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As the search for alternative energy sources intensifies in the United States, more attention is being focused upon geothermal energy. The issue of how to tax this natural resource has been an active, if not satisfactorily resolved one. The Energy Tax Act of 1978 explicitly authorizes percentage depletion allowances for geothermal deposits, but in a manner not well suited to developing geothermal technology. In this article, the author points out the problems which have arisen under the current Treasury Regulations on the subject, then offers a more appropriate method of calculation based on a return on investment model.

PERCENTAGE DEPLETION FOR GEOTHERMAL ENERGY: AN ALTERNATIVE METHOD FOR CALCULATION OF GROSS INCOME†

*Michael B. Packer**

While administrators and regulators strive to mold the world about them into a finite set of situations, each governed by a particular rule, new events obstinately resist such categorization. Innovations eventually force the introduction of new classifications into regulatory schemes, but in the interim these innovations must somehow be accommodated into the existing framework. The tax treatment of

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geothermal energy presents a continuing example of this problem.[1]

Section 613(a) of the Internal Revenue Code of 1954 provides, in part, that the allowance for depletion shall be a given percentage of gross income from the property.[2] However, prior to 1975, the Code omitted any reference to geothermal energy, the closest classification being oil and gas wells. The courts tried to categorize geothermal steam as a gas for depletion purposes in two early cases: *Reich v. Commissioner* and *Rowan v. Commissioner*.[3] In *Reich*, the taxpayer claimed percentage depletion on geothermal steam. Although geothermal fluid was nowhere mentioned in the Code, the court held that the steam was a "gas" within the meaning of the statute and thus qualified for a depletion allowance. However, as the Internal Revenue Service refused to acquiesce in the ruling, the classification issue remained unsettled.

In the Tax Reduction Act of 1975, Congress amended the Code to permit percentage depletion on any geothermal deposit determined to be a gas.[4] While the Act created an explicit category in the Code for geothermal steam, it still neglected hot water deposits, which constitute the overwhelming majority of geothermal resources. Thus it appeared that investors seeking to take percentage depletion on geothermal resources would run into hot water if the deposit did not contain dry steam.[5]

1. For a non-technical overview of geothermal energy resources, see Note, *"The Application of Depletion to Geothermal Resources,"* 9 U. MICH. J. L. REF. 233 (1976).
2. The depletion deduction is actually the larger of the amounts figured for cost depletion and percentage depletion. In addition, the deduction must not exceed 50% of the taxpayer's taxable income, computed without allowance for depletion. Treas. Reg. §1.613-1. Finally, excess depletion is a tax preference item. I.R.C. §57(a)(8).
3. *Arthur E. Reich v. Commissioner of Internal Revenue*, 52 T.C. 700 (1969), *aff'd* 454 F.2d 1157 (9th Cir. 1972); *George D. Rowan et al. v. Commissioner of Internal Revenue*, 28 T.C.M. 797 (1969), *aff'd* 454 F.2d 1157 (9th Cir. 1972). Both Reich and Rowan were involved in drilling at the Geysers field in California, now the largest geothermal electric power installation in the world. The deduction of intangible drilling costs by both taxpayers was also upheld by the courts.
4. Tax Reduction Act of 1975, Pub. L. No. 94-12, 89 Stat. 26, creating I.R.C. §613A(b)(1)(C). Superseded by provisions of the Energy Tax Act of 1978, Pub. L. No. 95-618, 92 Stat. 3174.
5. In the first case involving hot water wells rather than steam, the court denied a deduction for intangible drilling costs on the grounds that only

The long-awaited Energy Tax Act of 1978 substantially clarified matters by creating a new classification encompassing all types of geothermal deposits.[6] New Section 613(e) of the Code authorizes depletion allowances for any geothermal resource, and to identify the applicable percentage, prescribes use of a diminishing scale identical to that employed for certain oil and gas wells. While the new tax category for geothermal energy resolves the question of whether such resources qualify for the depletion allowance, it fails to address the issue of how gross income is to be computed. As we shall see, the present computational framework for gross income is inadequate to deal with non-electric uses of geothermal energy.

THE CALCULATION OF PERCENTAGE DEPLETION ALLOWANCES

The deduction for percentage depletion is computed by multiplying gross income from the property by a statutory percentage. Although the Energy Tax Act of 1978 extends percentage depletion to geothermal deposits by creating a separate category, the Regulations continue to define gross income for only two cases: oil and gas, and "other minerals."[7] The problem, again, is to fit geothermal resources into the appropriate category.

