THE GEOPRESSURED GEOTHERMAL
RESOURCES OF TEXAS

A REPORT ON
LEGAL OWNERSHIP AND ROYALTY ISSUES

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INTRODUCTION

The Gulf Coast of Texas is underlain by moderate temperature geothermal resources contained in overpressured sediments below depths of about 10,000 feet. Preliminary evidence indicates that these geopressured zones contain moderately saline fluids which are believed to be saturated with natural gas, largely methane. A broad-based interdisciplinary study of this potential energy resource is being conducted at the Center for Energy Studies of the University of Texas at Austin.¹

In support of this broad study effort, a comprehensive legal research project was proposed to examine the complex legal-regulatory framework within which any development of these geopressured resources would have to occur. As a first step in the proposed research, legal issues affecting ownership of the geopressured resources were examined. The results of that examination are reported separately in this paper as a possible aid in early resolution of a threshold issue for orderly resource development — who owns the resource, and how should this be established?

I. STATUTORY RESOURCE DEFINITION

An earlier review of geothermal resource definitions in country-wide statutes was undertaken as a possible aid in resolving resource ownership issues in Texas.² The analysis was critical of all current statutory definitions, and recommended a broader legal definition which would embrace all types of recognized geothermal systems. Nevertheless, in assessing ownership issues involving only the geopressed geothermal resources of the Texas Gulf Coast region, the resource definition in the Texas Geothermal Resources Act of 1975,³ regardless of some uncertainties, seems adequate, and must be used as a starting point.

Under the Resources Act, it is the declared policy of the state of Texas to develop "geothermal energy and associated resources" in a rapid and orderly manner. In this development, "the primary purpose is to provide a dependable supply of energy in an efficient manner that avoids waste of the energy resources."⁴ The definitions in the Texas statute are patterned closely on those in the federal Geothermal Steam Act of 1970,⁵ with the addition of "geopressed waters" in the Texas Act, and a substantial change from the exclusionary definition of "by-products" in the federal Act to a simpler, more inclusionary form in the Texas Act. Table I contrasts the definitions in the two Acts.

A. Federal Steam Act

Under the federal Steam Act, authority is given for geothermal leases on federal lands for the purpose of recovering energy from geothermal steam and associated geothermal resources. These include

Table I

Texas
Geothermal Resources Act⁶
of 1975

Federal
Geothermal Steam Act⁷
of 1970

(Word differences in the two acts are underlined.)

-
(a) "Geothermal <u>energy</u> and associated resources" means: (1) all products of geothermal processes, embracing indigenous steam, hot water and hot brines, <u>and geopressed waters</u>; (2) steam and other gases, hot water and hot brines resulting from water, gas, or other fluids artificially introduced into geothermal formations; (3) heat or other associated energy found in geothermal formations; and (4) any by-product derived from them. (b) The term "by-product" means <u>any element found in a geothermal formation which when brought to the surface is not used in geothermal heat or pressure inducing energy generation</u>;	(c) "geothermal <u>steam</u> and associated <u>geothermal</u> resources" means (i) all products of geothermal processes, embracing indigenous steam, hot water and hot brines; (ii) steam and other gases, hot water and hot brines resulting from water, gas, or other fluids artificially introduced into geothermal formations; (iii) heat or other associated energy found in geothermal formations; and (iv) any by-product derived from them; (d) "by-product" means <u>any mineral or minerals (exclusive of oil, hydrocarbon gas, and helium) which are found in solution or in association with geothermal steam and which have a value of less than 75 per centum of the value of the geothermal steam or are not, because of quantity, quality, or technical difficulties in extraction and production, of sufficient value to warrant extraction and production by themselves</u>;

steam, hot water, and hot brines, whether they are indigenous to the formation, or result from fluids artificially introduced during production. Under a geothermal lease, the developer may also recover some minerals of relatively minor value which are in solution or in association with the geothermal steam. However, a developer cannot use his geothermal lease to recover certain other valuable associated minerals. For their recovery, he would have to secure a broadening of his lease under other mineral leasing authority. The kinds of minerals excluded from a federal geothermal lease are oil, hydrocarbon gas, helium, minerals whose value is at least 75% of the value of the geothermal steam, and other minerals whose characteristics justify separate production for their own value.⁸ Under these definitions, the solute methane in the Texas geopressured resources would be excluded from "by-products," if these resources were developed under federal lease. This is certainly true because the methane is a hydrocarbon gas in solution. Perhaps, it could also be true because the methane value might be 75% or more of the value of the geopressured resource. Perhaps also, the methane may have sufficient quantity, ease of extraction, and value to justify separate production by itself.

