Gamalt[1] ljós á nýjum belgjum[2]

- Varma/Óreiðu breytt í Raforku/Skipulag!

Guðlaugur Kristinn Óttarsson
Flókagata 27
105 Reykjavík
Iceland
Eml: gko@islandia.is
Web: www.islandia.is/gko
Tel: +354 696 6536

$$E=mcT$$

E = Energy
m = Mass
c = Heat Capacity
T = Temperature

1) Með tímanum endar bæði ljós og hljóð sem varmi.

2) ***Belgur*** er hér samnefni fyrir rafeind, holu eða jón.

Erindi flutt á Höfuðblóti LOKA, Kornhlöðuloftinu, 2 október 2004

Gamalt ljós á nýjum belgjum.

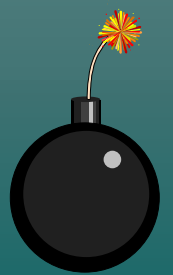
- Efnisyfirlit:

- Varmaorka vatns sigrar þyngdaraflið – með meiru.
- Varmarafali: Hljóðeindir, ljóseindir og rafeindir.
- Virkjun varmaorku með varmarafala og varmaskipti.
- Hátíðnivarmarafali: Frá Hveragerði til næstu stjarna.
- Niðurstöður.

Varmaorka í vatni: $E = m\,c\,\Delta T$

1 Kg af 80°C heitu vatni kólnar um 50°C. Hvað losnar mikil orka og hver eru jafngildi hennar? (E=0.21 MJ)

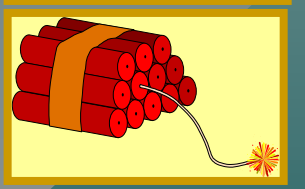
- 1000 Kg sem falla niður 21 metra, til dæmis vatn í fallgöngum vatnsaflsvirkjunar – (eða 1 Kg úr 21 Km hæð!).
- 1 Kg hraðað í 646 m/s = 2300 Km/h = Mach 1.9
- 5 Amper í eina klukkustund úr 12 volt rafgeymi.
- 2000 loftþyngda þrýstingur í eins-líters hylki.



- $E = mgh$
- $E = mv^2/2$
- $E = u\,i\,\Delta t$
- $E = p\,V$

Varmaorka vatns og saman-burður við aðra orkumiðla:

- Sjóðandi vatn $\Delta T=100K$ E=0.41 MJ/Kg
- Bensín E=48 MJ/Kg
- Methanol E=24 MJ/Kg
- Kol E=29 MJ/Kg
- TNT E=4.6 MJ/Kg
- Blýrafgeymir E=0.15 MJ/Kg



Sjóðandi vatn inniheldur þrefalda orku blýrafgeymis !

Verð[1,2] á raforku og varmaorku[3]:

- Electricity for resident homes: 9.7 ¢/KWh = 2.7 ¢/MJ
- Electricity for light industry: 4.8 ¢/KWh = 1.3 ¢/MJ
- Electricity for heavy industry: 2.4 ¢/KWh = 0.68 ¢/MJ
- Geothermal Hot Water for resident homes: 85 ¢/t = 0.33 ¢/MJ
- Geothermal Hot Water for light industry: 43 ¢/t = 0.15 ¢/MJ

1) Gögn frá Orkuveitu Reykjavíkur og Hitaveitu Suðurnesja.

2) Verð í US cents, 15.Aug,2003

3) Varmanýting $\Delta T = 60K$.

Heitt vatn í samanburði við bensín eða olíulind:

- Varmaorka[1] í 100 lítrum af sjóðandi vatni jafngildir efnaorku í einum lítra af bensíni!
- Heitt vatn frá jarðhitalind er hið "Glæra gull" og er vænlegur[2] staðgengill "Svarta gulls".

1) $\Delta T = 100°C - 0°C = 100K$
$E = m\ c\ \Delta T = 100x4200x100 = 42\ MJ$
42 Mega Joul jafngilda ca 1 l. af Bensíni.

2) Með 20% nýttni og ΔT=200K fást fjórir lítra úr tonninu.

Varmarýmd vatns er nánast kraftaverk !