The Oil and Gas Category

The history of tax treatment of geothermal deposits favors the gas classification. Both the *Reich* decision and the depletion provision contained in the Tax Reduction Act

steam qualified. *Miller v. U.S.*, 78-1 U.S.T.C. ¶9127 (C.D.Cal. 1977).

The applicability of depletion allowances to geothermal resources prior to the Energy Tax Act of 1978 is discussed in Note, *supra* note 1, and Maxfield, "*Income Taxation of Geothermal Resources*," 13 LAND & WATER L. REV. 217 (1977).

6. Energy Tax Act of 1978, Pub. L. No. 95-618, 92 Stat. 3174. The provisions of this Act relating to geothermal energy are described in Eisenstat, "*Geothermal Taxation: Impact of Energy Tax Act of 1978*," 27 OIL & GAS TAX Q. 273 (1979).
7. Treas. Regs. §§1.613-3(a) and 1.613-4 respectively. The Internal Revenue Service has not yet begun active consideration of regulations governing percentage depletion for geothermal energy. [Personal communication (unofficial) with Mr. Max Riley, Engineering and Valuation Branch, July 10, 1979.]

of 1975 explicitly associate geothermal steam with gas. In a different context, the Energy Tax Act of 1978 amends Section 263(c) of the Code to provide that the option to deduct intangible drilling costs shall extend to geothermal deposits (steam or hot water) "to the same extent and in the same manner as such expenses are deductible in the case of oil and gas wells."[8]

The Regulations governing percentage depletion for oil and gas employ two measures of gross income. The first involves income from an actual sale: Treasury Regulation Section 1.613-3(a) defines gross income for this category as "the amount for which the taxpayer sells the oil or gas in the immediate vicinity of the well." Frequently, however, the crude product is not sold immediately; it may be processed and refined prior to sale, or utilized by the manufacturing arm of an integrated field-developer and manufacturer. In this situation, the Regulations require use of the second measure of gross income—income from constructive sales based on a locally established "representative market or field price" for the crude product at the wellhead. The integrated developer-refiner or developer-manufacturer is considered for depletion purposes to be selling the crude product to himself; the price received by comparable non-integrated developers is thus attributed to him.[9]

It is at this point that difficulties arise in the tax treatment of geothermal energy. To appreciate their nature, one must distinguish between the two major uses of geothermal energy: electric-power and direct-use applications.

In those situations in which geothermal resources are employed to generate electricity, the field developer rarely operates the generating facility. The developer seeks to avoid the regulation concomitant with utility status, while the

8. I.R.C. §263(c) as amended by Energy Tax Act of 1978, Pub. L. No. 95-618, §402(a)(1), 92 Stat. 3201. For a more detailed analysis of this question, see Note, *supra* note 1. *See also* text accompanying notes 12-14, *infra*.
9. The principle that an integrated developer should employ a price representative of unintegrated developers was firmly established in *U.S. v. Cannelton Sewer Pipe Co.* "As we see it, the miner-manufacturer is but selling to himself the crude mineral that he mines, insofar as the depletion allowance is concerned." 364 U.S. 76, 87 (1960).

utility is either prohibited from engaging in such development activities or disinclined to enter a risky area in which it possesses no expertise. The arm's length sale of fluid from developer to utility creates an easily ascertainable sale price for the determination of gross income. Percentage depletion may then be calculated using this amount. Since electric-power applications have provoked most of the litigation and remain the most significant form of geothermal installation, utilization of the actual sales definition of gross income has thus far proved acceptable.

Frequently resource temperatures are too low to generate electricity economically. This lower-quality geothermal fluid can still be usefully employed in direct-use applications: the heat contained in the fluid is simply transferred to an industrial process or utilized for space heating. Here the final user of the energy often drills the wells and develops the field; no actual sale price exists, as the developer is integrated with the user.

The Regulations then indicate that a representative market price should be used to determine gross income. Unfortunately, no representative market exists at present for low-temperature geothermal fluid. The only sales involve the higher-temperature steam used for electric-power applications, a situation clearly not comparable and thus not "representative."[10] Moreover, even the existence of numerous sales of fluid for direct-use applications would not suffice to establish a representative market. Reservoirs of geothermal fluid differ greatly in temperature, pressure, required development costs, and other factors. The fluid resource being sold in a given location would not be comparable to that sold in another.