B. Analysis of Texas Geothermal Resources Act

In 1975, the drafters of the Texas Act were well aware that methane was expected to be present in substantial quantity in the geopressured resources of Texas, and to contribute a major part of the economic and energy value of the resources.⁹ Patterning the definitions in the Texas Act directly on the federal Steam Act, they must also have been aware

that the latter Act would exclude the methane from any leases if the federal definition of by-product were adopted. Since the Texas Act included provisions for leasing Permanent School Fund land, the changed definition for "by-products" was apparently adopted to achieve a legislative desire to include the methane in the "geothermal energy and associated resources." Certainly, it is included as a by-product of development, and presumably part of the "associated resources," if it is not used in heat or pressure inducing energy generation. If it is so used, there seems no logical and consistent reason why it should then be excluded from the resource. Nevertheless, it may be argued that it is not specifically included under those circumstances by the wording of the definitions. Presumably, the courts must resolve this matter in the absence of any legislative clarification. A review of the tapes recording committee hearings in the legislative history of the Act was not helpful in assessing legislative intent.¹⁰ However, it seems reasonable to conclude, absent any showing of other legislative purpose, which is not now apparent, that methane would be included within the "geothermal energy" part of the resource definition when it is used in energy generation. Perhaps, the definition for by-product should be interpreted to mean that methane is a part of the resource even though it is not used in energy generation at the surface. That would be consistent with the apparent legislative intent. There seems to be no particular significance in the use of the term "by-product" for resolving ownership aspects. The term may have been adopted only because it was used in the federal Act, and the Texas legislature apparently tried to follow the definitions in that Act as closely as possible, while making the minimum

changes required to include geopressed resources specifically.

In the Act, it seems evident that the Texas legislature established a systemic definition of the geopressed resources. The categorical wording, "geothermal energy and associated resources," and the statement of primary purpose, "to provide a dependable supply of energy," taken together, effect a clear characterization of the geopressed deposits as an energy resource. The legislature chose to integrate, as a resource system: all products of geothermal processes, including the geopressed waters; the heat and other associated energy of the geothermal formation; and any element found in the formation, presumably, whether or not it is used in energy generation at the surface.

The legislature did not choose to declare the ownership of the geothermal resources. During hearings of the Senate Natural Resources Committee on S. B. 685, which became the Resources Act, Senator Sherman argued for a determination by the legislature as to whether the mineral or surface owner owns the resource.¹¹ Nevertheless, such a determination was not made. Of course, there is no problem if the land overlying the resources is owned in fee, and future grants or leases for mineral exploitation should indicate intent with regard to geothermal resources. However, there has been so much mineral development along the Texas Gulf Coast that much of the onshore land has been divided previously by grant, reservation, or through mineral lease into separate surface and mineral estates. In Texas, the normal mineral lease grants a determinable fee in the mineral estate to the lessee.¹² Frequently, the mineral estates were created for the purpose of exploitation for "oil, gas and other minerals," a terminology long used in oil and gas leases. Thus,

disputes can be expected between surface and mineral estate owners as to ownership of the geothermal resources when they have not been mentioned specifically in the basic property documents. Is an energy resource included within the surface or the mineral estate?

The legislature did include both geopressured waters and methane within the integrated energy resource system, presumably to facilitate achievement of the State policy for rapid and orderly development. This aspect may have significance which will be discussed later. However, the legislature also did not indicate specifically whether water or mineral law would be applicable in resolving ownership issues. Perhaps, placing the regulatory authority for geothermal resource development, on both public and private lands, under the Texas Railroad Commission, the state agency responsible for regulation of oil and gas operations, may suggest an assumption, or an indication of preference, that mineral law should apply.

II. JUDICIAL THEORIES OF OWNERSHIP

During the past twenty years, the most extensive development of geothermal resources in the United States has been in "The Geysers," an area in Sonoma County, California. These geothermal resources are of the dry-steam or vapor-dominated type. As a result of profitable development of the resources there, early cases contesting ownership have arisen in California which illustrate many of the basic arguments, and two judicial theories of ownership.

A. Union Oil

United States v. Union Oil Co. of California¹³ was a test case brought by the Attorney General of the United States under the statutory direction of the federal Geothermal Steam Act to quiet the title of the United States to geothermal resources in lands, the surface of which had passed from federal ownership, but in which the minerals had been reserved to the United States. This case is still on appeal. The specific land in the case had been patented by the federal government to predecessors in interest of the defendants under the Stock Raising Homestead Act of 1916, with a reservation of "all the coal and other minerals."

