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Brief Note

Personal energy impact of attending a professional meeting

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Abstract

At a four-day energy workshop in Italy in September, 2002, 44 attendees, about half of the total, completed a questionnaire covering their travel (mode, distance) and monetary expenditures. These have been converted to direct and indirect energy requirements. Average total energy per respondent was 2.9 barrels of oil equivalent, of which 91% resulted from round trip travel of 6100 km. For comparison, global average annual per capita energy consumption is 12 barrels of oil equivalent.

1. Introduction

Arguing that resource accounting is a complement to economic analysis, researchers have been calculating the energy required for various consumption activities for three decades [1,2,3,4,5]. Often we have traveled to meetings to present the results, seldom if ever giving systematic attention to the resource requirements or impacts of the meeting itself. Yet a rough estimate shows that a person flying Chicago–Rome–Chicago uses half as much fuel as the average US automobile burns in a year (the latter is approx. 10 barrels or 1.3 t).

The Johannesburg Earth Summit in August–September 2002 was an exception: there was an associated web site [6] that allowed one to compute his/her CO_2 impact of attending. This encouraged me to canvass the participants at the 3rd Biennial Workshop: Advances in Energy Studies: Reconsidering the Importance of Energy, Porto Venere, Italy, 24–28 September 2002 [7]. Table 1 shows the questionnaire covering travel and expenditures. Details for the energy conversion factors are given in the notes to the questionnaire. Forty-four attendees, about one-half of the total, responded.

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Table 1
Questionnaire at the Porto Venere Workshop. Conversion factors for travel were erroneously large, and are corrected here. Forty-four usable responses were received.[a]
Porto Venere III Workshop, 24–27 September 2002. Please fill this form out and return it to me. You need not do the calculation; just fill out columns 2 and 4. If you wish, take a second copy for your own use. Comments are welcome

1.	2. Round trip distance (km)	3. Multiplier	4.	5. Energy (barrels oil equivalent)
		Barrels oil equivalent/km		
Travel:	Plane ————	×0.00043		=————
	Bus ————	×0.00039		=————
	Train ————	×0.00047		=————
	Car ————	×0.00090	Divide by total number occupants	=————
Per person:		Barrels oil equivalent/Euro		
Lodging	Euro spent ————	×0.00039		=————
Conference registration	Euro spent ————	×0.00060		=————
Food away from home	Euro spent ————	×0.00083		=————
Other expenses	Euro spent ————	×0.0011		=————
			Total, this meeting	————
For comparison:				
Per capita annual energy use (Barrels oil equivalent)		This meeting as fraction		
U.S.	64	————		
Germany	33	————		
World	12	————		
Bangladesh	0.6	————		

[a] The boundary to the question is basically economic: anything that costs money is included. Energy is expressed in barrels of oil equivalent, and includes all fossil sources, nuclear, and a fossil equivalent of hydroelectricity (even though not all our energy comes from oil.) They are updates of older coefficients and are approximate. Ground transport figures are drawn from US Bureau of Transportation Statistics [9]. The plane information is based on actual fuel use data I have collected every time I have flown for 28 years (and then multiplied by 1.4 to account for indirect energy use in the air transportation system). It agrees well with US Energy Information Administration figures [10]. My data (for the year 2000, pre 9/11/01) show an average load factor of 0.93, which exceeds the US average of about 0.7 [10]. Obviously the conversion factor is sensitive to this variable. For the car, a fuel-use efficiency of 0.93 l/10 km (= 25 mpg) is assumed. A multiplier of 1.5 is used to account for indirect energy requirements of the road transportation system. The multipliers include indirect energy, e.g. the energy to make cars and roads; they are based on Input-Output-based energy work in the1970s [2] and updated by me. These numbers are appropriate for the US. For lodging, registration, food, and other expenses, I multiplied the Italian energy/GDP ratio by a factor to account for relative energy intensity of these specific expenditures. The factor is calculated from US data. Italy's energy/GDP ratio is 54% of the US's.

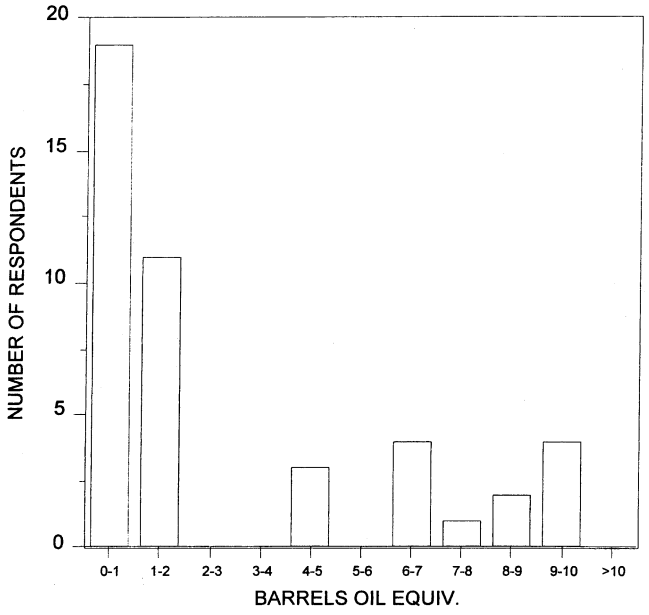

Fig. 1. Distribution of energy impacts for the 44 respondents.

