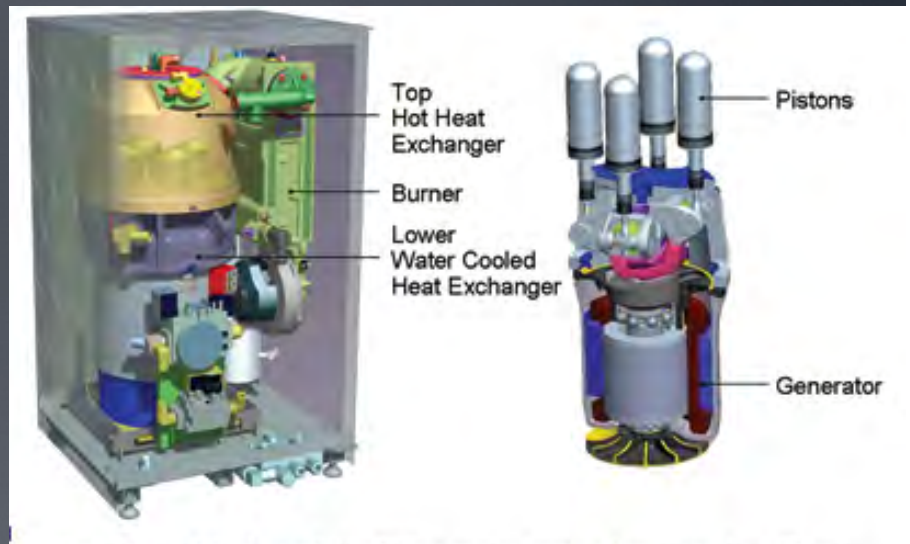


Stirling Cycle- Overview

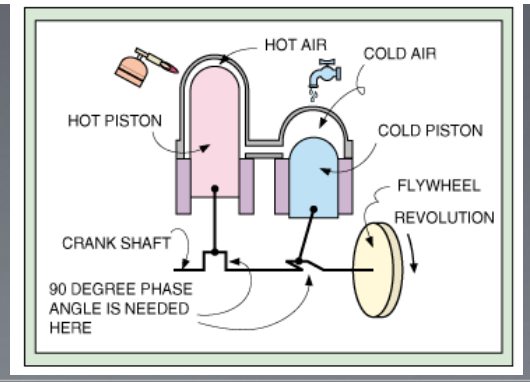


Stirling Cycle Engine- Up Side

- Originally Designed By Robert Stirling in 1816.
- Several Companies Have Developed the Technology over a Nearly 200 Year Period.
- Engine Can Reach Efficiencies as High as 50%!
- Gas Can Be "Looped" Through LENR Reactor As A Primary Method of Cooling, Similar to HTGR Fission Reactors of France.



Sectional views of the four cylinder Stirling engine heat and power system. (Figures courtesy of WhisperGen Ltd.)