The federal district court granted the defendant's motion for dismissal on the grounds that the reservation of the mineral rights by the United States had not effected a severance of the surface and mineral estates, and that geothermal fluids were not included within the definition of minerals as that term was interpreted "in the vernacular of the mining and mineral industry, the commercial world and the landowners at the time of the grant." This "contemporaneous knowledge" test as to what the term "minerals" included was taken from Fleming Foundation v. Texaco, a 1960 Texas civil appeals case from Amarillo.¹⁴

Certainly, the reasoning of the Texas Supreme Court in the 1971 case, Acker v. Guinn,¹⁵ would reach a different result, at least as to the first of those findings on the non-severance of the surface and mineral estates. In Acker, the court said:

A grant or reservation of minerals by the fee owner effects a horizontal severance and the creation of two separate and distinct estates: an estate in the surface and an estate in the minerals.

Further, the Texas Supreme Court quoted with approval from Kuntz, The Law Relating to Oil and Gas in Wyoming,¹⁶ that:

[T]he courts are seeking to give effect to an intention to include or exclude a specific substance, when, as a matter of fact, the parties had nothing specific in mind on the matter at all. . . . [A]n intention test is the proper one, but not as applied heretofore. The intention sought should be the general intent rather than any suggested but unexpressed specific intent, and, further, that general intent should be arrived at, not by defining and redefining the terms used, but by considering the purposes of the grant or reservation in terms of manner of enjoyment intended in the ensuing interests.

When a general grant or reservation is made of all minerals without qualifying language, it should be reasonably assumed that the parties intended to sever the entire mineral estate from the surface estate, leaving the owner of each with definite incidents of ownership enjoyable in distinctly different manners. The manner of enjoyment of the mineral estate is through extraction of valuable substances, and the enjoyment of the surface is through retention of such substances as are necessary for the use of the surface, and these respective modes of enjoyment must be considered in arriving at the proper subject matter for each estate.

While it can be argued that the Texas Supreme Court in Acker v. Guinn did not establish a specific test for determining what exceptional substances should be classed as minerals,¹⁷ they did say in their opinion that the basic approach suggested by Kuntz is entirely sound. Further, they cited Cain v. Neumann,¹⁸ a civil appeals court decision, as a Texas holding that uranium was covered by an instrument leasing "all of the oil, gas, coal and other minerals," even though uranium was unknown when the lease was executed. Together, these expressions of viewpoint, although they may be considered as dicta in the case, cast grave doubt on the continued validity, in Texas, of the "contemporaneous knowledge" test used by the lower court eleven years earlier in Fleming Foundation.

The district court in Union Oil also established the premise that geothermal steam was only superheated water, and water was not a mineral either at the time of the Stock Raising Homestead Act or now. Further, the court extensively quoted from, and appended to the record of trial, two letters from the Office of the Solicitor, United States Department of the Interior, dated in 1965, which said that geothermal steam is really water, a reservation of minerals does not reserve water, thus, the Stock Raising Homestead Act reservation does not cover geothermal steam. Apparently, the court's opinion was greatly, if not entirely, based upon that view from the Interior Department which had delayed leasing of federal lands for geothermal development until after passage of the Steam Act in 1970. One might well ask why a federal court, in 1974, in a case involving land in California which had been acquired under a United States patent, would choose an approach which includes a test from a Texas civil appeals opinion, given in 1960. Moreover, the continued validity of that test in its home state is highly questionable for determining whether exceptional substances (here geothermal steam or geothermal energy) are regarded as a mineral. It should be noted that the Department of the Interior letters previously mentioned had cited Fleming Foundation, which was a recent decision at the time of the letters, but only for the proposition that a reservation of minerals does not reserve water. Perhaps this further illustrates just how much the Union Oil decision was based upon the 1965 reasoning of the Deputy Solicitor of the United States Department of the Interior.

A critical analysis of the Union Oil case in a publication of the Stanford Environmental Law Society¹⁹ also reviews the legislative history

of the Stock Raising Homestead Act, as well as prior mineral case law cited by the Union Oil court, and suggests strongly that the case was decided incorrectly, and did not reflect the congressional intent in the Homestead Act. A similar analysis by K. R. Bjorge in a law review article reaches the same conclusions.²⁰ An appeal of the Union Oil case was docketed No. 74-1574, 9th Circuit, Jan. 11, 1974, but has not yet been decided.

B. Geothermal Kinetics

A more recent California case, Geothermal Kinetics v. Union Oil Co.,²¹ reached a completely contradictory finding as to the ownership of geothermal resources in The Geysers. This case was brought in the Superior Court of California, County of Sonoma, and judgment was filed Aug. 31, 1976. Here, the plaintiff, in a quiet title action, claimed ownership of the geothermal resources under certain land in The Geysers area through a conveyance of the mineral estate in 1951 by the fee owners. The original mineral grant was made in terms of "[a]ll minerals in, on or under those certain lots." A subsequent development lease of this mineral estate was assigned to plaintiff, Geothermal Kinetics, in 1972.