If, however, one considered the commodity being sold in the constructive sale to be energy rather than geothermal

10. See Dutcher, J. L. and Moir, L. H., "Geothermal Steam Pricing at the Geysers, Lake and Sonoma Counties, California," *Eleventh Intersociety Energy Conversion Engineering Conference Proceedings*, Vol. I, pp. 786-789.
While representative prices for geothermal fluid of high temperature conceivably could be adjusted to yield an estimated price for a given low temperature resource, it is unlikely that such an estimated price would be acceptable to the I.R.S. See the discussion *infra* and Treas. Reg. §1.613-4(c)(4).

fluid, a representative price might be found in the markets for fossil fuels. Several writers have proposed a representative market price method in which geothermal energy is priced by comparison with the cost of an equivalent quantity of energy derived from fossil fuels, for which established markets exist.[11] This proposal avoids the pitfalls of the representative market price scheme based on geothermal fluid as the commodity. However, a unit of energy delivered by geothermal fluid and one given off by the combustion of fossil fuel are not truly equivalent: since fossil fuels burn at temperatures far exceeding those of geothermal fluid, they can provide energy to higher temperature processes than would be possible with geothermal energy sources. In thermodynamics, this notion of "quality" of energy or of the ability of energy to perform useful work is termed "availability." The more versatile fossil fuels, which possess a higher "availability," should thus command a higher price per unit of energy than should geothermal resources.

Unfortunately, even were geothermal fluid to be priced comparably to fossil fuels on an availability basis, a method sufficiently esoteric to encounter opposition from the I.R.S., economic considerations would militate against acceptance of any representative market price method based on fossil fuel prices. In tying the price of geothermal energy for tax purposes to that of coal, for example, one must assume that a geothermal energy market, were one to exist, would be subject to economic and political pressures similar to those experienced by the market for coal. However, there is little reason to believe that the market for one energy source is influenced by the same forces that affect the market for

11. Dolan, W. M., "Considerations for the Pricing of Geothermal Energy," and Greider, Bob, "Pricing of Geothermal Energy," in *Proceedings: EPRI Annual Geothermal Program Project Review and Workshop*, Kah-nee-ta, Warm Springs, Oregon, July 25-28, 1977. Report ER-660-SR.

The equivalent energy pricing method proposed in these articles is suggested for contractual purposes between non-integrated developers and users. In tying the price of geothermal energy to that of fossil fuel, the user can guarantee that geothermal energy will always be less expensive than the alternatives, while the developer can take advantage of increases in price of the alternative to his product.

Since the Treasury Regulations do not explicitly allow use of this method for depletion purposes, the taxpayer would have to petition the I.R.S. as discussed in note 18, *infra*.

another; the oil market is much more susceptible to international pressures than is the coal market.

The "Other Minerals" Category

Gross income thus cannot be calculated for direct-use applications by either the actual sale price or the representative market price methods listed in the oil and gas category. Unfortunately, there is no case law concerning percentage depletion for direct-use geothermal applications, and the Regulations in the oil and gas category do not offer further guidance.

There is some justification for turning at this point to the Regulations governing percentage depletion for "other minerals." The Court of Claims has indicated that additional methods (such as those listed in the "other minerals" category) could be applied to oil and gas when, as in the present case, the above methods proved inapplicable.[12] This decision seems to imply that use of the additional methods need not be confined to cases concerning "other minerals." Alternatively, there are some grounds for arguing that geothermal resources should be classified as minerals *ab initio*. One state classifies such resources as minerals.[13] Furthermore, the courts have held that reservations of mineral rights either by the Federal Government or by private parties encompass geothermal resources.[14]

Section 1.613-4 of the Treasury Regulations, concerning "other minerals," requires use of the actual sale price

