Those of us associated with the Coastal Zone Management Program are pleased with the voluntary state response. All but one of the 30 eligible states are now participating, and all four territories are likely to take part soon.

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Recoverable Oil and Gas Resources

The recently released final report (*1*) of the Ford Foundation's Energy Policy Project (EPP) (News and Comment, 1 Nov. 1974) is a comprehensive and valuable addition to the current debate regarding this country's energy situation. However, estimates employed by EPP of the available resources of natural oil and gas appear to be overly optimistic and lead, we believe, to a complacent view of the necessity for rapidly developing alternative energy technologies and for reducing the demand for energy.

In the three energy scenarios discussed in the EPP report, domestic oil production is expected to rise from the current annual level of 3.79 billion barrels to between 5.17 and 6.89 billion barrels in the year 2000, and domestic gas production similarly is expected to increase from the current annual 22.3 $\times 10^{12}$ cubic feet to between 24.3 $\times 10^{12}$ and 35.9 $\times 10^{12}$ cubic feet.

We have investigated the compatibility of these production rates with various published estimates of the ultimately recoverable resources of oil and gas in the United States (including Alaska and the outer continental shelf). Since it is reasonable to assume that the curve of production of a resource as a function of time is roughly symmetrical about a peak, and since the EPP production rate estimates for oil and gas increase to the year 2000 in all cases but one, minimal values of the ultimately recoverable reserves required to achieve the EPP production rates were obtained by assuming that peak production occurs in the year 2000, integrating the production curve up to this peak, and doubling the result. (In the "zero growth" scenario, the gas production rate in 1985 is the same as the rate in 2000, and so the peak was assumed to occur in 1993.)

The results of this computation and the estimates of the ultimately recoverable resources made by M. King Hubbert (*2*), the National Petroleum Council (NPC) (*3*), and the U.S. Geological Survey (News and Comment, 12 July 1974, p. 127) are presented in Table 1. It is clear that the smallest oil resource bases consistent with the EPP production figures are considerably larger than the estimates of Hubbert and the NPC and only barely within the limits of the Geological Survey estimates. The same is true for gas in the "high growth" and "technical fix" scenarios of EPP. Only the "zero growth" gas figures are consistent with the resources estimated by the Geological Survey and NPC, but even in this case they exceed the Hubbert estimates by 65 percent.

In reviewing the energy supply situation, the EPP report (*1*, p. 332) concludes:

> Our judgement is that the oil and gas resource base in this country is far from exhausted and can supply over half the U.S. energy supply in the Technical Fix scenario for the remainder of the century. Limitations on oil and gas availability are likely to stem from a combination of environmental, social, and political constraints on rates of development rather than from a physical limit on the quantities in the ground that could in theory be available.

In a literal sense, this statement may possibly be true as long as one's outlook is strictly limited to the time period before the year 2000. However, the above analysis suggests that, from a longer perspective, such a view may be incautiously optimistic.

In assessing energy policies, the wisest approach would appear to be to employ reasonably conservative estimates of resource availability to ensure that one does not fail to develop alternative energy technologies before it is too late. A continued reliance on conventional oil and gas to supply the bulk of our energy needs is appealing since, on the whole, these energy sources are less environmentally damaging, require less capital investment, and are cheaper for the consumer than alternatives. However, postponing the development of alternative energy sources and the adoption of concerted efforts to reduce the demand for energy in the hopes that current estimates of oil and gas resources are low appears to us to be a shaky foundation for a responsible energy policy.

Table 1. Estimates of ultimately recoverable oil and gas resources. The figures for oil include estimates for natural gas liquids. The National Petroleum Council's (NPC) estimate for oil assumes a 40 percent recovery efficiency (current efficiency is estimated by NPC to be 31 percent).

Source	Oil (10^9 barrels)	Gas (10^{12} cubic feet)
Hubbert	253	1100
USGS	340 to 540	1600 to 2600
NPC	320	1860
Resources required for EPP scenarios		
High growth	530	2450
Technical fix	500	2300
Zero growth	480	1820

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References

1. *A Time to Choose: America's Energy Future* (Ballinger, Cambridge, Mass., 1974).
2. M. K. Hubbert, *U.S. Energy Resources: A Review as of 1972* (Government Printing Office, Washington, D.C., 1974).
3. *U.S. Energy Outlook* (National Petroleum Council, Washington, D.C., 1972).

Gnosis and Reductionism

Before the letters from John W. Corrington and David P. Barash (13 Dec., p. 976) confuse things hopelessly, please let me make two corrections regarding my criticism of science.

1) My use of the word "gnosis" (especially in the summer 1974 issue of *Daedalus*) in no way implies that I am a proponent of Gnosticism. That old and recurrent Christian heresy boasts an immense internal diversity; I would be hard put to say which of its many variations Corrington has in mind, and which I might care to endorse or reject. Granted my views may overlap some aspects of Gnosticism (along with many other traditions). But that is purely coincidental to my main purpose. Indeed, I have taken special care never to use the adjectival form "gnostic," precisely to avoid the confusion Corrington introduces. The word "gnosis" has a fully independent existence within Western philosophy; neither the term nor the concept is any more the monopoly of the Gnostics than truth (as he quaintly suggests) is the monopoly of Judeo-Christian culture.

I have carefully defined "gnosis" in