Certain of the defendants claimed ownership of the geothermal resources under what was actually a conveyance in 1953 of the retained surface estate by the original mineral grantor, although the deed did not mention the prior severance in 1951 of the mineral estate. The current owners of the surface estate, who were co-defendants, leased

their property in 1963, giving a right to:

Drill for, produce, extract, remove and sell steam and steam power and extractable minerals.

In an intended decision filed on June 1, 1976, and subsequently supported by the judgment, the state court made a much more sophisticated examination of the character and development of the geothermal resources in the area than had been done in Union Oil. The court also reviewed the basis for judicial decisions in applicable mineral law cases in substantial detail. At the time of trial, the plaintiff had drilled one successful steam well on the property at considerable cost.

The state court's discussion of the issues included presentation of somewhat conflicting expert testimony as to the source of the geothermal fluids, and a detailed description of the character of the steam condensate from turbines driven by geothermal steam flow. This condensate, from nearby steam wells and turbines, is contaminated by numerous elements which were contained in the original geothermal steam flow. The condensate is unsuitable for domestic or agricultural use without prohibitively expensive filtration, has been found environmentally unsafe for surface disposal, and must be disposed of by re-injection underground.

In analyzing the issues, the court dismissed any resort to assessing the intentions of the original mineral grantor and grantee as to the conveyance of the geothermal resource, because neither was thinking about it when the mineral estate deed was executed. The opinion stated, that the court relied upon an examination of how courts traditionally classify resources in disputes between mineral and surface owners. In his analysis, the state court conceded that water, whether surface or

underground, has been held traditionally to belong to the surface owner when mineral and surface estates have been severed. The opinion said that the reason behind the rule was that water is essential to the natural use of the ground for agricultural and other purposes, and for the support of life. The court also accepted what he said was the holding in the defense cited case of Robinson v. Robbins Petroleum Corp., Inc.,²² from Texas, that the presence of minerals in water did not thereby vest the ownership of the water in the holder of the mineral estate. However, the court stated his wording of a widely accepted rule that:

[A] grant of all minerals includes all minerals to be found on the premises, whether known to exist or not, unless an intent to the contrary can be demonstrated.

For determining what is or what is not mineral, he said the general approach of the courts was:

The mineral owner is seeking to extract valuable resources from the earth, whereas the surface owner desires the land and such resources as are necessary to make it useful. Water remains with the surface owner because it is necessary to the enjoyment and productivity of the land. On the other hand, the term minerals is generally construed as every substance which can be got from underneath the surface of the earth for the purpose of profit unless there is something in the content or in the nature of the transaction to induce the court to give it a more limited meaning. Mineral resources are generally found in veins or deposits and are distinct from the surrounding soil. Minerals are usually obtained by mining or drilling as opposed to open quarrying which would tend to destroy the surface. The mineral resource generally must be valuable for its own sake and not merely as fill, or as common rock or gravel.

This reasoning by the California court in regard to what is included in a mineral estate is entirely consistent with the Texas approach

expressed in Acker v. Guinn by the Texas Supreme Court in 1971. Also, at least fresh water is excluded from the mineral estate by Fleming Foundation, but the problem for salt water, considered in Robinson v. Robbins Petroleum Corp., Inc., is more complex and will be discussed in more detail below.

In Geothermal Kinetics, the court went on to say that both plaintiff and defendant were:

basically interested in owning, capturing and eventually delivering "energy" to the Pacific Gas and Electric Company for profit.

He said that the governments of both California and the United States have recognized a geothermal system as an energy resource. As discussed earlier, the same situation holds for Texas in regard to the geopressed deposits, where the legislature has also characterized them as an energy resource.

The California court in its findings of fact determined, among other things, that the ground water system and the geothermal steam reservoir are separate and distinct, and the small amount of ground water which enters the geothermal reservoir does not materially deplete the general supply of ground water available for use on the surface of the land. Further, the geothermal deposits are distinct from the surrounding soil of the property. The geothermal resources are obtained by drilling wells, not by any process such as open quarrying that would substantially destroy the surface of the land, and the methods employed in drilling and casing a geothermal well are very similar to those employed in oil and gas drilling. In addition, the principal commercially valuable product of the resources is energy in the form of heat

which can be sold for a profit. Thus, they have special value in themselves other than as a source of water, or of steam that can be condensed to water. Finally, the geothermal resources within the property are not necessary or useful to the surface owners in the use and enjoyment of their land other than as a source of electricity.

The court's conclusions of law stated that the geothermal resources under the property were minerals within the meaning of the 1951 mineral grant, and the judgment quieted title to the geothermal steam and power and geothermal resources in, on or under the property in the mineral estate owner.