12. *Panhandle Eastern Pipe Line Co. v. U.S.*, 408 F.2d 690 (Ct.Cl.1969). The taxpayer must use "a 'representative market or field price,' *if* an acceptable price of such nature can be established. Neither the court's decision in [*Hugoton Production Co. v. U.S.*, 349 F.2d 418 (Ct. Cl. 1965)] nor the regulation requires the impossible, i.e. the use of a price that cannot be determined *representative*, or as precluding us from applying some other formula that produces a fair result." 408 F.2d at 718.
13. HAWAII REV. STAT. §182-1(1) (1976); Idaho, Montana and Washington declare geothermal resources to be *sui generis* (IDAHO CODE §42-4002(c) (1977); MONT. CODE ANN. §77-4-104 (1979); WASH. REV. CODE ANN. §79.76.040 (Supp. 1978)). Utah and Wyoming do not define geothermal resources, but regulate them under water law statutes (UTAH CODE ANN. §73-1-20 (Supp. 1979); WYO. STAT. §41-3-901 (1977)).
14. *Geothermal Kinetics, Inc. v. Union Oil Co. of California*, 75 Cal.App.3d 56, 141 Cal.Rptr. 879 (1977); *U.S. v. Union Oil Co. of California*, 549 F.2d 1271 (9th Cir. 1977), *cert. den.* 434 U.S. 930 (1977), *reh. den.* 435 U.S. 911 (1978).

method or, if that is not possible, the representative market price method.[15] Both of these were described and rejected above. Unlike the regulations for oil and gas, however, this provision continues, stating that if a representative price cannot be ascertained, gross income should be imputed to the developer in proportion to the costs incurred to extract the mineral. Under this cost-based method, called the proportionate profits method, gross sales (actual or constructive) from the first marketable product made from the mineral are multiplied by a fraction the numerator of which is the total annual mining cost attributable to that product, and the denominator of which is the total annual cost (mining and non-mining) attributable to that product.[16] The justification for this cost-based approach lies in the principle that "each dollar of the total costs paid or incurred to produce, sell, and transport the first marketable product . . . earns the same percentage of profit."[17]

While the principle appears to be reasonable, it is important to note that only annual costs are considered in the proportionate profits method; initial capital costs are neglected. This formulation is appropriate for traditional mining enterprises, in which annual costs for the extraction of minerals dominate the initial costs. In the case of direct-use geothermal applications, however, methods based upon annual costs such as the proportionate profits scheme are unsuitable; annual costs, which consist primarily of maintenance charges, are minor in comparison with the capital investment required. The profits attributable to the use of geothermal fluid constitute a return on initial rather than annual costs. As a result, the proportionate profits method also fails to yield reasonable estimates of gross income for depletion purposes.

All is not lost, however. The Regulations permit the taxpayer to request (and hopefully obtain) a determination by the I.R.S. that an alternative method of computation

15. Sale price method, Treas. Reg. §1.613-4(b); Representative market or field price method, §1.613-4(c).
16. Treas. Regs. §1.613-4(d)(l) and §1.613-4(d)(4)(ii).
17. Treas. Reg. §1.613-4(d)(4)(i).

which he proposes is more appropriate than the proportionate profits scheme.[18] According to the Regulations, the standard for appropriateness is whether, "under the particular facts and circumstances, the [proportionate profits method] consistently fail[s] to clearly reflect gross income from mining, and the alternative method being considered more clearly reflects gross income from mining. . . ."[19] The burden of proof rests upon the taxpayer. Three possible alternatives are specifically suggested in the Regulations: a method based upon representative schedules, a scheme using prices outside the taxpayer's market, and a method utilizing a rate of return on the relevant investment.[20]

The first two alternatives are merely variations on the representative market price theme. The representative schedule rule permits use of a pricing formula to determine crude mineral prices for integrated producers if such a formula is in general use among unintegrated producers. Again the lack of a representative market for low-temperature geothermal fluid precludes adoption of this procedure. A method using prices outside the taxpayer's local market for the same substance is unfeasible for similar reasons. Unfortunately, the return on investment method, the only cost-based method other than that of proportionate profits, is reserved for future regulation, and no explanation of the particular scheme envisioned is given.

THE RATE OF RETURN ON INVESTMENT METHOD

For direct-use geothermal applications, the procedures listed in existing regulations based upon actual sales prices, representative market prices, or annual costs do not provide an appropriate method for calculating gross income from the property. The absence of a market for geothermal fluid and the lack of correlation between annual expenses

18. In order to utilize an alternative methodolgy for computing gross income, the taxpayer must request permission from the I.R.S. to do so pursuant to Treas. Reg. §1.613-4(d) (1) (ii) (d). The procedures governing this application appear in I.R.S. Rev. Proc. 74-43, 74-2 C.B. 496.
19. Treas. Reg. §1.613-4(d) (1) (ii) (c).
20. Treas. Regs. §1.613-4(d) (1) (ii) (e) and §1.613-4(d) (5), (6), and (7).

and the true cost of extracting fluid comprise the principal impediments to such schemes.

