More from Discussions of Presentations

On biological ‘disequilibrium’ as a sign of life on a planet

On volcanoes and climate change

On comparing costs of different sources of energy

The ionosphere (reversing magnetic pole, expanding/contracting atmosphere)

From Wapedia

The Gaia hypothesis was first scientifically formulated in the 1960s by the independent research scientist James Lovelock, as a consequence of his work for NASA on methods of detecting life on Mars. [4] [5] He initially published the *Gaia Hypothesis* in journal articles in the early 1970s [6] [7] followed by a popularizing 1979 book *Gaia: A new look at life on Earth*.

The theory was initially, according to Lovelock, a way to explain the fact that combinations of chemicals including oxygen and methane persist in stable concentrations in the atmosphere of the Earth. Lovelock suggested detecting such combinations in other planets' atmospheres as a relatively reliable and cheap way to detect life, which many biologists opposed at the time and since. Later, other relationships such as sea creatures producing sulfur and iodine in approximately the same quantities as required by land creatures emerged and helped bolster the theory. Rather than invent many different theories to describe each such equilibrium, Lovelock dealt with them holistically, naming this self-regulating living system after the Greek goddess Gaia, using a suggestion from the novelist William Golding, who was living in the same village as Lovelock at the time (Bowerchalke, Wiltshire, UK). The Gaia Hypothesis has since been supported by a number of scientific experiments [8] and provided a number of useful predictions, [9] and hence is properly referred to as the Gaia theory.

Since 1971, the noted microbiologist Dr. Lynn Margulis has been Lovelock's most important collaborator in developing Gaian concepts. [10]

Until 1975 the hypothesis was almost totally ignored. An article in the New Scientist of February 15, 1975, and a popular book length version of the theory, published in 1979 as *The Quest for Gaia*, began to attract scientific and critical attention to the hypothesis. The theory was then attacked by many mainstream biologists. Championed by certain environmentalists and climate scientists, it was vociferously rejected by many others, both within scientific circles and outside them.

I commented that there’s no life on Mars, a bit tongue-in-cheek. What this was in reference to is the fact that if you look at the atmosphere of Mars, it is in geologic equilibrium – meaning that if there is life, it isn’t much – certainly not enough to throw the atmosphere out of balance as is the case for Earth. This doesn’t mean, of course, that there can’t be some very minor life (bacteria under rocks or under the ice), but it would have to be so small as to not change the composition of the atmosphere. It could also be the case that there used to be more life on Mars, but it is now long dead and the atmosphere is in equilibrium with the rocks.

See the following web site for more on “Life on Mars”

http://wapedia.mobi/en/Life_on_Mars

On the Iceland volcano

"With the first phases, the ash was going up to 30,000 to 40,000 feet," Day said. "The current levels that the ash is being ejected to is maybe only 10,000 or 20,000 feet. It's probably also coarser-grained ash as well -- it's not quite so finely divided on the whole -- so it's going to settle out faster. So although the eruption may continue for a long time, and we may over the next few months see bursts of explosive activity, it's probably not going to be as much of a problem as it has been during this last week." – from CNN, April 20

So it’s probably not going to affect climate very much, but it will sure have some local impacts on air quality, travel, and perhaps a short-term climate impact in some regions of the northern hemisphere.

What about alternative (renewable) energy? We discussed briefly how solar panels aren’t carbon-free, so to speak. The manufacture of one solar panel with a 1-m^2 area produces about 300 kg of CO_2. If one lives in an area where electricity is generated from coal, each kW-hr produces 1 kg of CO_2. So the breakeven point is when this panel has generated 300 kW-hr. In Colorado, a 10000 kW solar PV system can generate 12,500 kW-hr of electricity in one year, so a 160 W solar panel with 1 m^2 area will generate 200 kW-hr in one year. Therefore, in 18 months a typical modern solar panel will ‘break even’ relative to coal in the CO2 emissions game. After those 18 months, all the electricity is essentially carbon free, so with an estimated lifetime of 25+ years, the solar panel produces only 6% of the CO_2 as would have otherwise been generated by coal.

AND - The estimate of 300 kg CO_2 per 1m^2 of solar panel area is on the high side. As production costs decrease with larger scale production, this number will certainly decrease. For a 160 W solar panel, which produces about 5000 kW-hr of electricity in 25 years and costs about $950 to install, including purchase price, a kW-hr costs about $0.19, which is only 50% more than the current cost of electricity in Colorado from coal. If the price of coal increases…well, you get the point. Solar is almost equal to coal, and the impact on the environment is much smaller. It’s only a matter of time.

Here is a recent estimate of the total carbon footprint of different energy sources, which includes production, distribution, etc. It would be interesting to try to find the sources for this information. The units are CO_2e/kWh, meaning the equivalent grams of Co2 per kilowatt hour of useful energy production. That is, electricity production from coal is responsible for 1 kg of CO2 per kWh of energy. New solar panels (which are easier to make now than older ones were) is responsible for only 3.5% of the CO2 from coal. Yet the price of solar electricity is about 5 times larger than production of energy from coal.

1000 - coal
900 - oil
750 - open cycle natural gas
580 - closed cycle natural gas (closed cycle natural gas combined with co-generation might bring this down to 400 CO_2e/kWh)
110 - old solar photovoltaics
85 - nuclear
40 - concentrated solar thermal with thermal storage
35 - new solar photovoltaics
21 - wind
15 - hydroelectricity
<10 - geothermal doublet

A pretty disheartening report, if you are the USA!

