

MEMORANDUM

TO: William W. Paty, Chairperson

FROM: Manabu Tagomori, ^{Deputy Director} ~~Division of Water Resource Management~~

SUBJECT: Calculation of Geothermal Royalty

BACKGROUND

DLNR Administrative Rule Section 13-183-31 (a) provides that "The rate of the royalty to be paid to the State for the production of geothermal resources shall be determined by the board prior to the bidding for or granting of a mining lease, but the rate shall not be less than ten percent nor more than twenty percent of the gross amount or value of the geothermal resources produced under the lease as measured at the wellhead and sold or utilized by the lessee."

Section 13-183-31 (b) also states that "For the purpose of computing royalties, the amount or value of geothermal resources produced shall be determined as the gross proceeds received by the mining lessee from the sale or use of geothermal resources produced from the leased land as measured at the wellhead. In the event that geothermal production hereunder is not sold to a third party but used or furnished to a plant owned or controlled by the lessee, the gross proceeds of the production for purposes of computing royalties shall be that which is reasonably equal to the gross proceeds being paid to other geothermal producers for geothermal resources of like quality and quantity under similar conditions after deducting any and all treating, processing, and transportation costs incurred."

Ideally, in a situation where steam is sold to a third-party under an "arms-length sale", gross proceeds are computed as follows: $\text{Gross Proceeds} = (\text{total pounds of steam produced and measured at the wellhead}) \times (\text{unit value of steam, } \$/\text{lb})$.

However, the current situation in Hawaii is different from that described above and the calculation of gross proceeds as provided by section 13-183-31(b) for a no-sales or non arms-length arrangement should be as follows: in the event that steam is not sold to a third party and is used by a plant owned or controlled by the lessee, the gross steam proceeds, for purposes of computing royalties, shall be determined by measuring the steam (lb/hr) used by the lessee's facility and multiplying that amount by the steam unit value ($\$/\text{lb}$) utilized by other similar geothermal steam producers.

A problem arises, however, that although an equivalent unit value of steam ($\$/\text{lb}$) equal to that paid to other producers/suppliers of steam of like quality and quantity could be used to calculate gross proceeds, no such "standard" unit value of steam is available for computing gross proceeds.

Puna Geothermal Venture's (PGV) geothermal resource mining lease R-2, Section 5, provides that the State shall receive a "royalty of ten (10%) percent of the gross proceeds received by the Lessee from the sale or use of geothermal resources produced from the leased lands and measured at the wellhead without any deduction for treating, processing and transportation cost, notwithstanding Rule 3.13 b. of Regulation 8" (now identified as Sect. 13-183-31 (b)). It should be noted that contrary to the regulation, mining leases R-1, R-2, R-3, and R-4 have language which disallows the deduction of those costs allowed in Section 13-183-31(b). Only lease R-5 has language contained therein which allows the deduction of any treating, processing and transportation costs incurred.

Notwithstanding any conflict between the regulation and the leases, the PGV 25 MW project is a typical case where the lessee both produces the geothermal resource and utilizes it in its own power plant to generate electricity. In this situation, the electrical energy is sold, and not the geothermal resource (steam). The resultant gross revenue is a function of the sale of electricity generated rather than from the sale or use of steam. Therefore, there is no steam sales transaction by which to measure the value of the geothermal resource and an alternative method must be selected in which to calculate the value of the geothermal resources produced.

NETBACK METHOD

There are several alternative valuation methods that are currently used, one of which is the federal "netback" method. The U.S. Department of the Interior, Minerals Management Service is in a similar position to the State of Hawaii, in that it leases land for geothermal development and receives royalties on the value of geothermal resources produced. In situations like that of PGV, where the lessee both produces geothermal resources and utilizes the resources in its own plant to generate electricity, the Minerals Management Service (MMS) uses a method called the "netback" method to assess the value of the resource in order to calculate the royalty.

In the current MMS netback method, calculations are expressed in terms of cost rates (i.e. \$/kWh), however, cost figures alone (rather than rates) may be used to determine the value of the resource, without expressing them in terms of kWh of electricity produced or sold. In this method, the costs of generating and transmitting the electricity are subtracted from the gross revenues received from the sale of electricity to arrive at a value of the resource.

