Statistical Analysis with Comparison of Environmental Disruption of Energy Consumption in Hilla City

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Abstract

Most of the world's energy resources are from the sun's rays hitting earth. Some of that energy has been preserved as fossil energy. Discussions of energy technology have examined the past, present, and future patters of energy production and consumption, turn to a discussion environmental impacts.

The research undertakes calculation for a specified country or region, Hilla city to get comparison of current energy use in, solar radiation, food, and fuel. Random samples were used to measure the food energy consumption by a questionnaire and statistics based on disappearance data from markets; fuel energy from fuel stations. Results show that environmental disruption ratios for energy are Fuel 4, Solar 992 , and Food 3, the fuel energy consumption is 1,2 times the food, the average person consumes food per day containing 3651.7 calories, and human energy needs are small compared to solar radiation.

تحليل إحصائي مع المقارنة للتوزيع البيئي لاستهلاك الطاقة في مدينة الحلة

الخلاصه

معظم مصادر الطاقة العالمية هي من الأشعة الشمسية التي تضرب الأرض وبعض من هذه الطاقة تتحول الى وقود احفوري ، والنقاشات حول تقنية الطاقة التي اختبرت في الماضي والحاضر وللمستقبل لإنتاج الطاقة واستهلاكها اتجهت الى بحث الاثار البيئية.

البحث أخذ على عاتقه حساب منطقة محددة هي مدينة الحلة للحصول على مقارنة لاستعمالات الطاقة فيها، كالأشعة الشمسية، الطعام، والوقود. واستعملت عينات عشوائية لقياس طاقة الطعام المستهلك بواسطة استمارة استبيان والإحصائيات المستندة على معلومات ما هو مفقود من السوق، وطاقة الوقود من محطات التعبئة. وأظهرت النتائج أن نسب التوزيع البيئي للطاقة هي للوقود 4 ، الشمسية 992 ، والطعام 3 ، وطاقة الوقود المستهلكة هي 1.2 مرة أكثر من الطعام ، ومعدل استهلاك الطعام للشخص في اليوم يحوي 3651.7 سعرة ، واحتياجات طاقة الأنسان هي قليلة مقارنة بالأشعة الشمسية .

Introduction

Iraq's economy is dominated by the oil sector, which provides over 90% of government revenue and 80% of foreign trade earnings (World bank, 1981). Most discussions of energy technology and politics include an account of environmental aspects, since it is generally recognized that environmental considerations can constrain energy production, especially when the environment is exposed to risk. Environmental issues contain topics such as air pollution from automobiles and power plants, thermal pollution from power plants, and water pollution from oil spills (Henry, 2009; Biswas, 1973).

The study goals are to discuss some recurring themes in the energy-environment issue. These are (1) a comparison of current energy use in an industrial society with the "background" of solar radiation that we receive and with the minimum energy necessary as food for survival; (2) the volumes of fuels that we use; and (3) the changing picture of energy availability.

Background of solar radiation and food energy

Most of the world's energy resources are from the sun's rays hitting earth. Some of that energy has been preserved as fossil energy (Masters, 2005 ; Budyko, 1958). The term solar constant is the amount of incoming solar electromagnetic radiation per unit area, measured on the outer surface of earth's atmosphere, in a plane perpendicular to the rays. The solar constant includes all types of solar radiation, not just visible light (Masters, 2005; Randall, 1999 ; Gates, 1962).

Commercial energy consumption by society can be compared with the background of energy received through solar radiation and the minimum food energy necessary for survival (Henry, 2009).

Calories (kcal), a measure of the amount of energy from food, come from three major sources: carbohydrate, fat, and protein (Tuve, 1976). In 2002, an average Canadian consumed 2,788 kcal per day, compared to 2,356 kcal in 1991(Statistics Canada, 2003).In USA, the aggregate food supply in 2000 provided 3,800 calories per person per day, 500 calories above the 1970 level and 800 calories above the record low in 1957 and 1958. Americans at the beginning of the 21st century are consuming more food and several hundred more calories per person per day than did their counterparts in the late 1950s (when per capita calorie consumption was at the lowest level in the last century), or even in the 1970s. Of that 3,800 calories, USDA's Economic Research Service (ERS) estimates that roughly 1,100 calories were lost to spoilage, plate waste, and cooking and other losses, putting dietary intake of calories in 2000 at just under 2,700 calories per person per day. A variety of factors are responsible for the changes in consumption patterns in the last 50 years, including changes in relative prices, increases in real (adjusted for inflation) and disposable income. New products, particularly more convenient ones, also contribute to imports, growth in the away-from-home.

