TECHNICAL NOTES

CONSERVATION ECONOMICS

June 26, 1986

NOTE NO. 2

Subject: Economic Feasibility with Variable Input Prices

This Conservation Economics Technical Note transmits Report No. 2.

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TECHNICAL NOTE

Subject: ECONOMICS

Series No.: 2

Reference: ECONOMIC FEASIBILITY WITH VARIABLE INPUT PRICES

Date: JUNE 6, 1984

SOIL CONSERVATION SERVICE
U. S. DEPARTMENT OF AGRICULTURE

Economic Feasibility with Variable Input Prices*

The Principles and Guidelines (PG) state that purchased inputs such as labor, energy and fertilizer, should be valued at current market prices when determining the agricultural benefits of water resource plans (p. 26). Plans that envision an overall improvement in irrigation system efficiency can result in reduced groundwater pumping. According to the PG, real increases in energy and OM costs over the life of the plan cannot be considered in estimating the national economic benefits of increased irrigation efficiency. However, the PG procedure is only mandatory for federally funded water resource projects. Other projects and program activities funded by state, local or private agencies can take advantage of the greater realism of an analysis that accounts for real changes in input prices.

This note investigates the effects of variable input prices on the economic feasibility of conservation plans which do not have to comply with the PG procedure. The example plan selected for evaluation involves the conversion of a sloped cotton field to a level basin with 1280′ runs. The benefits of this plan are the savings in water which are valued by the savings in energy costs from reduced groundwater pumping. Installation costs include the leveling of the field and construction of the ditches. OM costs are incurred for releveling the field and maintaining ditches. The following data, used for the evaluation, pertain to the Pinal Agricultural Management Area, Casa Grande Field Office (Arizona):

Installation cost	$430/acre
OM costs (every 4 years)	$22/acre
Annual energy savings	$40/acre

Water savings amount to 1.25 acre feet per acre. Energy savings are achieved through lower electricity costs on a 620′ well.

A base case is defined which assumes no real increases in energy and OM costs. Ten other cases are defined utilizing various rates of growth in real energy and OM costs. The benefit-cost ratios and net benefits for these ten cases are then compared to the base case.

The benefit-cost ratio and net benefits are calculated as follows:

$$b/c = esav \cdot pvfe/inst + OM \cdot pvfo$$

$$nb = esav \cdot pvfe - inst - OM \cdot pvfo$$

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where:

esav = energy savings,

inst = intallation cost,

OM = operating and maintenance costs,

pvfe, pvfo = present value factor for energy savings and OM costs, respectively.

The numerator of the benefit-cost ratio is the present value of benefits and the denominator is the present value of costs. For simplicity, it is assumed that installation costs are incurred in the first year of the project.

Table 1 summarizes the results of the economic evaluation. The first two columns give the growth rates used for electricity (ge) and OM costs (go). For the base case (first row), real electricity and OM costs remain constant over time (ge=go=0). The non-zero growth rates are divided into three categories. In the first category, electricity and OM costs increase at the same real annual percentage rate. In the second category, the OM growth rates exceed the electricity growth rates by 2%, and vice versa for the third category. The growth rates range from 2% to 8% per year.

The base case has the lowest benefit-cost ratio (1.14) and net benefits ($76/acre). For all three categories of non-zero growth rates, the benefit-cost ratio and net benefits rise as the growth rates increase. When growth in energy prices exceeds growth in OM costs, both measures of economic feasibility are greater than when the reverse holds.

To determine the relative effect of real input price increases on economic feasibility, the benefit-cost ratio and net benefits are expressed as a percent of the benefit-cost ratio and net benefits for the base case (see last two columns in table 1). This comparison shows that the benefit-cost ratio is 116% to 231% higher and net benefits are 242% to 1206% higher than in the base case. Therefore, economic feasibility improves when escalation in energy and OM costs are taken into account.

Two major conclusions can be drawn from this evaluation. First, for federally-funded projects which must be evaluated using constant real input prices, benefit-cost ratios and net benefits will be conservative when real input prices increase during the evaluation period. Second, if a project does not qualify for federal funding or it is planned as a non-federal project, real input price changes should be taken into account because of their potentially significant effect on economic feasibility.

Table 1. Effects of Escalating Electricity Prices on Economic Feasibility of Land Leveling in Pinal AMA, Arizona

ge	go	b	c	nb	b/c	ratio nb	ratio b/c
(percent)		($/acre)				(percent)	
0	0	564	492	76	1.14	100	100
2	2	701	507	193	1.38	253	120
4	4	885	527	357	1.67	469	146
6	6	1133	554	579	2.04	761	178
8	8	1472	590	881	2.49	1159	217
2	4	701	527	173	1.32	227	116
4	6	885	554	330	1.59	434	139
6	8	1133	590	542	1.91	713	167
8	6	1472	554	917	2.65	1206	231
6	4	1133	527	606	2.14	797	187
4	2	885	507	377	1.74	496	152

Legend:

ge = annual percent growth in real electricity prices
go = annual percent growth in real OM costs
b = present value of benefits at 5% real discount rate
c = present value of costs at 5% real discount rate
nb = net benefits (b−c)
b/c = benefit-cost ratio
ratio = b/c or nb as a percent of base case value