Of course, the geothermal reservoirs in The Geysers area of California are a substantially different type than those in the geopressured deposits in Texas, but, as will be shown later, these selected findings of fact are generally applicable to the Texas resources. However, arguments have also been made, as in Union Oil, that rules of water law should apply in determining ownership of the Texas geopressured geothermal resources.

III. ANALYSIS OF OWNERSHIP ISSUES FOR TEXAS RESOURCES

When land has been horizontally severed into surface and mineral estates, arguments for surface ownership of the Texas geopressured resources must be based, as in the California cases, on the premise that the resource is really "water," and water remains with the surface estate after severance. The broad use of the word "water," without qualification, can lead to erroneous conclusions, since the law recognizes many kinds of water.

A. Body of Law for Resolving Issues

Clearly, the largest material component of the geopressured resources is water, and in a report to the Governor's Energy Advisory Council, this led one Texas analyst to say:²³

[I]n practice the right to make use of the resource will necessarily depend on the right to drill for and dispose of the waters in which the thermal and kinetic energy is contained, so that Texas water law would seem to be the necessary point of departure for any legal analysis in this area.

The report from which this statement is taken was published in October, 1974, prior to passage of the Texas Geothermal Resources Act of 1975. Pursuant to that Act, current Railroad Commission regulations deal with "geothermal resource wells," not "water wells," and statewide rules for geothermal resource wells were incorporated as an integral part of the statewide rules applicable to oil and gas operations.²⁴ Presumably, geothermal resource field development will be regulated, insofar as practicable, under oil and gas law, not water law, precedents.

Also in the quoted report, Union Oil was cited for its holding that the geothermal resources in The Geysers were essentially water, and water was not an "other mineral" which had been reserved. Of course, Geothermal Kinetics had not yet been decided when the report was written, and its rationale was not considered. Robinson v. Robbins Petroleum Co.²⁵ was cited as well for its holding on salt water rights, and the statement was made that, under the Robinson rule:

a mineral lessee who attempted to assert rights in geothermal resources would have to convince a court that a geopressured deposit was not water, even before he attempted to show that the resource was a mineral under the type of test applied in Fleming, (emphasis added).

As discussed earlier, the Fleming Foundation test of intent, using "contemporaneous knowledge," seems clearly outmoded by the approach considered sound in Acker v. Guinn. Further, the Texas legislature has characterized the geopressured deposits as an energy resource which includes geopressured waters, not a water resource. The Texas State Attorney General, in a keynote address to a geothermal conference, said:²⁶

Before this time, the statutes in this state have said nothing about geothermal energy. We know it's an energy resource and yet it isn't defined by law. There have been great debates among lawyers as to whether it belongs in mineral law or whether it belongs in water law or whether it belongs in some other body of law.

I think our Texas legislature has taken a giant step in the right direction this session in trying to solve these kinds of problems by the passage of [The Geothermal Resources Act of 1975]. . . . [I]t is a significant beginning.

[T]he Act says that geothermal is a unique resource, . . . and it sets up a regulatory framework in the General Land Office and the Railroad Commission - primarily in the Railroad Commission.

Presumably, the Geothermal Resources Act, considered in light of the statement by the State Attorney General, greatly weakens the argument that the resource is really water, and that water law, primarily, should be used in determining overall resource system ownership. Clearly, other bodies of law, certainly oil and gas law, will be applicable, as needed, in resolving issues. Perhaps, a new body of law concerning geothermal energy matters is developing in this important field to complement existing law.

Texas water law itself, particularly as it applies to underground water, might undergo change since it is based to a significant degree on the 1904 case of Houston and T. C. Ry. Co. v. East,²⁷ and that decision

has been criticized in dissent in more recent cases such as City of Corpus Christi,²⁸ and by water resource management experts.²⁹ Texas water doctrine, since it developed so early, was influenced to a substantial degree by an agrarian economy, and by an inadequate understanding at that time of the movement and characteristics of underground water, particularly its interdependent relationship with surface water. A literal interpretation of Sec. 23.002 of the Texas Water Code³⁰ suggests that the Water Rights Commission can regulate underground, subterranean, and percolating water uses for protection and conservation, but this apparent authority has never been implemented. If there should be any modification of Texas water law before extensive geothermal development, it would presumably be directed toward greater state control, under police powers, to reduce waste through increased regulation of withdrawal and use of underground water by the landowner. In any event, applying current Texas water law, which is presumably most favorable to the surface owner, does not seem to benefit him in support of a claim of ownership of geopressed geothermal resources.