The factors used in the netback method to calculate the value of the geothermal resource (steam) are: (1) transmission costs; (2) generating costs; (3) transmission deduction, which is calculated by adding any wheeling charges to the transmission costs, and is limited to 50% of the value of delivered electricity;

(4) tailgate value of electricity which is equal to the total revenues minus the transmission deduction; (5) generating deduction which is determined by comparing the actual generating costs calculated in (2) against 2/3 of the tailgate value (i.e. if the actual cost of generating the electricity exceeds the 2/3 tailgate limit, then 2/3 of the tailgate value is used as the generating deduction); (6) value of the geothermal production (resource) which is computed by subtracting the generating deduction from the total revenues, to arrive at the value of the geothermal resource. Generally, the MMS will not accept a resource value that is less than one-third of the power plant's revenue.

Under the current netback method rules, if the actual generation deduction exceeds the tailgate limit, then 2/3 of the tailgate value of electricity shall be used as the generating deduction, and not the actual generating costs. Therefore, in simple terms, when the generating costs are greater than the 2/3 tailgate limit, the value of the resource will be equal to 1/3 of the tailgate value of electricity.

The present netback method uses the Standard and Poor's monthly average BBB industrial bond rate with a multiplication factor of 1.0 to calculate the allowable return on undepreciated assets for the depreciation method, and to also calculate the annual return on allowable capital investment for the return on investment method.

Two methods are used in the netback calculation, either the return on investment method or the depreciation method. In the return on investment method, the current investment rate of return is applied to the entire allowable capital amount with no deductions for depreciation. In this method, allowable deductions include operation and maintenance costs, generation and transmission costs, and an annual return on allowable capital investment. The transmission costs are based on the annual operating and maintenance expenses (E(t)), plus the annual return on allowable capital investment, (R(t)). Generating costs are equal to the annual operating and maintenance expenses (E(g)), plus the annual return on allowable capital investments (R(g)).

In the depreciation method, allowable deductions include the costs of operation and maintenance, generation and transmission costs, annual depreciation, and an annual return on the undepreciated investment. The transmission costs are equal to the annual operating and maintenance expenses (E(t)), plus the annual straight-line depreciation of allowable (transmission) capital investments (D(t)), plus the annual rate of return on the undepreciated investment balance (I(t)). Generating costs are equal to the annual operating and maintenance expenses (E(g)), plus the annual straight-line depreciation of allowable (generation) capital investments (D(g)), plus the annual rate of return on the undepreciated investment balance (I(g)).

Based on the above, both netback methods can be shown by the following formulas:

Return on Investment Netback Method

Transmission Cost (Cost (t)):

$$\text{Cost (t)} = \text{E(t)} + \text{R(t)}$$

Transmission Deduction (TD):

$$\text{TD} = \text{Cost (t)} + (\text{Wheeling charges, if applicable})$$

(Note: TD cannot exceed 50% of delivered electricity value)

Generating Cost (Cost (g)):

$$\text{Cost (g)} = \text{E(g)} + \text{R(g)}$$

Generating Deduction (GD):

$$\text{GD} = \text{Cost (g)}, \text{ provided that GD cannot exceed } 2/3 \text{ of tailgate value}$$

Tailgate Value (TV):

$$\text{TV} = \text{Total Revenues} - \text{TD}$$

Resource Value (RV):

$$\text{RV} = \text{TV} - \text{GD}$$

Depreciation Netback Method

Transmission Cost (C(t)):

$$\text{Cost (t)} = \text{E(t)} + \text{D(t)} + \text{I(t)}$$

Transmission Deduction (TD):

$$\text{TD} = \text{Cost(t)} + (\text{Wheeling charges, if applicable})$$

(Note: TD cannot exceed 50% of delivered electricity value)

Generating Cost (Cost (g)):

$$\text{Cost (g)} = \text{E(g)} + \text{D(g)} + \text{I(g)}$$

Generating Deduction (GD):

$$\text{GD} = \text{Cost (g)}, \text{ provided that GD cannot exceed } 2/3 \text{ of tailgate value}$$

Tailgate Value (TV):

TV = Total Revenues - TD

Resource Value (RV):

RV = TV - GD

ANALYSIS

In addition to the netback method described above, three proposed variations of the current netback method were evaluated. Also presented is the "proportion of profits" method proposed by the Geothermal Resource Association. The MMS is currently revising its rules for calculating the value of steam and the new rules are expected to be promulgated in May or June 1991. The proposed revisions to the current MMS netback method and variations thereof, include increasing the bond rate multiplication factor from 1.0 to 1.5 times the S&P average BBB industrial bond rate for the first month of the annual reporting period for which the deduction is applicable; and eliminating the 2/3 tailgate value limit on the generating deduction.