Stirling Cycle Engine- Down Side

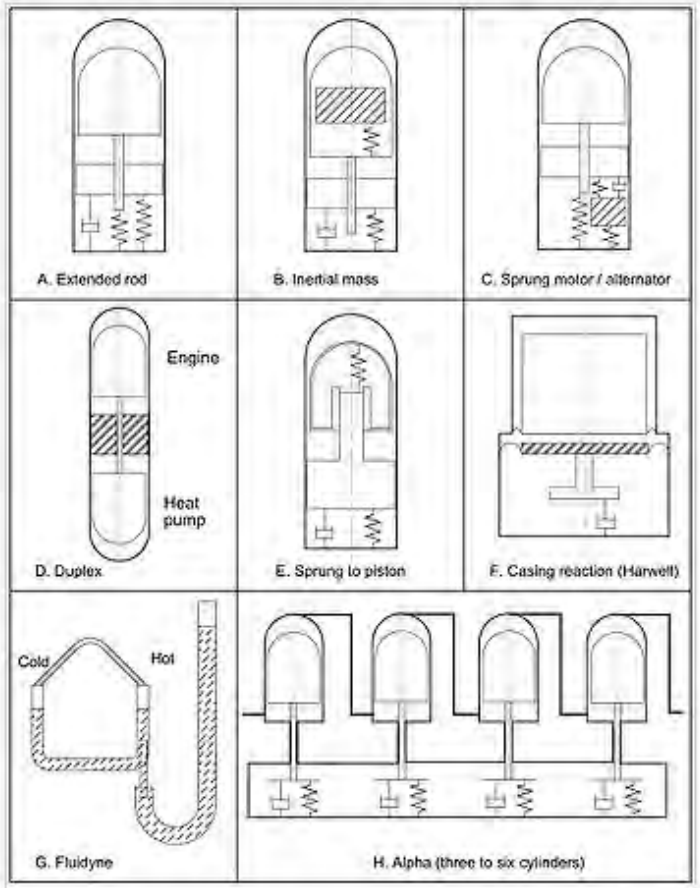
- High Pressures are More Efficient, But More Difficult to Seal Over Long Periods of Time.
- Needs Higher Temps to be More Efficent: 500-1000 Deg. Celsius.
- More Moving Parts Than Other Methods of Conversion.

Philips MP1002CA Stirling generator of 1951

Stirling Cycle Engine- Variants

Free Piston

- Extended Rod
- Inertial Mass
- Sprung Motor/Alternator
- Duplex
- Sprung to Piston
- Casing Reaction
- Fluidyne
- Alpha (Three to Six Cylinders)

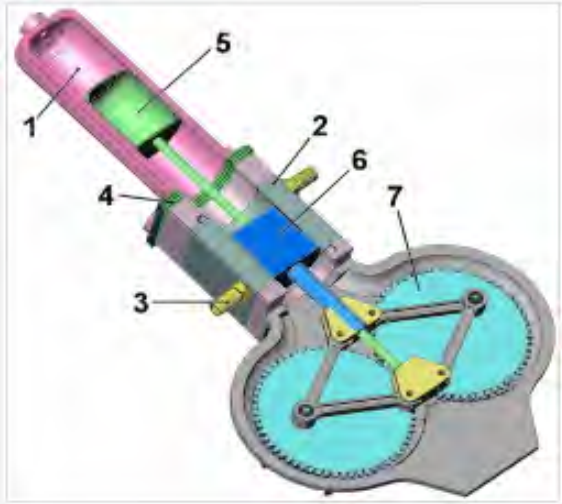


Various Free-Piston Stirling Configurations... F."free cylinder", G. Fluidyne, H. "double-acting" Stirling (typically 4 cylinders)

Stirling Cycle Engine- Variants

Beta Configuration

- Inherently Balanced
- High Output
- Regenerator Can Have Nickel Mesh For Direct LENR Operation
- Can Have Plasma Ignition for H1 Operation (Variant)
- Co-Generation Possible