B. Qualification of the General Term "Water"

In law, there are many kinds of water, and the unqualified word is frequently used very broadly in the cases. Even in Geothermal Kinetics, a case unfavorable to the water ownership theory, the court said:

No authority need be cited to support the proposition that courts have held traditionally that water, surface and underground, belongs to the surface owner when the mineral and surface rights have been separated into different ownerships. A grant of the mineral rights has never carried with it the right to the use of water, (emphasis added).

In Sun Oil v. Whitaker,³¹ the Texas Supreme Court was a bit less broad in saying:

Underground water is part of the surface estate, and unless severed by reservation or conveyance, it belongs to the owner of the surface, (emphasis added).

Moreover, in contrast to the Geothermal Kinetics statement that the mineral right has "never" carried with it the right to the "use" of water, the Texas court went further in Sun Oil to say that the mineral lessee has an implied grant of reasonable use which:

extends to and includes the right to use water from the leased premises in such amount as may be reasonably necessary to carry out the lessee's operations under the lease.

Nevertheless, over-broad statements on the water rights of surface owners have been made in Texas also, which the cases did not require, and which are seemingly not supported by the Texas Water Code. For example, in what is surely dictum in Fleming Foundation,³² the civil appeals court quoted, and agreed that the following statement from Genevra O'Brien v. United States³³ is correct:

What is referred to . . . as the surface ownership and interest means not only the soil, but also any underground water supplies at all depths under the land, (emphasis added).

Further, the Fleming Foundation holding was:

[W]e hold that the reservation of oil, gas and other minerals does not include the sub-surface waters, (emphasis added).

C. Surface Estate Vested Rights in Underground Water

Various sections of the Texas Water Code, i.e., Secs. 5.001(a), 5.339 and 52.002, confirm vested private rights in "underground water,"

not "sub-surface water" as held in Fleming Foundation. This is in contradistinction to state rights in surface water, which is controlled in private use by an appropriation system. Sec. 52.002 says:

The ownership and rights of the owner of the land and his lessees and assigns in underground water are hereby recognized, and nothing in this code shall be construed as depriving or divesting the owner or his lessees and assigns of the ownership or rights, (emphasis added).

However, the term "underground water" used in Chapter 52 of the Water Code is defined in Sec. 52.001(3), to mean:

water percolating below the surface of the earth and that is suitable for agricultural, gardening, domestic, or stock raising purposes, but does not include defined subterranean streams or the underflow of rivers, (emphasis added).

One might argue that this restrictive definition of underground water applies only to Chapter 52 of the Water Code, and that chapter deals only with underground water districts. However, Chapter 5 of the code covers water rights in general. Its Subchapter G codifies the Water Rights Adjudication Act. Under that subchapter, Sec. 5.339 says that the subchapter does not apply to underground water. This term is defined by reference to previous legislation and amendments which resulted in the definition for underground water used in Chapter 52. Consequently, it appears that the legislature intended that definition to be of general use for defining underground water.

The same generality of use of the definition has been recognized by the courts. For example, in an underground water rights case, Bartley v. Sone,³⁴ decided in 1974, a civil appeals court said:

[T]he owner of land owns the water under the surface, generally referred to by hydrologists as "ground water." Our statutory law recognizes

this principle, although the legislature uses the term "underground water," rather than "groundwater." Our statutes define "underground water" as . . . [The definition from Sec. 52.001(3) of the Water Code quoted above was quoted here.] The Water Code expressly recognizes "the ownership and rights of the owner of the land . . . in underground water These statutory provisions are but the embodiment of well settled rules relating to the ownership of percolating waters. [Citing East and A. L. R.].

The statutory use of the word "percolating" in defining underground water, and the further qualification as to the suitability of the water for the specified agrarian or domestic surface uses, would seem to limit significantly the extent of the estate the surface owner may claim under cases such as Sun Oil, which say that "underground water" is part of the surface estate when there is a dispute with the mineral owner. Of course, such a statutory definition normally would have only a limited effect on earlier private transactions. However, the Water Code merely restates and codifies existing law without making substantive changes.³⁵ Thus, the court in Bartley said the definition was "the embodiment of well settled rules," and applied it to the settlement of a private dispute.

Many of the principal Texas water cases, particularly older cases by the Supreme Court, were careful to say "percolating underground waters" in defining the water rights of a land owner. In City of Corpus Christi,³⁶ the court referred to Frazier v. Brown,³⁷ an Ohio case, and quoted with approval the words:

underground waters percolating, oozing or filtering through the earth.

Further, the court said:

[U]nder the common-law rule adopted in this state an owner of land could use all of the

percolating water he could capture from wells on his land for whatever beneficial purposes he needed it, on or off the land, and could likewise sell it to others for use off the land, (emphasis added).