In the examples that follow, all figures are for the year 1992 (the first full year of production) and are based on confidential financial data submitted by PGV, except for those estimated by DWRM. The current MMS netback method is shown using both the return on investment and the depreciation method, and the proposed variations of the netback method are presented using only the depreciation method. *It should be noted that the capital costs used in these examples are those presented by PGV. As such, they may contain costs not allowable under MMS rules.*

CURRENT NETBACK - RETURN ON INVESTMENT METHOD (using the 2/3 tailgate limit and a 1.0 multiplication factor of the Standard and Poor's average BBB industrial bond rate of 9.0%)

<u>1992 Transmission Costs</u>	<u>Dollars (\$)</u>	<u>Source</u>
Operation and Maintenance	170,000	PGV
Annual Return on Allowable Capital Investment (\$8,789,000 X 9.0% X 1.0)	791,010	DWRM
Total	<u>961,010</u>	

<u>1992 Generating Costs</u>		
Operation and Maintenance	3,634,000	PGV
Annual Return of Allowable Capital Investment (\$86,499,000 X 9.0% X 1.0)	7,784,910	DWRM
Total	<u>11,418,910</u>	

<u>1992 Total Revenues</u>	16,469,000	PGV
Minus		
<u>1992 Transmission Deduction</u> (No wheeling charges are applicable)	<u>(961,010)</u>	DWRM

Tailgate Value of Electricity 15,507,990

1992 Generating Deduction 10,338,660 DWRM

(Note: Although the generating cost is equal to \$11,418,910, the generating deduction is limited to two-thirds (2/3) of the tailgate value, \$15,507,990 X 2/3 = \$10,338,660.)

Value of the Geothermal Resource

<u>1992 Tailgate Value</u>	\$15,507,990	PGV
Minus		
<u>1992 Generating Deduction</u>	<u>(\$10,338,660)</u>	DWRM
<u>1992 Resource Value</u>	<u>\$5,169,330</u>	

1992 Royalty Amount
(Based on 10% of the resource value) \$516,933

However, based on the MMS minimum resource "floor value" of 1/3 of the power plant revenues, the royalty amount would be \$16,469,000 X 1/3 X 10% = \$548,967.

6-8%

CURRENT NETBACK - DEPRECIATION METHOD (Using the 2/3 tailgate limit, and a 1.0 multiplication factor for the Standard and Poor's average BBB industrial bond rate of 9.0%)

<u>1992 Transmission Costs</u>	<u>Dollars(\$)</u>	<u>Source</u>
Operation and Maintenance	170,000	PGV
Depreciation (35 year S.L.)	251,000	PGV
Interest on Undepreciated Balance (\$8,663,000 X 9.0% X 1.0)	780,000	PGV
Total	1,201,000	
 <u>1992 Generating Costs</u>		
Operation and Maintenance	3,634,000	PGV
Depreciation (35 years S.L.)	2,471,000	PGV
Interest on Undepreciated Balance (\$85,264,000 X 9.0% X 1.0)	7,674,000	PGV
Total	13,779,000	
 <u>1992 Total Revenues</u>		
	16,469,000	PGV
Minus		
<u>1992 Transmission Deduction</u> (No wheeling charges are applicable)	(1,201,000)	PGV
 <u>Tailgate Value of Electricity</u>	 15,268,000	 PGV
 <u>1992 Generating Deduction</u> (Based on the 2/3 tailgate value limit, \$15,268,000 X 2/3 = \$10,178,667)	 10,178,667	 DWRM
 <u>Value of the Geothermal Resource</u>		
 <u>1992 Tailgate Value</u>	 \$15,268,000	 PGV
Minus		
<u>1992 Generating Deduction</u>	(\$10,178,667)	DWRM
 <u>1992 Resource Value</u>	 <u>\$5,089,333</u>	
 <u>1992 Royalty Amount</u> (Based on 10% of the resource value)	 \$508,933	

However, based on the minimum MMS resource "floor value", the royalty amount is equal to \$548,967.

PROPOSED NETBACK MODIFICATION NO. 1 - DEPRECIATION METHOD
 (Variation of the current MMS method that eliminates the 2/3
 tailgate limit, increases the bond rate multiplication factor from
 1.0 to 1.5 times the S&P average BBB Industrial Bond Rate, and
 assumes no minimum resource "floor value".)