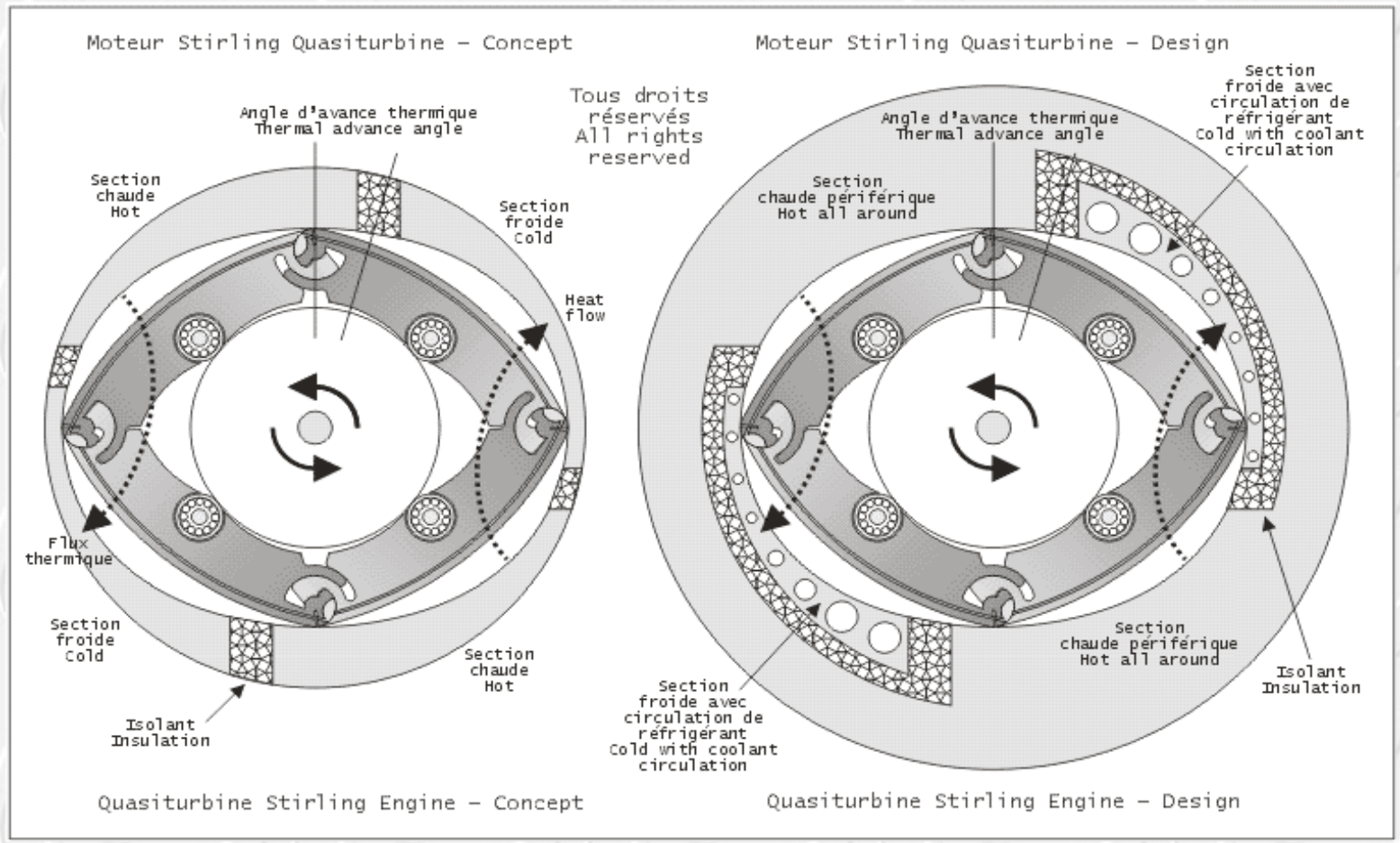
Cut-away diagram of a rhombic drive beta configuration Stirling engine design:

1. Pink – Hot cylinder wall
2. Dark grey – Cold cylinder wall
3. Yellow – Coolant inlet and outlet pipes
4. Dark green – Thermal insulation separating the two cylinder ends
5. Light green – Displacer piston
6. Dark blue – Power piston
7. Light blue – Linkage crank and flywheels

Not shown: Heat source and heat sinks. In this design the displacer piston is constructed without a purpose-built regenerator.

Stirling Cycle Engine- Variants

Quasiturbine Stirling



http://quasiturbine.promci.qc.ca/QTStirling.html

Stirling Cycle Engine- Variants

Stirling Radioisotope Generator

- Work Done At NASA Glenn Research Center.
- 12.5 Kwe Per Cylinder.
- 650 Deg. Celsius Operation.
- Work Abandoned For Cheaper, Less Efficient Systems.
- Design Lends Itself Well to LENR.