ERS estimates per capita food and nutrient supplies based on food disappearance data. These data are used as a proxy to estimate human consumption. The data are used more appropriately as indicators of trends in consumption over time. (USDA's Center for Nutrition Policy and Promotion, 2000). The average person eats about 3000 food calories per day (Statistics Canada, 2003; Tuve, 1976).

Fuel volumes

Iraq's economy is dominated by the oil sector (World watch Institute, 2009; World Bank, 1981), and the twentieth century saw a rapid increase in the use of fossil fuels. According to the US Energy Information Administration estimate fossil fuels supplying 86% of the world's energy (Statistical Review of World Energy, 2009)

The potential for environmental disruption by energy-related activities can be elucidated by calculating the mass or volume of fuel used by each person per year. Obtaining this mass of fuel, separating it from other undesired materials, transporting it, and eventually burning it all have environmental impacts (Henry, 2009 ; International Energy Agency, 2007). Table (3), indicates the energy densities of selected fuels in units of MJ/L (megajoules or 10^6 J/L). Energy density means the amount of energy contained in a unit volume of the fuel. Coupling this to per capita energy use shows that we are each responsible for the production and movement of a considerable volume of energy-related materials annually. These volumes are substantial, especially when it is noted that obtaining the fuel may require the removal of other material. For availability, in the past there has been an understandable tendency for industrialists to exploit first the cheapest, closest, richest, and least contaminated energy sources. These sources lead to maximum profit. Rightly or wrongly, less desirable sources tend to be left for future generations. Onshore petroleum has been preferred to offshore; where available, natural gas has been used as an energy source in preference to coal or coal gas (Fuel consumption guide, 2011; Henry, 2009).

Energy production in Hilla City

The area of Hilla city is equal to 55 km^2 with population of 258568 persons (Babylon Statistics, 1997). The geographical location of city in position intersect longitude 44.26° west and latitude circle 32.29° north (Kateib, 1974).

Random samples were used to measure the energy consumption in Hilla city by a questionnaire distributed to persons in different areas to get necessary numerical and qualitative information, matches with statistics (Naser, 1989). Food calculations based on disappearance data from markets, and compered with questionnaires to get accuracy.
Profiling consumption, the food a person eats at a given time is related to sensory issues, but it is also related to how appropriate they perceive this food for that situation, Table (2) gives average measurement of the energy from daily food consumption.

The comparison and discussion for the energy consumption or flow rates in units of joules per year, gigawatts (GW), and watts per person as fuel, food, and solar radiation for the city of population density 4701.3 persons km^2, an area of 55 km^2, and a fuel energy consumption rate of 6.6 GJ per person per year. Solar radiation reaching the ground is approximately 240 W/m^2 from Figure (1) in Appendix (2). The average person consumes food containing 3651.7 calories.

Calculations of energy uses (Henry, 2009):

1- Fuel:

0.75 × 0.036 = 0.027 MJ/ person .day , 0.5 × 35 = 17.5 MJ/ person .day

Total energy (J/yr) = $17.53 \times 10^6 \times 258568 \times 365 = 1.7 \times 10^{15}$

(Energy is usually expressed in watts : J/s)

J/s = watts (W) = $\frac{1.7\times 10^{15}}{365 \times 24 \times 3600}$ = 5.4×10^7 = 0.054 GW

Watts / person = $\frac{5.4\times 10^7}{258568}$ = 208.5

2 - Solar:

Total energy (watts) = 240 (W/m^2) × 10^6 (m^2/km^2) × 55 km^2 = 1.32 × $l0^{10}$ W = 13.2 GW