Black, in his Law Dictionary, defines "percolating waters"³⁸ to be:

Those which pass through the ground beneath the surface of the earth without any definite channel, and do not form a part of the body or flow, surface or subterranean, of any water course. They may be either rain waters which are slowly infiltrating through the soil or waters seeping through the banks or the bed of a stream, and which have so far left the bed and the other waters as to have lost their character as part of the flow of that stream.

This definition from Black conforms to that in the Texas Water Code for "underground waters" except that the code divides even percolating waters into two classes: those which are "suitable for agricultural, gardening, domestic, or stock raising purposes;" and those which are not. Only the first class of percolating waters belongs to the land owner as a vested right under the Water Code, and would continue within the surface estate ownership if a tract of land were severed into surface and mineral estates. Of course, the suitability limitation does not mean pure, fresh water only, since even brackish water can be suitable for agricultural, stock raising, and even domestic purposes, particularly if its salt content is diluted by mixing with less salty water.³⁹

D. Rights in Salt Water

Perhaps the suitability limitation of percolating waters in the Texas Water Code may have been intended by the legislature to exclude "salt water," defined as not suitable for the specified agrarian and domestic purposes, from the surface estate ownership of underground

water, presuming that it was not useful for natural development of the surface. As indicated above, Sec. 1.001(c) of the Water Code says the code does not make any changes in the substantive laws of the state. Moreover, such an exclusion from the surface estate would be consistent with early Texas law as interpreted by the courts. Even as late as 1964, in Ambassador Oil Corp. v. Robertson,⁴⁰ a civil appeals court held that salt water was a mineral within the meaning of the phrase "oil, gas, and other minerals." A writ was denied by the Supreme Court, on other grounds, without either approving or disapproving this holding. The Water Code, of course, does not control mineral development. Moreover, all references to "salt water" in the code seem designed only to protect fresh water supplies, vegetation, and the surface of the ground from salt water damage, i.e., in Secs. 20.044, 23.003, and 24.042. The inference that salt water might have been considered a mineral resource by the legislature also seems borne out by the fact that otherwise a substantial category of readily accessible water supply would not be covered by the code. State water, defined in Sec. 5.021, does not embrace percolating salt water, although it does include bays and arms of the Gulf of Mexico, which are quite saline. Under the suitability limitation of the Water Code, neither does the privately owned underground water include the percolating "salt water" supply. However, such an inference as to legislative intent has apparently not been recognized by the courts since promulgation of the Water Code. Additional legislation would be needed to effectuate this purpose, if it were intended. Such legislation would clarify a troublesome point in Texas law.

Because he felt there was no clear line of authority to establish the ownership of underground salt water, Hudson, in his article, Salt

Water is a Mineral,⁴¹ argued strongly for a separation of underground water into two classes which he called, "domestic water" and "salt water." He also suggested that salt water be embraced by the "other minerals" phrase frequently used in creating mineral estates. Curiously, his article did not refer to the Water Code suitability limitation, or use it in defining his "domestic water" category, although he adopted a similar wording from a 1964 Oklahoma case.

The Texas Supreme Court was faced with the issue of underground salt water ownership in 1973 in Robinson v. Robbins Petroleum Corp.⁴² Robinson owned only the surface estate in a tract of land, and the mineral estate under the tract had been leased to Robbins Petroleum for producing "oil, gas, and all other minerals." Salt water had been drawn from a former oil well on the Robinson tract to waterflood for secondary recovery of oil under Robinson's property, but also under other property outside of that tract. The court said that a question was presented as to whether "salt water" is part of Robinson's surface estate, but they did not answer that question directly. Many people have assumed that the question was answered, perhaps only indirectly, as a necessary part of the holding. For example, one law review article says:⁴³

The Court, in Robinson v. Robbins Petroleum Corp., has now extended the reasoning of Sun Oil and classified subterranean salt water as an incident of ownership belonging to the surface owner, (emphasis added).

The Supreme Court did say that "water" is part of the surface estate, (using the broad term), and water is never pure in nature. In the case, the salt water was being used as "water," not for the value of its mineral content, and the court said, under those circumstances, "saline

content has no consequence upon ownership." They pointed out, in dictum, that if the water were being produced for the value of its mineral content:

[t]he substance extracted might well be the property of the mineral owner, and he might be entitled to use the water for purposes of production of the mineral.

The case held Robinson was entitled to recover the value of that portion of the salt water used for the benefit of land outside of the Robinson tract. No reference was made in the case to the Water Code limitation of underground water to that which is suitable for general agrarian and domestic purposes.