Material	c	ρ	κ	α=κ/ρc
	(J/Kg°K)	(Kg/m3)	(W/m°K)	(mm2/s)
Water	4180	1000	0.6055	0.1449
Wood (pine)	2801	512.6	0.1125	0.0784
Wood (oak)	2383	608.8	0.1471	0.1014
Thermal grease	2090	2403	0.865	0.1722
Rubber	2006	961.2	0.1557	0.0808
Earth(Course/Dry)	1839	2051	0.519	0.1376
Oil (light)	1797	913.1	0.1332	0.0812
Bakerlite	1588	1282	0.2318	0.1139
Plexiglass (Acrylic)	1446	1410	0.2595	0.1273
Polyurethane (foam)	1129	28.84	0.0346	1.0626
Berylia Ceramic 99%	1087	2884	230.1	73.3993
Air	1003	1.185	0.026	21.8753
Aluminum	898.7	2707	204.1	83.8958
Graphite	836	2563	5.709	2.6644
Alumina	836	3572	35.29	11.8177
Glass (common)	794.2	2579	0.7958	0.3885
Ceramic AlO	775	3700	34.6	12.0663
Glass Wool	668.8	200.3	0.03979	0.2970
Concrete	652.1	2884	1.090	0.5796
BiTe	543.4	7529	1.505	0.3679
Alumel	543.4	8603	29.41	6.2911
Titanium	528	4500	17	7.1549
Chromel	459.8	8411	13.49	3.4882
Stainless Steel	459.8	8010	13.84	3.7578

Flatarmáls-þéttleiki varmaafls og annara náttúrulegra aflmiðla:

Orkuöflun:	Rafali:	Dæmi:
• Varmaskiptir	$\eta\ \kappa\ \Delta T/\Delta x$	1000 W/m^2
• Sólargeisli	$\eta\ q\ \cos(\lambda)$	20 W/m^2
• Vindmilla	$\eta\ \rho\ v^3$	10 W/m^2
• Uppistöðulón	P/A	7 W/m^2

• ΔT = 100K, Δx = 5mm • q = 800W/m^2 • v = 3m/s • P=700MW, A=100Km^2

Varmarafali: Hljóðeindir, ljóseindir og rafeindir.

Varma umbreytt í rafmagn:

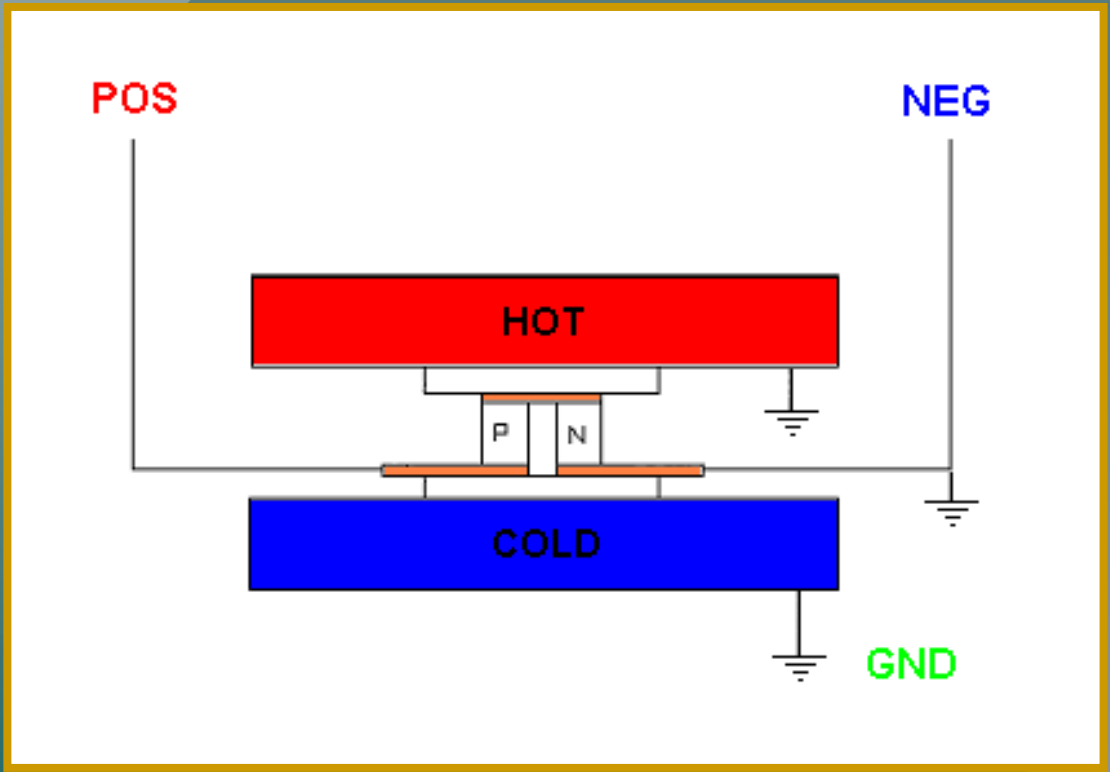
Í varmarafala er **varmaorku** breytt í **raforku**, og það millliliðalaust - með beinu samspili varma við atóm, hljóð-eindir, ljóseindir og rafeindir.

Varmi leitar frá heitari til kaldari svæða – og í mörgum efnum eru lausar og hreyfanlegar rafeindir sem geta flutt varma. Varmi breytist því - að hluta til - í rafstraum.