Any alternative method of calculation for direct-use applications suggested by the taxpayer must address these difficulties. First, the method should relate gross income most closely to the initial investment, since geothermal wells require small expenses during production but large expenditures during development. Second, such a cost-based method must estimate the gross income which a hypothetical unintegrated producer would derive from the sale of his fluid, so that a gross income equal to this amount may be imputed to the integrated geothermal developer.

As will be shown, the return on investment scheme is such a method.[21] In its simplest form, gross income as determined by this procedure depends upon three factors: the rate base, an appropriate rate of return, and operating expenses. The principle involved is straightforward—an investor expects to earn a minimum net income on his investment. If he cannot obtain a price for his goods sufficient to cover all operating expenses and still leave the required profit, he will not invest at all. Thus, by multiplying the geothermal investment, or rate base, by the proper rate of return, one may estimate the profit required by any geothermal developer, in particular an unintegrated producer.

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21. The concept of fixing prices based on a return on investment has frequently come under theoretical attack. A particularly cogent critique by Justice Jackson in an opinion in *Federal Power Commission v. Hope Natural Gas Co.*, 320 U.S. 591, 628 (1944) argued that rate of return methods were suitable for utilities which provide services primarily through investment (e.g. streetcar companies laying track and purchasing cars). In drilling for natural gas (or geothermal fluid), however, one producer could easily spend five times the amount another invests to obtain the same quantity of gas, a situation hardly justifying the former being allowed to charge five times as much for his gas. "The service one renders to society in the gas business is measured by what he gets out of the ground, not by what he puts into it, and there is little more relation between the investment and the results than in a game of poker." 320 U.S. at 649.

Yet few workable alternatives exist, especially for geothermal applications for which the notion of mineral replacement value is difficult if not impossible to implement. In addition, methods based on historical cost and rates of return are easier for regulatory authorities to administer than schemes involving either present or future valuation. "Administrative expedience, the pursuit of the achievable rather than the perfect, provides a reasoned basis for . . . judgment." *Tenneco Oil Co. et al. v. Federal Energy Regulatory Commission*, 571 F.2d 834, 841 (5th Cir. 1978), *cert. den.* 439 U.S. 801.

To compute the value of gross income which yields this profit one need only add to the profit a sum representing operating expenses and all taxes. Each of the three elements of a return on investment scheme will be examined in turn, with the emphasis on applying the method to the present situation.[22]

The rate base is essentially equivalent to the capital investment in the project. By explicitly including the initial investment in computing gross income, the return on investment method overcomes the difficulties which plague the proportionate profits method.

Two approaches are possible for evaluating the rate base for geothermal property. The first and theoretically more correct approach employs the adjusted basis provided in Section 1011 of the Code, with the addition of expensed intangible drilling costs and the subtraction of tax credits taken at the time of investment. Since this measure of investment represents the total cash outlay upon which an investor in an unintegrated firm expects a return, it is the appropriate figure to utilize in estimating the gross income which constitutes that return. That this rate base contains expenditures which fall into depreciable accounts or which may be expensed for tax purposes should cause no alarm; the ultimate goal is to ascertain the dollar return an investor would require on his investment.

The second approach defines the rate base as equal to the basis for cost depletion purposes determined in Treasury Regulation Section 1.612-1.[23] This approach takes cognizance of the reluctance of regulators to adopt new philosophies and methods. As the Internal Revenue Service has already sanctioned the definition of cost employed for cost depletion, it is likely that such a definition would prove more acceptable. Moreover, omitting depreciable investment and expensed

22. The actual method of calculation proposed by this article is set out algebraically in Appendix II.
23. The principal differences between this basis and the basis considered above are that (1) the cost depletion basis excludes amounts recoverable through depreciation deductions, (2) it excludes the residual value of land and improvements, and (3) it excludes intangible drilling costs. Treas. Regs. §1.612-1(b)(1) and §1.1016-2(a).

intangible drilling costs from this basis will result in an understatement of the gross income required and thus of the depletion deduction allowable, an outcome of dubious economic merit but one easily defensible before the I.R.S.[24]