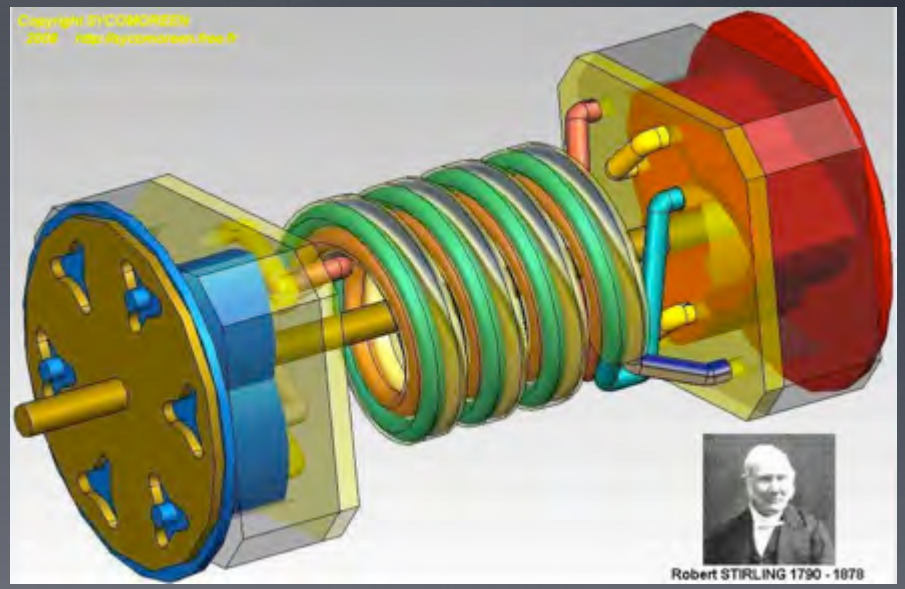
Component of Stirling radioisotope generator is heated by induction during testing.

http://en.wikipedia.org/wiki/Stirling_radioisotope_generator

Stirling Cycle Engine- Variants

Rotary Stirling Systems

- Over 20 Different Variations, Including a Stirling Wankel.
- Some More Efficient Than Alpha, Beta or Gamma Configurations.
- An "Abandoned" Technology Begging to be Repurposed for LENR.
- Studies Need to Be Done For Specific Applications.



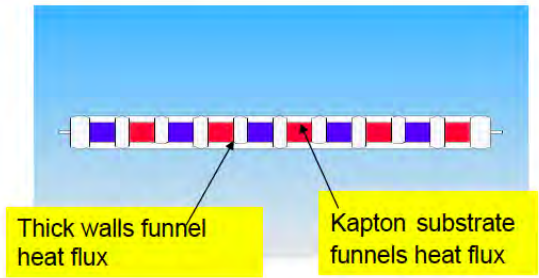
http://stirlingengineforum.com/viewtopic.php?t=379

On The Horizon— Quantum Well Technology

- Efficiencies as High as 32.5%, and Higher in the Future!
- 450 Deg. C. Temp Differential.
- Can Go As High As 800 Deg.
- Future Efficiencies of 50% and Above Compete with Turboelectric Conversion.