Ef rafeind er eini valkosturinn, t.d. í loft-tæmis-varmarafala, nálgast nýtnin hið fræðilega hámark: $\eta = \Delta T/T_{hot}$

1) $E = k\,T = h\,f = q\,u$. Ferðalag varma: "atóm -> ljóseind -> rafeind"

Varmarafali úr P&N hálfleiðurum:



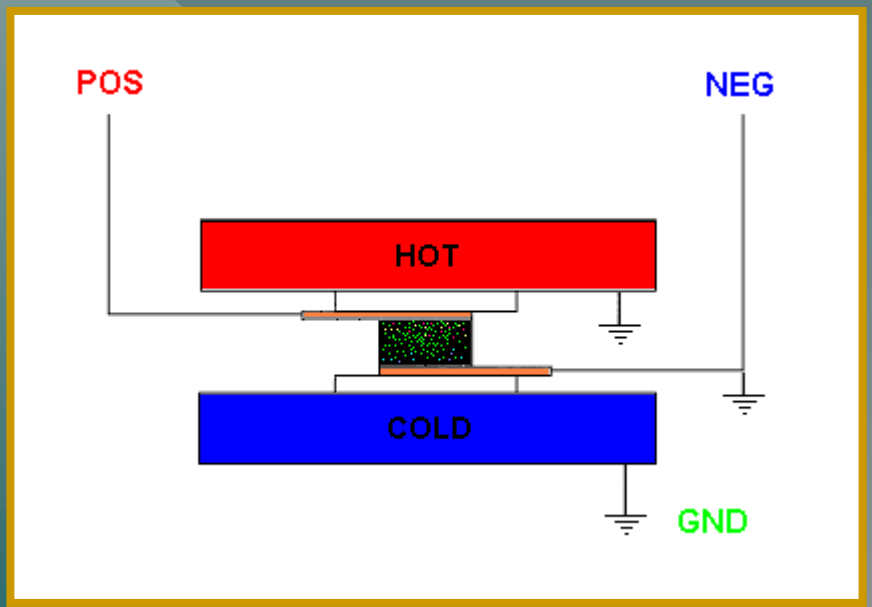
N-efni: Rafeindir flytja varma og (-) raforku.

P-efni: Holur[1)] flytja varma og (+) raforku.

Varmaorka sem ekki flyst yfir á rafbera, endar í kælimiðlinum!

1) Ef líkja má Rafeind við fallandi regndropa – er Hola loftbóla sem stígur upp af vatnsbotni.

Vakúm, Plasma eða "Quantum Tunneling" varmarafalar lofa hámarks nýtni á lágu verði - úr vistvænum og langlífum efnum:



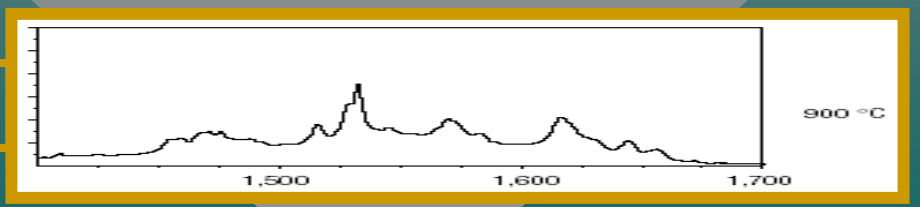
Málmar og ýmis efni gefa frá sér rafeindagas við upphitun. Vakúm varmarafali hefur heit og köld rafskaut með vakúm rými á milli sem leiðir ekki (eða lítinn) varma.

Hagnýting á óvenjulegu varma-litrófi efna til raforkuframleiðslu:

Rare-earth oxide materials emit thermal radiation in a narrow spectral region, and can be used for a variety of different high-temperature applications, such as the generation of electricity by thermophotovoltaic conversion of thermal radiation.

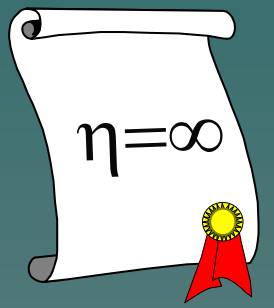
This will contribute significantly to the design and the development of new materials and structures for a variety of different applications: aerospace radiative dissipaters, broadband amplifiers for communication systems operating at high temperature, and thermophotovoltaic energy converters.

Varmalitróf Er O_6 Al_8 við 27°C



Guðlaugur Kristinn Óttarsson: Höfuðblót LOKA, Kornhlöðuloftinu, 2 október 2004

Annars stigs eilífðarvélar?
(Perpeteum Mobilis of the 2nd kind)



Varmavélar og hefðbundnir varmarafalalar vinna úr hitastigsmun og þurfa því bæði hitun og kælingu.

Endothermic eða Innverminn Varmarafali vinnur úr einu og sama hitastiginu - og þarf því hvorki hitun né kælingu!