The definition of an appropriate rate of return is to some extent subjective, and thus finding a proper rate for geothermal investments may prove problematical. One approach involves a comparable earnings standard, which allows the investor returns similar to those earned at the same time and in the same part of the country on investments attended by corresponding risks and uncertainties.[25] Another approach provides that a proper rate of return should "enable the company to operate successfully, to maintain its financial integrity, to attract capital, and to compensate its investors for the risks assumed. . . ."[26]

The most tractable approach to determining rates of return for geothermal applications is based upon the comparable earnings standard. Companies engaged in oil and gas drilling experience types of risk similar to those encountered by geothermal producers, and thus rates earned by such companies could be employed in this context without excessive error.[27]

Operating expenses constitute the remaining element of the basic return on investment model. One list of operating expenses already used in the calculation of the depletion

24. The underestimation of gross income inherent in using the cost depletion basis is to some extent offset by inclusion in the basis of that portion of the cost which is recovered through the investment tax credit.
25. *Southern Louisiana Area Rate Cases v. F.P.C.*, 428 F.2d 407 (5th Cir. 1970), *reh.* 444 F.2d 125 (5th Cir. 1970), *cert. den.* 400 U.S. 950 (1970); *In re Permian Basin Area Rate Cases*, 390 U.S. 747, 806 (1968), *reh. den.* 392 U.S. 917 (1968); *F.P.C. v. Hope Natural Gas Co., supra* note 21 at 605.
26. *F.P.C. v. Hope Natural Gas Co., supra* note 21 at 605. See also *Tenneco Oil Co. v. F.E.R.C., supra* note 21 at 840.
27. Note that an approach based upon the weighted cost of capital for the firm fails for the individual, as opposed to corporate, taxpayers who are frequently involved in direct-use applications. In any case, the risks attending the rest of the firm's activities need bear no relationship to those involved in production of geothermal fluid, and thus such an approach would fail the "comparable earnings" test discussed previously.

Methods based upon returns earned by drilling companies engaged in geothermal exploration will founder upon the same obstacles encountered in the search for representative market prices: the absence of an identifiable market or of similar firms engaged in geothermal drilling.

deduction appears in Treasury Regulation Section 1.613-5, in which the enumerated expenses are subtracted from gross income in order to compute taxable income for the purposes of a limitation on the depletion deduction. These expenses may be employed in the return on investment method. Since the product of the rate base and the rate of return discussed above equals net income after taxes, not only operating expenses but also federal income tax liability must be added to net income to arrive at gross income.[28]

Two elaborations upon the basic "return on investment" model are frequently employed. The first concerns inflation, which can quickly erode the real return earned by the investor. The second involves the time value of money. While one court recently characterized a discounted cash flow analysis which includes this factor as an "esoteric costing methodology which counsel could scarcely describe in their briefs or at oral argument," the principle of discounting cash flows is both long established and well accepted.[29]

The return on investment model presented here constitutes an alternative method of calculating gross income for the purposes of the depletion allowance. It is true that selection of an appropriate rate of return still depends upon considerations that are somewhat subjective. However, in the case of direct-use geothermal applications, the return on investment method is the only suitable method mentioned in the Regulations. Since the method does not require an actual sale of the extracted product, it can be applied to integrated resource developers. The method can be used for products lacking representative markets because it is not dependent on market price comparisons. Furthermore, by relating gross income to initial costs, it is more appropriate than methods based upon annual costs (such as the pro-

28. The procedure for computing this allowance is set out in Appendix II.

29. *Shell Oil Co. et al. v. Federal Power Commission*, 520 F.2d 1061, 1080 (5th Cir. 1975), *cert. den.* 426 U.S. 941. This case upheld F.P.C. Opinion 699-H, 52 F.P.C. 1604 (1974), which employed discounted cash flow methodologies. For a succinct description of the fundamental assumptions involved, see ANTHONY and REECE, MANAGEMENT ACCOUNTING. Chapter 19, (5th ed. 1975).

The procedures used to include inflation and the time value of money are set out in Appendix I.

portionate profits method) for those products which require large capital investments. Finally, the method suggested here fits well into the present structure of the Code by utilizing concepts such as cost depletion basis and allowable deductions which are already defined on the Code.

CONCLUSION

While the Energy Tax Act of 1978 has explicitly extended the percentage depletion deduction to geothermal resources, it neglects the issue of how to compute gross income for depletion purposes. Three generic methods of calculating gross income are given in the Regulations: income from actual sales, income from constructive sales based on a representative market price, and income imputed to the taxpayer in proportion to the annual costs incurred for resource extraction.