J/yr = 1.32 × $l0^{10}$ (J/s) × 3600 (s / h) ×24 (h/day) ×365 (days/yr) = 4.163× $l0^{17}$ J/yr

Watts / person = $\frac{1.32 \times 10^{10}\ W}{4701.3\ persons/km^2 \times 55\ km^2}$ = 51049.71

3 - Food:

J/yr = 3651.7 (cal/day. person) × 4182 (J/cal) × 365 (days/yr) × 258568 (person) = 1.4× 10^{15} J/yr =1.4× 10^{15} / 3600 (s / h) ×24 (h/day) ×365 (days/yr) = 4.4×10^7 J/s = 0.044 GW

Watts / person = $\frac{4.4\times 10^7\ W}{4701.3\ persons/km^2 \times 55\ km^2}$ = 170.2

Table (1) : Recommended daily energy intake (kcal/day).(Statistics Canada, 2003)

Age (years old)	13-15	16-18	19-24	25-49	50-74	75 +
Male	2.800	3.200	3.000	2.700	2.300	2.000
Female	2.200	2.100	2.100	1.900	1.800	1.700

Table (2) : Average measurement of the energy from Daily food consumption in Hilla City, adjusted for spoilage, cooking losses, plate waste and other losses; by the researcher**.**

No	Item	gm. per person per day		Calories* per 100 gm	Calories	
		2010	2011		2010	2011
1	Red Meat **(**Veal and lamb)	**140.6**	**155.1**	**226**	**317.8**	**350.5**
2	Fish (without fat)	**20.5**	**30**	**126**	**25.8**	**37.8**
3	Chicken	**308**	**304**	**315**	**970.2**	**957.6**
4	Cheese	**37.2**	**40**	**244**	**90.8**	**97.6**
5	Milk	**0.24**	**0.35**	**463**	**1.1**	**1.6**
6	Total fats	**95.3**	**101**	**886**	**844.4**	**894.9**
7	Total fruit and vegetables	**879.9**	**855**	**106**	**932.7**	**906.3**
8	Total grain	**249.5**	**277**	**100**	**249.5**	**277**
9	Total caloric sweeteners	**190.5**	**185**	**41.1**	**78.3**	**76.1**
10	Eggs	**35**	**25**	**209**	**73.2**	**52.3**
Total					**3583.8**	**3651.7**

*With assistance of nutrition information on food products in local market

Table (3) Energy consumption of selected fuels in Hilla City, for all purposes; by the researcher**.**

No	Fuel	Energy density*[1] (MJ/L)	energy consumption*[2] (L/ person .day)
1	Natural gas	**0.036**	**0.75**
2	Oil or gasoline (petroleum)	**35**	**0.5**

1*Source :(Henry, 2009)**.**

2* By the researcher from Fuel stations in the city center 2011 , and compared with data of ministry of oil.

Table (4) : Summary of environmental disruption for energy-related activities elucidated by calculations; by the researcher with assistance of (Henry, 2009).

No		J/yr	GW	Watts/person	Ratio
1	Fuel	1.7×10^{15}	0.054	208.5	4
2	Solar	4.163×10^{17}	13.2	51049.71	992
3	Food	1.4×10^{15}	0.044	170.2	3

Conclusions

1. Environmental disruption ratios for energy are for Fuel 4, Solar 992 , and Food 3.

2. Human energy needs are small compared to solar radiation, but it is the wide dispersal or dilution of solar energy that makes it difficult to exploit.
3. Food energy needs are very small, although each person is generating nearly the same energy.
4. The fuel energy consumption of 208.5 w (0. 2085 kW) is 1.2 times the food consumption, thus leading to statements that "modern industrialized man has the equivalent of 1.2 energy slaves".
5. If the population density increases (as may occur in urban areas) fuel and solar energy flows become more equal. This leads to local climatic modifications, hence winters in large cities are often milder than those in suburbs.