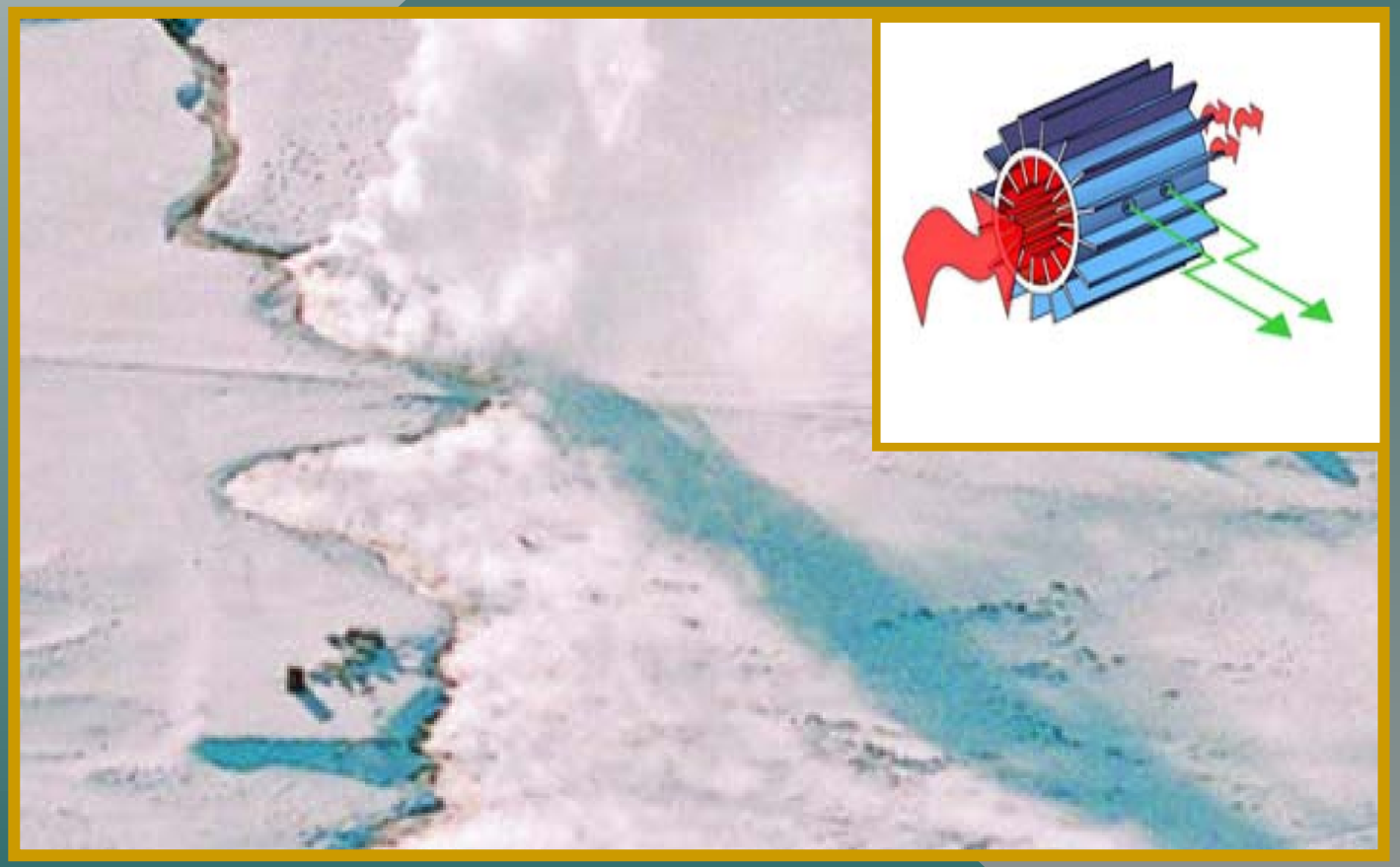
Endothermic Varmarafali er því "Maxwells Demon" - slíkur varmarafali gæti nýst sem bæði ísskápur og eldavél - knúin áfram af varma umhverfisins !!!

Varmi er handahófskend hreyfing atóma og þar með rafeinda sem skapar óreiðu-riðstraum (AC). Þennan riðstraum má virkja með "afriðli" og yfirfæra í DC sem er stefnuvirk rafspenna sem knúið getur rafstraum í gegnum álag.

"Brownian Engine" við 20°C stofuhita veldur riðstraumi sem jafngildir 25 millivoltum eða 1/40 út Volti.

Frumuhimna safnar ljósi af bylgjulengd tveggja þvermála => Fruman vermist !!

Framleiða má **Græna** raforku með **hita** og **kulda** í vatnsknúnum varmarafala:



Heitavatnslögn getur framleitt varma-raforku "í leiðini".