Since direct-use geothermal applications frequently involve an integrated field developer-fluid user, no sale is made and the first method fails. The second method succumbs to the lack of a representative market for geothermal fluid or energy. Finally, the last method yields an inappropriate estimate of gross income because the annual costs of extracting geothermal fluid are minor in comparison to the initial capital investment.

One additional method, based upon the return expected on the capital investment, is listed in the Regulations although no details are given. The present article expands upon this suggestion to offer a detailed alternative method of calculating gross income. Gross income as determined by this method depends upon three factors: the rate base, a rate of return, and operating expenses. To integrate the method into the present framework of the Code, the definitions of cost depletion basis and allowable expenses given in the Code are adopted for the rate base and operating expenses respectively. By multiplying the geothermal investment (rate base) by the rate of return, the net income required by the developer may be estimated. If operating expenses and taxes are added to this figure, the gross income which yields this net income can be found. The method is thus independent of the need for either an actual sale or a representative market. Moreover, since it explicitly includes the capital investment, it avoids the pitfalls of methods based solely on annual costs.

The rate of return method presented here offers some respite for the taxpayer who can justify it as an alternative method of calculation. As with all regulatory procedures, its efficiency and durability must await the test of innovations to come.

APPENDIX I — THE INCORPORATION OF DISCOUNTING AND INFLATION IN THE METHODOLOGY

The fundamental premise of the discounted cash flow methodolgy is that the net present value of all cash flows must equal zero at the required rate of return. R. N. Anthony and J. S. Reece, **Management Accounting, supra.** If for simplicity of method it is assumed that all investment is made in year zero, and that the net income to be received by the investor is constant from year one to year n, then the following relation must be satisfied:

$$I = Ar + Ar^2 + Ar^3 + \ldots + Ar^n ,$$

where

I = initial investment in the project
A = constant annual net income to the investor
r = present value of one dollar received one year from now, equal to $1/(1+i_{real})$, where i_{real} is the required rate of return in real terms.

It can be shown that the above equation is equivalent to:

$$A = I \left[\frac{r - 1}{r^{n+1} - r} \right] ,$$

thus determining the requisite value of net income once the initial investment, project lifetime, and required rate of return are established.

Two procedures can be used to incorporate the effects of inflation. In the first, an estimated future rate of inflation is used to determine net income in constant dollars, which is then adjusted year by year by employing an appropriate price index to find net income in current dollars. Alternatively, net income as found above in constant dollars can be inflated from year to year by the inflation rate estimated at project start. The latter method possesses the advantages of simplicity and definiteness. In either case, inflation can be accounted for simply by redefining r in the equation above:

$$r = \left\{ \frac{1 + e}{1 + i_{nom}} \right\} ,$$

where

e = estimated future inflation rate
i_{nom} = required rate of return in nominal terms.

The annual net income needed to yield the proper rate of return is then given in constant year-zero dollars by A in the equation above. To convert to current year m dollars, one must multiply A by $(1+e)^m$, representing m years of inflation.

APPENDIX II — CALCULATION OF GROSS INCOME BY THE PROPOSED RETURN ON INVESTMENT METHOD

The basic relation between gross income and net income can be represented by the following equation:

$$A = (G - E)(1 - t) ,$$

where

A = net income
G = gross income
E = operating expenses, including state taxes
t = federal income tax rate.

Rearranging this equation to isolate gross income yields

$$G = \frac{A}{(1 - t)} + E .$$

Note that the allowance for federal taxes mentioned previously is included in arriving at gross income. Inflation and discounting of cash flows are incorporated by substituting for A in the expression above the relation developed in Appendix I:

$$G = I \left\{ \frac{r - 1}{(r^{n+1} - r)(1 - t)} \right\} (1 + e)^m + E ,$$

where

r = $(1 + e)/(1 + i_{nom})$
e = estimated future inflation rate, in decimal form

i_{nom} = required rate of return in nominal terms, decimal
n = estimated production lifetime of the geothermal field
m = number of years from start of production to present, counting the first year of production as year one
t = federal income tax rate, in decimal form
I = cost depletion basis in the property at the start of production, Treas. Reg. §1.612-1
E = operating expenses for the current year as defined in Treas. Reg. §1.613-5, in current dollars
G = gross income in current dollars.

The last equation can now be employed to determine gross income from the property for direct-use geothermal applications.