<u>1992 Transmission Costs</u>	<u>Dollars(\$)</u>	<u>Source</u>
Operation and Maintenance	170,000	PGV
Depreciation (35 year S.L.)	251,000	PGV
Interest on Undepreciated Balance (\$8,663,000 X 9.0% X 1.5)	1,170,000	PGV
Total	<u>1,591,000</u>	
 <u>1992 Generating Costs</u>		
Operation and Maintenance	3,634,000	PGV
Depreciation (35 years S.L.)	2,471,000	PGV
Interest on Undepreciated Balance (\$85,264,000 X 9.0% X 1.5)	11,511,000	PGV
Total	<u>17,616,000</u>	
 <u>1992 Total Revenues</u>	16,469,000	PGV
Minus		
<u>1992 Transmission Deduction</u> (No wheeling charges are applicable)	<u>(1,591,000)</u>	PGV
 <u>Tailgate Value of Electricity</u>	14,878,000	PGV
 <u>1992 Generating Deduction</u> (Based on <u>no</u> 2/3 tailgate limit)	17,616,000	PGV
 <u>Value of the Geothermal Resource</u>		
 <u>1992 Tailgate Value</u>	\$14,878,000	PGV
Minus		
<u>1992 Generating Deduction</u>	<u>(\$17,616,000)</u>	PGV
 <u>1992 Resource Value</u>	<u>(\$2,738,000)</u>	
 <u>1992 Royalty Amount</u> (Based on 10% of the resource value)	\$0	

(Note: This proposed method results in a negative resource value
 and therefore, no royalty)

PROPOSED NETBACK MODIFICATION NO. 2 - DEPRECIATION METHOD (Using no 2/3 tailgate limit, a multiple of 1.0 X Standard and Poor's average BBB Industrial Bond Rate, and no minimum resource "floor value".)

<u>1992 Transmission Costs</u>	<u>Dollars (\$)</u>	<u>Source</u>
Operation and Maintenance	170,000	PGV
Depreciation (35 year S.L.)	251,000	PGV
Interest on Undepreciated Balance (\$8,663,000 X 9.0% X 1.0)	780,000	PGV
Total	<u>1,201,000</u>	
 <u>1992 Generating Costs</u>		
Operation and Maintenance	3,634,000	PGV
Depreciation (35 year S.L.)	2,471,000	PGV
Interest on Undepreciated Balance (\$85,264,000 X 9.0% X 1.0)	7,674,000	PGV
Total	<u>13,779,000</u>	
 <u>1992 Total Revenues</u>	16,469,000	PGV
Minus		
<u>1992 Transmission Deduction</u> (No wheeling charges are applicable)	(1,201,000)	PGV
<u>Tailgate Value of Electricity</u>	<u>15,268,000</u>	PGV
 <u>1992 Generating Deduction</u> (Based on <u>no</u> 2/3 tailgate limit)	13,779,000	PGV
 <u>Value of the Geothermal Resource</u>		
 <u>1992 Tailgate Value</u>	\$15,268,000	PGV
Minus		
<u>1992 Generating Deduction</u>	(\$13,779,000)	PGV
 <u>1992 Resource Value</u>	<u>\$1,489,000</u>	
 <u>1992 Royalty Amount</u> (Based on 10% of the resource value and <u>no</u> minimum resource "floor value".)	\$148,900	

PROPOSED NETBACK MODIFICATION NO. 3 - DEPRECIATION METHOD (Using the current 2/3 tailgate limit, a multiple of 1.5 X Standard and Poor's average BBB Industrial Bond Rate, and no minimum resource "floor value".)

<u>1992 Transmission Costs</u>	<u>Dollars(\$)</u>	<u>Source</u>
Operation and Maintenance	170,000	PGV
Depreciation (35 year S.L.)	251,000	PGV
Interest on Undepreciated Balance (\$8,663,000 X 9.0% X 1.5)	1,170,000	PGV
Total	<u>1,591,000</u>	
<u>1992 Generating Costs</u>		
Operation and Maintenance	3,634,000	PGV
Depreciation (35 year S.L.)	2,471,000	PGV
Interest on Undepreciated Balance (\$85,264,000 X 9.0% X 1.5)	11,511,000	PGV
Total	<u>17,616,000</u>	
<u>1992 Total Revenues</u>	16,469,000	PGV
Minus		
<u>1992 Transmission Deduction</u> (No wheeling charges are applicable)	(1,591,000)	PGV
<u>Tailgate Value of Electricity</u>	<u>14,878,000</u>	PGV
<u>1992 Generating Deduction</u> (Based on the 2/3 tailgate value limit, \$14,878,000 X 2/3 = \$9,918,667)	(9,918,667)	DWRM
<u>Value of the Geothermal Resource</u>		
<u>1992 Tailgate Value</u>	\$14,878,000	PGV
Minus		
<u>1992 Generating Deduction</u> DWRM	(\$9,918,667)	
<u>1992 Resource Value</u>	<u>\$4,959,333</u>	
<u>1992 Royalty Amount</u> (Based on 10% of the resource value and <u>no</u> minimum resource "floor value".)	\$495,933	