Recommendations

1. Future energy supplies may (1) tend to come from more remote areas, incurring longer transportation distances; (2) be more contaminated with undesirable elements; and (3) be more "dilute" .
2. Compare the city and highway fuel consumption ratings of different vehicles to find out which vehicles consume the least amount of fuel, and costs savings.
3. The future engineers must be able to express the perceived problem and its potential solution in quantitative terms.
4. Ultimately development will require a stabilized population living in secure social.
5. Stresses the need in, and the opportunities for, avoiding or minimizing the creation of wastes through technological changes.
6. Reviews or introduce scientific knowledge necessary to understand the nature of energy problems and to be able to quantify them.

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Appendixes:

Appendix (1):

1 (kilo) calorie = 4182 J
Watts = J/s
kC (1 food Calorie = 1000 calories**)**

Appendix (2):

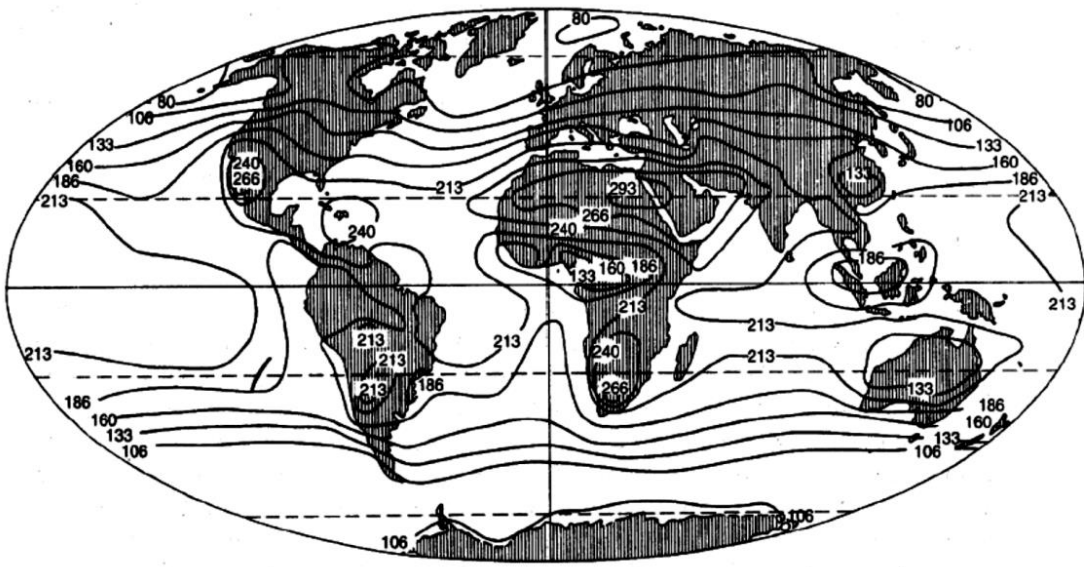

Figure (1) Average annual solar radiation on a horizontal surface at ground level (W/m^2); (Henry, 2009 ; Budyko, 1958)**.**

Babylon University **Appendix (3)**

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Questionnaire of daily food consumption in Hilla City

No. ( ) **Date** / / 2011

Research title: Statistical Analysis with Comparison of Environmental Disruption of Energy Consumption in Hilla City.

Researcher name: Ahmed T. S. Auda

Note: This Research for scientific purpose**.**

First: Personal information

1. Male ( ) , Female ( ).
2. Age ( ).
3. Do you have any illness problem: Yes ( ) , No. ( ).

Second: Net of approximate food consumption

No	Item		Details									
1	Red Meat	Veal	Gm.	Daily		weekly						
		lamb		Daily		weekly						
2	Fish		Gm.	Daily		weekly						
3	Chicken		Gm.	Daily		weekly						
4	Cheese		Gm.	Daily		weekly						
	Cream		Gm.	Daily		weekly						
	Milk		(Liter)	Daily		weekly						
	Yogurt		(L)	Daily		weekly						
5	fats		Gm. per day			L per day						
6	Type of fruit											
	Gm. per day											
	Type of vegetables											
	Gm. per day											
7	grain		Bread (No. per day)		Rise (Number of Dishes)		Daily		Weekly			
8	caloric sweeteners		Drink (300 ml) (No).		Tea(No. of cup per day)		Cake (piece)		Sweets (piece)			
9	Eggs (No.)		Daily			weekly						
10	Others											

Third: Any necessary information or details