See where we rank on the next pages.

Environmental Performance Index – Rankings & Scores

Rank	Country	Score
1	Iceland	93.5
2	Switzerland	89.1
3	Costa Rica	86.4
4	Sweden	86.0
5	Norway	81.1
6	Mauritius	80.6
7	France	78.2
8	Austria	78.1
9	Cuba	78.1
10	Colombia	76.8
11	Malta	76.3
12	Finland	74.7
13	Slovakia	74.5
14	United Kingdom	74.2
15	New Zealand	73.4
16	Chile	73.3
17	Germany	73.2
18	Italy	73.1
19	Portugal	73.0
20	Japan	72.5
21	Latvia	72.5
22	Czech Republic	71.6
23	Albania	71.4
24	Panama	71.4
25	Spain	70.6

Rank	Country	Score
56	Syria	64.6
57	Estonia	63.8
58	Sri Lanka	63.7
59	Georgia	63.6
60	Paraguay	63.5
61	United States	63.5
62	Brazil	63.4
63	Poland	63.1
64	Venezuela	62.9
65	Bulgaria	62.5
66	Israel	62.4
67	Thailand	62.2
68	Egypt	62.0
69	Russia	61.2
70	Argentina	61.0
71	Greece	60.9
72	Brunei Darussalam	60.8
73	Macedonia	60.6
74	Tunisia	60.6
75	Djibouti	60.5
76	Armenia	60.4
77	Turkey	60.4
78	Iran	60.0
79	Kyrgyzstan	59.7
80	Laos	59.6

Rank	Country	Score
111	Tajikistan	51.3
112	Mozambique	51.2
113	Kuwait	51.1
114	Solomon Islands	51.1
115	South Africa	50.8
116	Gambia	50.3
117	Libya	50.1
118	Honduras	49.9
119	Uganda	49.8
120	Madagascar	49.2
121	China	49.0
122	Qatar	48.9
123	India	48.3
124	Yemen	48.3
125	Pakistan	48.0
126	Tanzania	47.9
127	Zimbabwe	47.8
128	Burkina Faso	47.3
129	Sudan	47.1
130	Zambia	47.0
131	Oman	45.9
132	Guinea-Bissau	44.7
133	Cameroon	44.7
134	Indonesia	44.6
135	Rwanda	44.6

25	Spain	70.6
26	Belize	69.9
27	Antigua & Barbuda	69.8
28	Singapore	69.6
29	Serbia & Montenegro	69.4
30	Ecuador	69.3
31	Peru	69.3
32	Denmark	69.2
33	Hungary	69.1
34	El Salvador	69.1
35	Croatia	68.7
36	Dominican Republic	68.4
37	Lithuania	68.3
38	Nepal	68.2
39	Suriname	68.2
40	Bhutan	68.0
41	Luxembourg	67.8
42	Algeria	67.4
43	Mexico	67.3
44	Ireland	67.1
45	Romania	67.0
46	Canada	66.4
47	Netherlands	66.4
48	Maldives	65.9
49	Fiji	65.9
50	Philippines	65.7
51	Australia	65.7
52	Morocco	65.6
53	Belarus	65.4
54	Malaysia	65.0
55	Slovenia	65.0
80	Laos	59.6
81	Namibia	59.3
82	Guyana	59.2
83	Uruguay	59.1
84	Azerbaijan	59.1
85	Vietnam	59.0
86	Moldova	58.8
87	Ukraine	58.2
88	Belgium	58.1
89	Jamaica	58.0
90	Lebanon	57.9
91	Sao Tome & Principe	57.3
92	Kazakhstan	57.3
93	Nicaragua	57.1
94	South Korea	57.0
95	Gabon	56.4
96	Cyprus	56.3
97	Jordan	56.1
98	Bosnia & Herzegovina	55.9
99	Saudi Arabia	55.3
100	Eritrea	54.6
101	Swaziland	54.4
102	Côte d'Ivoire	54.3
103	Trinidad & Tobago	54.2
104	Guatemala	54.0
105	Congo	54.0
106	Dem. Rep. Congo	51.6
107	Malawi	51.4
108	Kenya	51.4
109	Ghana	51.3
110	Myanmar	51.3
135	Rwanda	44.6
136	Guinea	44.4
137	Bolivia	44.3
138	Papua New Guinea	44.3
139	Bangladesh	44.0
140	Burundi	43.9
141	Ethiopia	43.1
142	Mongolia	42.8
143	Senegal	42.3
144	Uzbekistan	42.3
145	Bahrain	42.0
146	Equatorial Guinea	41.9
147	North Korea	41.8
148	Cambodia	41.7
149	Botswana	41.3
150	Iraq	41.0
151	Chad	40.8
152	United Arab Emirates	40.7
153	Nigeria	40.2
154	Benin	39.6
155	Haiti	39.5
156	Mali	39.4
157	Turkmenistan	38.4
158	Niger	37.6
159	Togo	36.4
160	Angola	36.3
161	Mauritania	33.7
162	Central African Republic	33.3
163	Sierra Leone	32.1

For detailed analysis of each country, visit http://epi.yale.edu