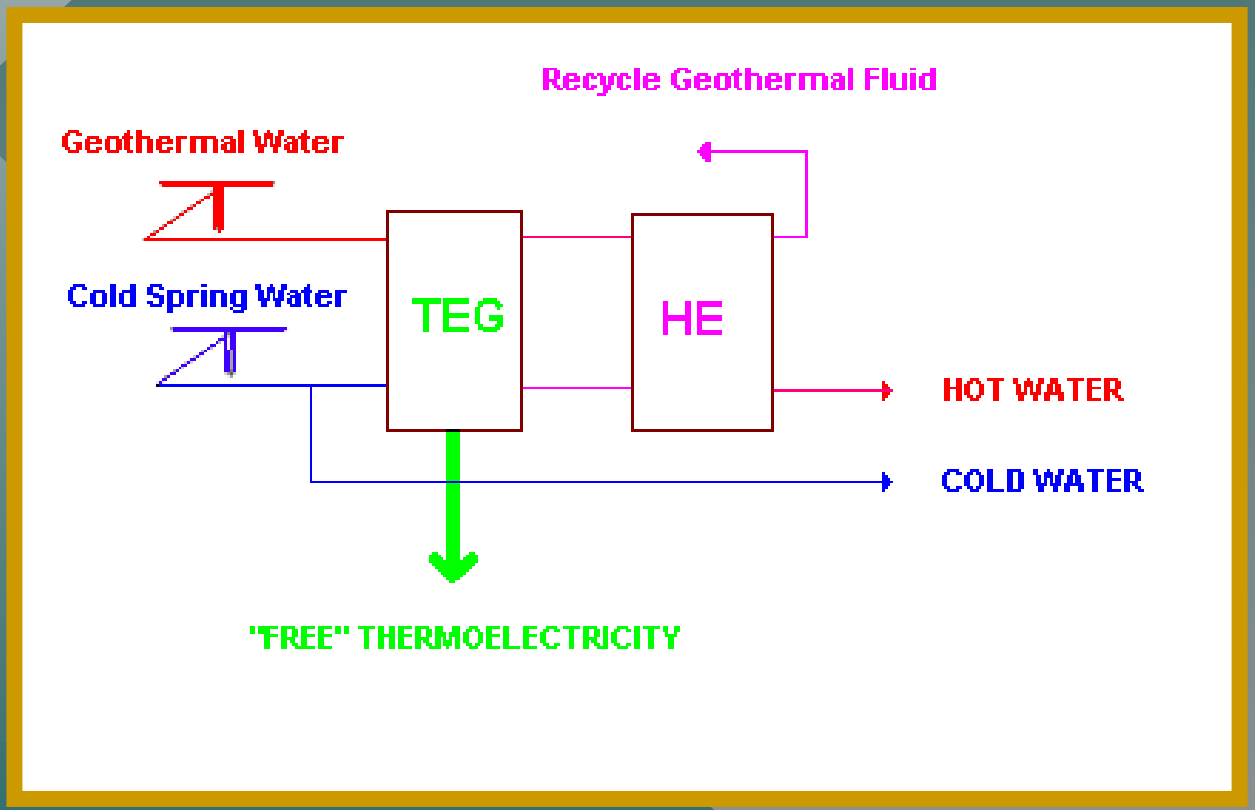
Dreyfikerfið verður sjálfbært raforkuver.

1 Km heitavatnslögn með 1 m þvermál - hefur flatarmálið 3140 m^2 og gæti því framleitt 0.33 MW af raforku (100 W/m^2).

Ekkert hreyfist nema vatn og rafeindir!