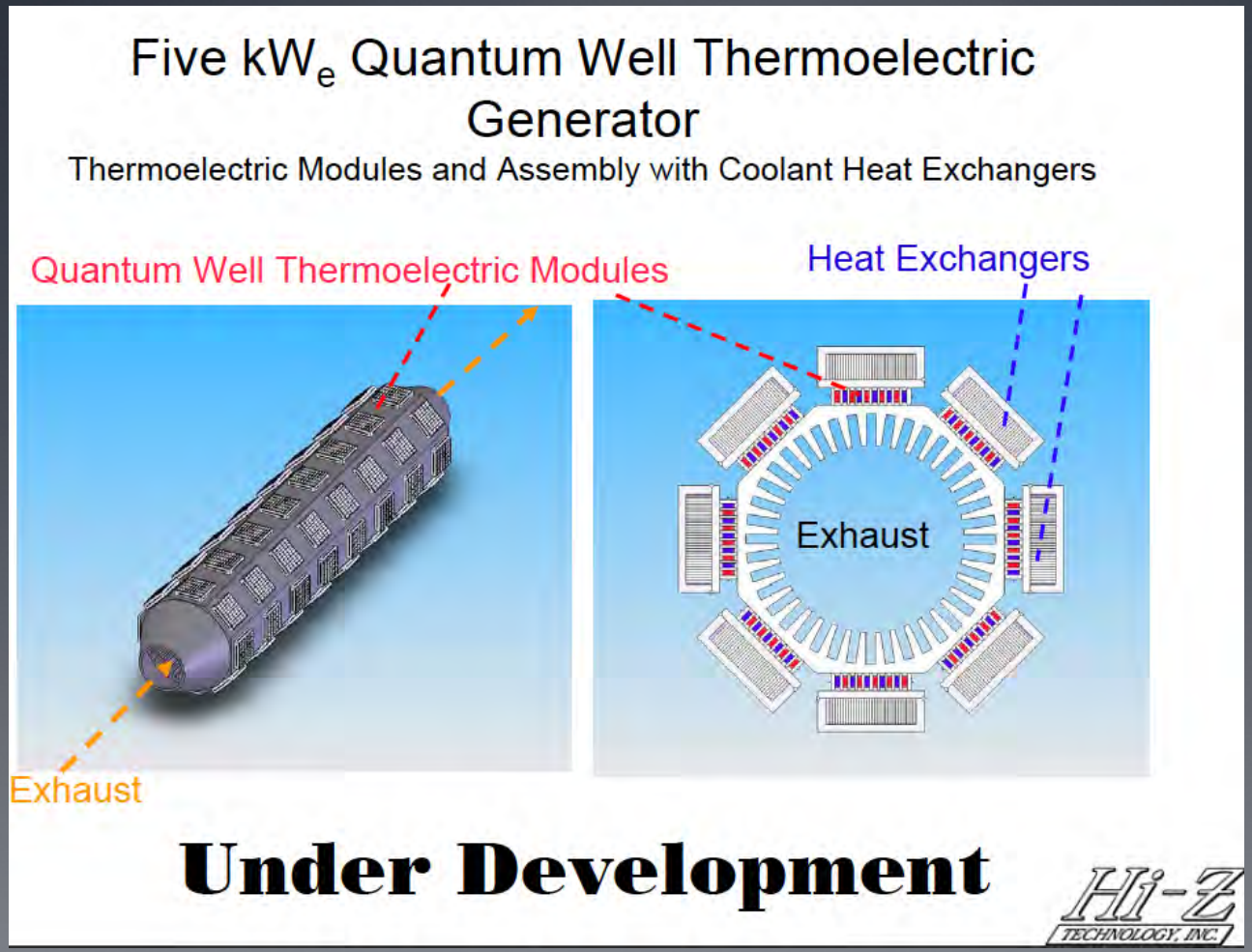
Funneled Heat Flux Module

Increases power & reduces amount of QW material



Method to match module resistance with heat flux of hot and cold sides while increasing power putput

On The Horizon— Quantum Well Technology



On The Horizon— IR (Nano) Antennas

- Uses Infrared in Direct Conversion.
- Efficiencies as High as 92%!
- Originally Proposed by Steve Elzwick in 1980's.
- Once Again in 2008. What Happened to This Technology?
- Terahertz Diodes Are Available Right Now!

If these technical hurdles can be overcome, nanoantennas have the potential to be a cheaper, more efficient alternative to solar cells. Computer models of nanoantennas predict up to 92% efficiency (compared to solar cells around 20%).

On The Horizon—
IR (Nano) Antennas

Solar cells that work at night

Solar cells become ineffective when the sun goes down. At night, the earth radiates heat back toward the sky. Scientists at the U.S. Department of Energy's Idaho National Laboratory are working on a device to turn infrared radiation into electricity.