2. Results

Fig. 1 shows the distribution of energy impacts, which are summarized in Table 2. The mean is 6100 km traveled round trip, and energy = 42 barrels oil equivalent (1 barrel = 42 gallons = approx. 1/8 t). The medians are 2100 km and 1.2 barrels. The mean is 24% of the average global *annual* per capita use and five times that in Bangladesh. Fig. 2 shows energy

Table 2
Summary data for the 44 respondents

	Mean	Median	Minimum	Maximum
Corrected round trip distance (km)[a]	6120	2120	10[b]	21200
Total energy (barrels oil equivalent)	2.9	1.2	0.09[b]	10.0
Per cent from transportation	80[c] (91[d])		8.0[b,c]	99.8[c]
Total energy as percentage of annual per capita use in:				
US	5	2		
Germany	9	4		
World	24	10		
Bangladesh	480	200		

[a] corrected distance = plane + train + bus + (car/number of occupants).
[b] respondent was vacationing locally.
[c] simple average.
[d] energy-weighted average.

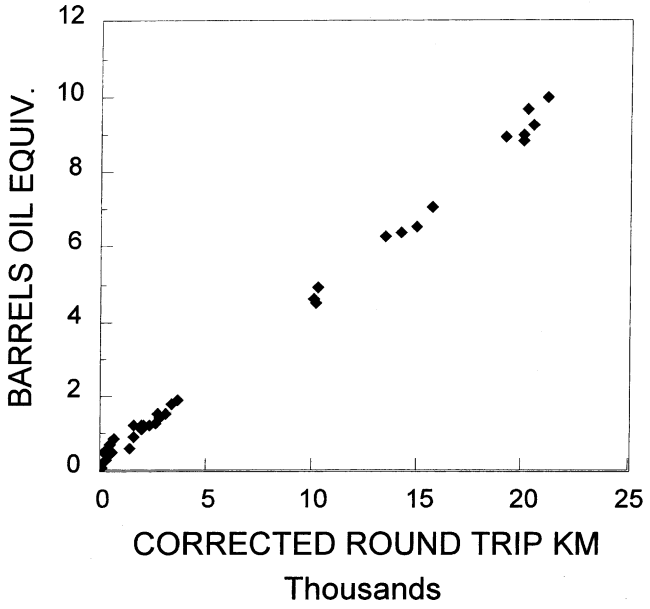

Fig. 2. Energy impact vs corrected distance traveled for the 44 respondents

vs distance traveled. In Fig. 2 we can see three clusters, corresponding to Europe, North/South America, and Asia/Oceania.

Not surprisingly, the energy for activities and life-support at the conference is typically minor compared with that for transportation. For the entire meeting, only 9% of total energy is from non-transport activity; for the average respondent, this fraction was 20%. The dominance of transportation is also illustrated in Fig. 2.

Basic questions of accuracy, aggregation, nonlinearity, and system boundary complicate interpreting these numbers. However, given the dominance of transportation energy, nuances of energy-costing the conference and hotel activities are relatively unimportant. Because I have actual data for airplane fuel use, that conversion factor is relatively good. Average (not marginal) energy-costing is used here; e.g., I do not allow the argument that a partially full plane 'would have flown anyway' to give selected passengers a free ride. Additionally, energy intensities of public transportation are based on typical load factors: planes are fairly full, while intercity buses are much less so. I did not ask respondents for trip-specific load factors or automobiles-specific fuel efficiency, and that remains as a potential source of error. (I will do so in future canvasses.) Beyond that, I give the following estimates of uncertainty in the conversion factors in Table 1: air transportation,+20% to −40%; auto, +0% to −20%; bus and train, +50% to −50%; lodging, registration, etc. +50% to −67%.

3. Discussion

As I noted previously [3], usually attendees pay for professional meetings from grants or similar sources outside of personal income. Whether to consider this energy impact a part of one's energy cost of living is a familiar system boundary question. Is knowledge of the energy impact determined here a factor in one's decision about what meetings to attend? In 1975 I refused a gratis meeting in Sweden on this basis. In recent years Donella Meadows, coauthor of *Beyond the Limits* [8], limited her travel on the basis of carbon emissions. Donella died in 2001, and I now use more conventional criteria. An indication of a lack of burning interest is that I received not one comment pointing out that the conversion factors for travel in the questionnaire handed out in Porto Venere were too large by a factor of $(1.6)^2 = 2.56$! (they are corrected here). Nonetheless I believe the issue of resource impacts of meetings is important.

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