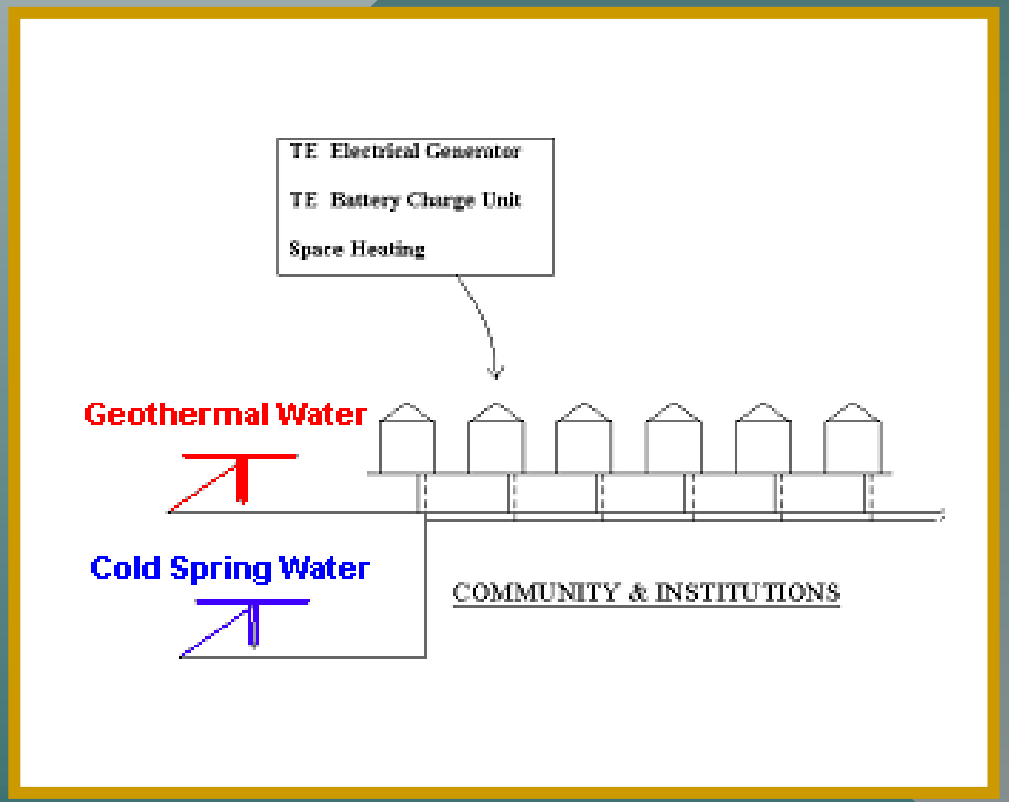
Guðlaugur Kristinn Óttarsson: Höfuðblót LOKA, Kornhlöðuloftinu, 2 október 2004

Allt að 90% heildarnýttni á varma ...



... fæst með Varmarafala (TEG) og Varmaskipti (HE)!

Lagnir fyrir Heitt og Kalt vatn – en ekki rafmagn!



Orkusamfélag á norðlægu (eða suðlægu) jarðhitasvæði.

Raflagnalaust samfélag gæti verið eftirsóknarvert.

Gaslagnalaust samfélag ***er mjög*** eftirsóknarvert !

Raforka er framleidd í hverju húsi - eftir þörfum !

Varmarafmagn og "Global Warming"

Japanese National Project:
Development for Advanced Thermoelectric Conversion System.

The Shonan Institute of Technology works on thermoelectric technology as a part of a concerted effort in Japan to help prevent **global warming**.

This may be the most important thrust in the entire thermoelectric community.

Source: 23rd International Conference on Thermoelectrics - Adelaide, Australia July 25-29, 2004.

Verði ljós!

Tilraunakeyrsla á varmarafala.
GHR, Reykjum, Hveragerði, vorið 2001.

Varmarafmagn er nú þegar samkeppnisfært við marga smærri virkjanakosti – ef varmi er á annað borð fyrir hendi. Helst ber að nefna:

I) Sólarrafmagn. Nýtist í fáar og jafnvel engar stundir. Varmarafali gengur í 24 st. – og allan ársins hring!

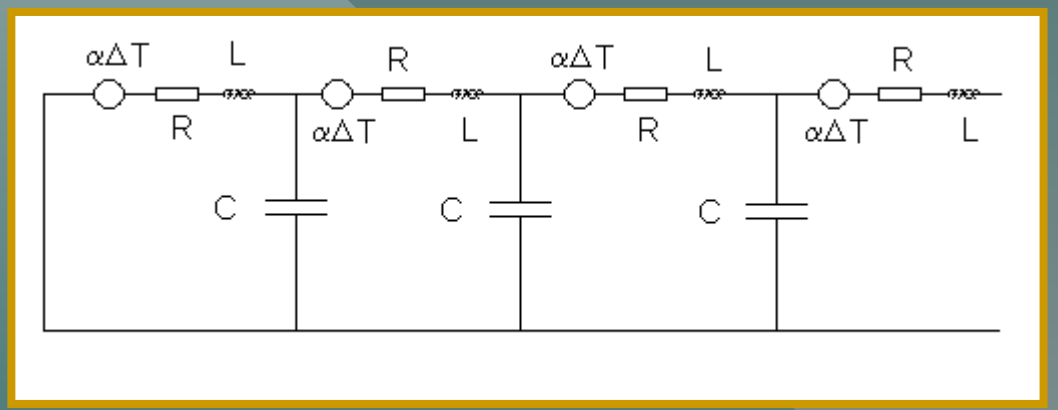
II) Vindrafmagn. Sömu rök. Byggist einnig í eðli sínu á hreyfanlegum hlutum sem bæði slitna og tapa út orku.

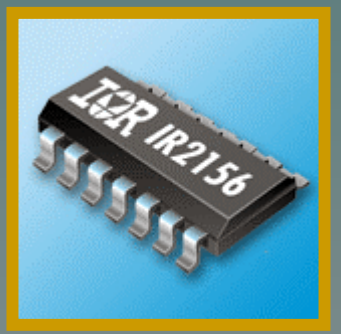
Jarðgufuvarmarafali knýr 300 Watta gróðurlampa.