Nanoantennas convert infrared rays into electricity

Billions of nanoantennas printed onto thin, inexpensive sheets will transform heat energy into electricity. The physics behind this conversion is the same as that of a radio antenna. The only difference between radiowaves and infrared light is wavelength. Antennas 1/25 the size of a human hair resonate when bombarded with heat radiation. If the resulting alternating current can be passed through a rectifier (one way valve) the current can charge up batteries. The infrared rays create alternating currents in the nanoantennas that oscillate trillions of times per second.

On The Horizon— IR (Nano) Antennas

- Common Chip Manufacturing Techniques Are Used.
- Tech Results in a Self-Regulating Effect To Prevent "Runaway" Reactions.
- Antenna Technology is Mature and Easily Understood.
- Prototypes Already Done at Rice University.

Nano-antenna optics + semiconductor electronics = IR photovoltaics

May 5, 2011 | Post Your Comment

More than a third of the solar energy on Earth arrives in the form of infrared light. But silicon -- the material that's used to convert sunlight into electricity in the vast majority of today's solar panels -- cannot capture infrared light's energy. Every semiconductor, including silicon, has a bandgap where light below a certain frequency passes directly through the material and is unable to generate an electrical current. By attaching a metal nanoantenna to the silicon, where the tiny antenna is specially tuned to interact with infrared light, the Rice team showed they could extend the frequency range for electricity generation into the infrared. When infrared light hits the antenna, it creates a plasmon, a wave of energy that sloshes through the antenna's ocean of free electrons.

The research is described in a new paper this week in the journal *Science*: http://www.sciencemag.org/content/332/6030/702.short

The study of plasmons is one of Halas' specialties, and the new paper resulted from basic research into the physics of plasmons that began in her lab years ago.

Plasmons decay and give up their energy in two ways: they either emit a photon of light or they convert the light energy into heat. The heating process begins when the plasmon transfers its energy to a single electron -- a 'hot' electron. Rice graduate student Mark Knight, lead author on the paper, together with Rice theoretical physicist Peter Nordlander, his graduate student Heidar Sobhani, and Halas set out to design an experiment to directly detect the hot electrons resulting from plasmon decay.

Patterning a metallic nanoantenna directly onto a semiconductor to create a Schottky barrier, Knight showed that the infrared light striking the antenna would result in a hot electron that could jump the barrier, which creates an electrical current. This works for infrared light at frequencies that would otherwise pass directly through the device.

"The nanoantenna-diodes we created to detect plasmon-generated hot electrons are already pretty good at harvesting infrared light and turning it directly into electricity," Knight said. "We are eager to see whether this expansion of light-harvesting to infrared frequencies will directly result in higher-efficiency solar cells."

In Houston, Texas, Rice University is consistently ranked among the nation's top 20 universities by U.S. News & World Report. Learn more at www.rice.edu.

Applications of LENR

- Adsorption Type Refrigeration Systems & HVAC.
- Transportation- Hybrid Cars & Trucks.
- Transportation- Substitute For Diesel-Electric Locomotives .
- Transportation- Turbine Driven Ships & Submarines.
- Space- Substitute for "Hot Isotope" RTG Units.
- Space Planes & Exotic Propulsion.
- Site Generated Power.

Photos Courtesy of Pure Energy Systems

Conclusions

- Almost All Technologies Have Merit.
- When Nanoantennas Are Available, That One Will be the Most Efficient (We May Have To Develop That In Our Own Facilities).
- So Far, Thermoelectrics are Not Cost Competitive with Mechanical Power Conversion.
- Both Stirling as Well as the Tesla Turbine Are Close Competitors for Cost as Well As Efficiency.
- The only Ones THAT DO NOT Measure up, are Conventional Power Conversion Systems.

R&D Developments For E-Cat Technologies

- Contact Roger Green
- Ecoglobalfuels@earthlink.net
- www.e-cataustralia.com (Go to resource page for documentation.
- Complete benchmarks for R and D is available by request
- We are seeking investment into our R and D projects involving desalination and heat to electricity conversion utilizing the E cat Technology
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