PROPOSED PROPORTION OF PROFITS METHOD

In this method, proposed by the Geothermal Resources Association, transmission operating costs, generating operating costs, and resource operating costs are subtracted from gross revenues to calculate operating income. To calculate the value of the resource, an allocation percentage is applied to the operating income, and the resource operating costs are added back to that product to arrive at the value of the resource.

The Proportion of Profits method differs radically from the netback method in several regards. First, it allows the deduction of resource operating costs in the calculation of the resource value. These costs are not allowable deductions under the present netback method. Second, this method does not include capital costs of transmission and generation, return on investment, or depreciation and return on undepreciated assets. Third, this method first subtracts resource operating costs from revenues and then adds them back to the resource operating income share to determine the value of the resource. The resource operating income share is based on the premise that the resource (steam) contributes to a proportionate share or percentage of the total assets. PGV calculates the percentage allocated to the resource at 26.97% of the total assets, which is then used to determine the resource operating income share.

The figures for 1992 based on the proportion of profits method are as follows:

	<u>Dollars(\$)</u>	<u>Source</u>
<u>Total Revenues</u>	16,469,000	PGV
Minus		
<u>Transmission Operating Costs</u>	(170,000)	PGV
Minus		
<u>Generating Operating Costs</u>	(3,634,000)	PGV
Minus		
<u>Resource Operating Costs</u>	(732,000)	PGV
<u>Operating Income</u>	<u>11,933,000</u>	PGV
<u>Resource Operating Income Share</u>	3,218,000	PGV
(Based on \$11,933,000 X 26.97%)		
Plus		
<u>Resource Operating Costs</u>	732,000	PGV
<u>Resource Value</u>	<u>3,950,000</u>	PGV
<u>Royalty Amount</u>	\$395,000	
(Based on 10% of the resource value)		

SUMMARY AND COMPARISON OF ROYALTIES

<u>Current Netback Method:</u>	<u>1992 Royalty Amounts</u>
1) Return on Investment Method	\$516,933 *
2) Depreciation Method	\$508,933 *
* Based on ^{Assumes} no minimum resource "floor value".	
<u>Proposed Netback Modification No.1</u> (Depreciation Method)	\$0
<u>Proposed Netback Modification No.2</u> (Depreciation Method)	\$148,900
<u>Proposed Netback Modification No.3</u> (Depreciation Method)	\$495,933
<u>Proportion of Profits Method</u>	\$395,000

The figures indicated above are for 1992, using PGV assumptions of the amount of kilowatt hours of electricity delivered. The royalties will change each year depending upon the kilowatt hours delivered and the energy rate (i.e. avoided cost) payable during that period. In the proportion of profits method, the royalties will change depending on the percentage of the resource assets to total assets committed to the project.

RECOMMENDATIONS

Based on the preceding analysis of several methods available to calculate the value of geothermal resources (steam), staff recommends adoption of the current Minerals Management Service's netback depreciation method for computation of royalty payments to the State. Should this netback method be selected as the Department's procedure for calculating royalty payments, provisions which allow for incorporation of any future changes to the current MMS netback depreciation method should be considered.

However, any such provision which would require periodic updating of the State's methodology in order to match the federal government's version, may warrant further discussion. Automatic adoption by the Department of any federal changes to the MMS netback method should be carefully reviewed because some revisions may not be beneficial to the State (i.e. proposed modifications to the netback method which may result in a reduction of royalty payments).

Regardless of whether or not the current MMS netback method (with or without any future revisions) is the best valuation method for the State, selection of an alternate method will require adoption and incorporation into the Department's Administrative Rules, Chapter 13-183, "Rules on Leasing and Drilling of Geothermal Resources".

Selection of a resource valuation method is vital to the Department's current evaluation of PGV's request for waiver of royalty and needs to be resolved as quickly as possible before any further action can be taken on the waiver request.