ENVIRONMENTAL IMPACTS OF RENEWABLE ENERGY SOURCES: METHODOLOGICAL ISSUES

Kirk R. Smith

Resource Systems Institute, East-West Center
Honolulu, Hawaii, USA

1. INTRODUCTION

There is a burgeoning and increasingly sophisticated literature on the comparative environmental hazards of large-scale energy technologies. Much of its attention has focused on electricity production where comparisons are often made between the nuclear and non-nuclear alternatives such as coal\(^1\). In spite of this attention, however, there are still major methodological and conceptual difficulties encountered in doing such studies\(^2\).

Small-scale technologies for energy production also have environmental impacts associated with them, but the methodologies for making comparisons are not as well developed\(^3\). It will be important to have a carefully designed and applied methodology in order to fully assess the relative merits of the many small-scale technologies now being considered for wide-spread implementation mostly in the rural areas of the world. By drawing upon the experience gained in comparing large-scale systems, it is possible to make a few general comments about the required characteristics of a methodology for examining small-scale systems.

In order to accomplish a comparison of the environmental effects of making energy by different means, it is necessary to do three kinds of tasks. First, it is necessary to identify the categories of possible harm. Second, a tabulation is needed of the quantitative harm in each category in an accounting scheme that treats each technology on an equal basis with the others. Finally, some means is needed to evaluate the relative concern that should be
placed on different amounts of different types of harm. These three
tasks—identification, accounting and evaluation—together comprise
comparative environmental assessment(3,4). In this look at methodo-
logical issues, focus will be placed on the problems of the second
task, accounting. Accounting environmental impacts requires, of
course, considerable and often unavailable scientific information
about doseresponse relationships, the effects of pollutants on cli-
mate, the causes of deforestation and so on. However, this aspect of
the problem will not be treated here. Rather, this discussion focuses
on a somewhat neglected part of the accounting task; the determi-
ation of exactly what activities and their associated impacts should
be accounted to each energy technology.

This may sound strange. After all, the activities asso-
ciated with an energy technology such as a coal plant or a biogas
digester would seem to be fairly obvious. However, there are actually
quite tricky problems of several sorts involved in making sure that
the activities associated with each technology are treated consis-
tently by the accounting procedure. In order to explain these prob-
lems, examples will be drawn from the environmental impacts that
directly cause damage to human health. Although there are many other
types of impacts that should also be considered in an environmental
assessment, the accounting principles will be the same.

2. NET VERSUS GROSS IMPACTS

If you should suddenly die of a heart attack while read-
ing this book, it is probably not fair to account the death as part
of the risk of nuclear power in Pakistan even though the Pakistan
Atomic Energy Commission sponsored the Fourth Summer College which
lead to the book's publication. The heart attack would most likely
have occurred anyway. When comparing the impacts of various energy
systems, it is important to separate those impacts that are due to
the existence of the system from those associated with the system
but that would have occurred anyway. The former might be called the
'net impacts' while the two impacts together might be called 'gross
impacts', if economic terms were to be used.

Confusing gross with net impacts is often done when public
and occupational risks are both being considered in an environmen-
tal assessment.

In most cases the assessment procedure is as follows: the
public impacts such as those caused by air pollution are calculated
for each energy facility. The occupational impacts such as indus-
trial accidents associated with working in the facility are also
found. What is implied in most analyses and explicit in many is that
the occupational and public risks are to be added together to arrive
at a 'total risk'(5).