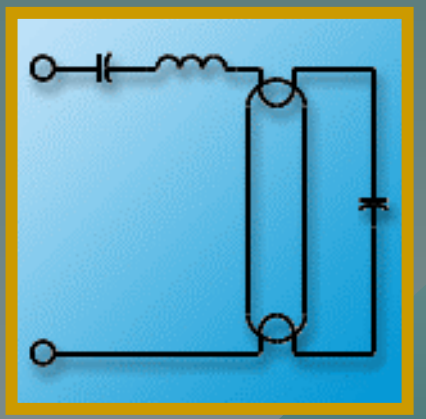
Guðlaugur Kristinn Óttarsson: Höfuðblót LOKA, Kornhlöðuloftinu, 2 október 2004

Jarðtengdur Hátíðni-Varmarafali:

A Ladder Thermoelectric Generator, GKO, ICT2003 France, *www.its.org*







Varmarafali - 4 einingar

Stýring

Ljós

Impendance of 4 TE Pellets in a Grounded Ladder TE Generator:

A Ladder Thermoelectric Generator, GKO, ICT2003 France, *www.its.org*

$$Z_4 = R + L \cdot s + \cfrac{1}{C \cdot s + \cfrac{1}{R + L \cdot s + \cfrac{1}{C \cdot s + \cfrac{1}{R + L \cdot s + \cfrac{1}{C \cdot s + \cfrac{1}{R + L \cdot s}}}}}}$$

$$s = \beta + i\omega$$

Guðlaugur Kristinn Óttarsson: Höfuðblót LOKA, Kornhlöðuloftinu, 2 október 2004

Impendance of 1, 2, 3 & 4 Pellets in a Grounded Ladder TE Generator:

A Ladder Thermoelectric Generator, GKO, ICT2003 France, www.its.org

$$Z_1 = R + L \cdot s$$

$$Z_2 = Z_1 \cdot \left(\frac{2 + a}{1 + a} \right)$$

$$Z_3 = Z_1 \cdot \left(\frac{3 + 4 \cdot a + a^2}{1 + 3 \cdot a + a^2} \right)$$

$$Z_4 = Z_1 \cdot \left(\frac{4 + 10 \cdot a + 6 \cdot a^2 + a^3}{1 + 6 \cdot a + 5 \cdot a^2 + a^3} \right)$$

$$a = R\,C\,s + LC\,s^2$$

The Ladder TEG Impendance Coefficients for up to 6 Pellets:

A Ladder Thermoelectric Generator, GKO, ICT2003 France, *www.its.org*

Denominator:												Numerator:											
					1												1						
				1		1										2		1					
			1		3		1								3		4		1				
		1		6		5		1						4		10		6		1			
	1		10		15		7		1				5		20		21		8		1		
1		15		35		28		9		1		6		35		56		36		10		1	

Find the general formula ...

Guðlaugur Kristinn Óttarsson: Höfuðblót LOKA, Kornhlöðuloftinu, 2 október 2004

General Formula for a Grounded Ladder TEG with n Pellets:

A Ladder Thermoelectric Generator, GKO, ICT2003 France, *www.its.org*

$$Z_n = Z_1 \cdot \left(\frac{n + \frac{1}{6} \cdot n \cdot \left(n^2 - 1\right) \cdot a + \cdots + \left(2 \cdot n - 2\right) \cdot a^{n-2} + a^{n-1}}{1 + \frac{1}{2} \cdot n \cdot \left(n - 1\right) \cdot a + \cdots + \left(2 \cdot n - 3\right) \cdot a^{n-2} + a^{n-1}} \right) = Z_1 \cdot \frac{P_n(a)}{Q_n(a)}$$

$$Q_1(a) = 1$$

$$Q_n(a) = Q_{n-1}(a) + a \cdot P_{n-1}(a)$$

$$Q_n(a) = 1 + a \cdot \sum_{k=1}^{n-1} P_k(a)$$

$$Q_n(a) = \prod_{k=1}^{n-1} \left(a + 4 \cdot \sin^2 \left(\frac{\pi \cdot \left(2k - 1\right)}{2 \cdot \left(2n - 1\right)} \right) \right)$$

$$P_1(a) = 1$$

$$P_n(a) = Q_{n-1}(a) + \left(1 + a\right) \cdot P_{n-1}(a)$$

$$P_n(a) = 1 + P_{n-1}(a) + a \cdot \sum_{k=1}^{n-1} P_k(a)$$

$$P_n(a) = \prod_{k=1}^{n-1} \left(a + 4 \cdot \sin^2 \left(\frac{\pi \cdot k}{2 \cdot n} \right) \right)$$

Poles & Zeros for a TEG Module:

A Ladder Thermoelectric Generator, GKO, ICT2003 France, www.its.org

The 1st Pole:

$$a_{P1} = -4 \cdot \sin^2\left(\frac{\pi}{4 \cdot n - 2}\right) \quad \Rightarrow f_{P1} = 2 \cdot f_0 \cdot \sin\left(\frac{\pi}{4 \cdot n - 2}\right)$$

The 1st Zero:

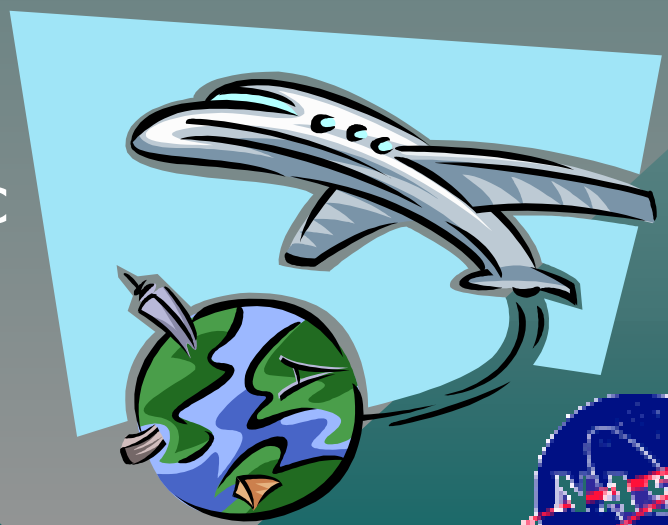
$$a_{Z1} = -4 \cdot \sin^2\left(\frac{\pi}{2 \cdot n}\right) \quad \Rightarrow f_{Z1} = 2 \cdot f_0 \cdot \sin\left(\frac{\pi}{2 \cdot n}\right)$$

A traveling-wave engine to power deep space travel.

LOS ALAMOS, N.M., Sept. 16, 2004 – A University of California scientist working at Los Alamos National Laboratory and researchers from Northrop Grumman Space Technology have developed a novel method for generating electrical power for deep-space travel using sound waves. The travelingwave thermoacoustic electric generator has the potential to power space probes to the furthest reaches of the Universe.

Hátíðnivarmarafali er náskyldur ofangreindum "Thermoacoustic Electric Generator" eða TAEG.

- Hljóð er jú skipuleg hreyfing atóma,
- en varmi er óreiða í hreyfingu atóma.



Guðlaugur Kristinn Óttarsson: Höfuðblót LOKA, Kornhlöðuloftinu, 2 október 2004

Sound Makes Electricity for Space:

Technology Research News - September 30, 2004

Generating electricity is all about changing one source of energy into another.

Researchers from Los Alamos National Laboratory and Northrop Grumman Space Technology have built a compact generator that converts heat to electricity with the relatively high efficiency of 18 percent.

The generator is simple, making it potentially long-lived and easy to maintain. This makes it especially appropriate for generating electricity aboard spacecraft, according to the researchers.

The generator uses a small version of a thermoacoustic sterling engine developed at Los Alamos in 1999. That engine converted heat to acoustic energy using no moving parts. Compressed helium cycles between heat exchangers, and the movement of the gas generated sound waves.

In the generator, the sound waves from the engine drive a piston, which moves a coiled copper wire. As the wire moves through a magnetic field produced by a permanent magnet it produces electricity.

Existing spaceship thermoelectric power converters are about seven percent efficient, and produce 5.2 watts per kilogram. The researchers' thermoacoustic sterling heat engine could eventually produce 8.1 watts per kilogram, according to the researchers. The researchers' next steps are to better match the engine and alternator to make the engine more efficient, and to reduce the engine's volume.

A space power application could be practical in two to five years, according to the researchers. The work appeared in the August 9, 2004 issue of *Applied Physics Letters*.

Guðlaugur Kristinn Óttarsson: Höfuðblót LOKA, Kornhlöðuloftinu, 2 október 2004

A Relativistic Thermoelectromagnetic Theory.

Óttarsson, G. K., ICT2003 La Grande Motte, France, www.its.org

E-paper: A Relativistic Thermoelectromagnetic Theory

Abstract:

A new Vector-Scalar notation, inspired from Maxwell's Electromagnetic Equations, and a new thermoelectric speed-constant, attributed to any material or medium, is jointly used to derive a fully relativistic theory about the energy, momentum and charge transport in the presence of thermal gradients. Thermomagnetic effects are inherent with more rigor than from a phenomenological treatment alone. By reconsidering the thermoelectric transport parameters and eliminating duplicate definitions, we are in a better position to obtain analytical solutions to nonlinear and dynamic thermoelectromagnetic problems.

Guðlaugur Kristinn Óttarsson: Höfuðblót LOKA, Kornhlöðuloftinu, 2 október 2004