The case illustrates that the Texas Supreme Court considers ownership aspects in such disputes between surface and mineral estate owners, but ownership is not necessarily decisive. The court is also very concerned with accommodation between the rights of the dominant mineral and servient surface estates. In Robinson, the accommodation doctrine was determinative, and the decision was based upon a desire to avoid increasing the burden on the surface estate for the benefit of lands outside the leased premises. The dictum quoted above, relative to use of water for its mineral content, will be important for cases involving geopressured waters. In Sun Oil,⁴⁴ large quantities of underground fresh water, clearly belonging to the surface owner under the Water Code, were permitted to be used by the mineral lessee for waterflooding for secondary mineral recovery. While this waterflooding was all under the leased premises, it was shown to be at considerable detriment to the value of the surface estate. The decision was based upon an implied grant of reasonable use of the surface estate for exploitation of the

dominant mineral estate. The decision was reached on rehearing, and reversed the court's own earlier decision. A strong minority in dissent would have applied the accommodation doctrine giving due regard to the rights of the owner of the surface. It should be noted that the issue of reasonableness of the use of the water was stipulated away by Whitaker in the case.

From the above discussion, it seems clear that a mineral lessee in a geothermal resource development may use water, fresh or salt, even if it belongs to the surface estate, if he can show that it is reasonably necessary for developing his mineral estate under the leased premises. It is possible, however, that consideration will be given to accommodating the rights of the owner of the surface.

E. Classification of Geopressured Waters

In his Law Dictionary, Black defines a broad category of waters, which embraces percolating waters as a sub-category. Subterranean waters are defined as:⁴⁵

Waters which lie wholly beneath the surface of the ground, and either ooze and seep through the subsurface strata without pursuing any defined course or channel, (percolating waters), or flow in a permanent and regular but invisible course, or lie beneath the earth in a more or less immovable body, as a subterranean lake.

This last element of the subterranean waters, those which "lie beneath the earth in a more or less immovable body" seems to be descriptive of the geopressured zones or deposits in Texas.

A recognized expert on the Texas-Louisiana geopressured zones, Dr. P. H. Jones, explains their geological formation as follows:⁴⁶

Water expelled from sediments with deepening burial and increasing overburden load escapes upward and toward the basin margin. Where it moves freely in the hydropressure zone, the basin is relatively cool; but where rapid sedimentation and contemporaneous faulting have retarded water loss from compacting sediments, the interstitial fluid pressure reflects a part of the overburden load, and the formation waters are superheated and geopressured.

This geopressured zone is a natural pressure vessel from which superheated water of moderate salinity could be produced through wells, each yielding millions of gallons a day at pressures of several thousand pounds per square inch, and temperatures above 300°F, with considerable amounts of methane gas in solution.

From this expert, technical description of geopressured waters, they appear to be a sub-category of subterranean waters, which is separate and distinct from the other sub-categories: those which pursue a defined course or channel, and percolating waters. This is consistent with the definition of geopressured waters in the Geothermal Resources Act which says they are products of geothermal processes. Defined subterranean streams, or the underflow of rivers, are state waters in Texas, and controlled in their use by the appropriation system.⁴⁷ Percolating waters are usually called "ground water" in modern hydrology, and are part of the hydrologic cycle. Geopressured waters appear to be, for all practical purposes, entirely removed from that cycle in their "natural pressure vessel." From a purely theoretical standpoint, some hydrologists might argue that all subterranean waters are interconnected in some degree, no matter how small. Thus, they are all part of the hydrologic cycle in the broadest sense. In a legal sense, as defined above by Black, there is a division between "percolating," and "more or less immovable" subterranean waters. Moreover, development of the geopressured geothermal resources, through deep wells, would not have

any practical effect on the availability of ground water to a surface owner for the natural development of his estate. Furthermore, geothermal well drilling procedures are controlled, primarily through Rule 8 of the statewide rules of the Railroad Commission, which are applicable to oil and gas operations, for the protection of fresh water supplies.

Even though a surface owner should attempt an argument, under some authority such as Fleming Foundation,⁴⁸ that all sub-surface water belongs to him, it would be extremely difficult, if not impossible, to show that superheated water, of moderate salinity, and under pressures of several thousand pounds per square inch when brought to the surface, at great expense, are "suitable for agricultural, gardening, domestic, or stock raising purposes," as the Water Code qualifies his underground water rights.

In considering a possible application of the accommodation doctrine to give due regard to the rights of the owner of the surface, the virtually complete, physical separation of geopressured waters from the ground water system on which the surface owner depends for natural enjoyment of his estate seems highly significant. Further, this ground water system is protected from contamination during geothermal resource field development by Railroad Commission rules.

F. Geothermal Deposits as a Sui Generis Resource

As discussed earlier, the Geothermal Resources Act characterizes Texas geothermal resources as an energy resource, and apparently includes all elements of the geopressured deposits in an integrated resource system. Arguably, the reticence of the legislature to resolve

ownership issues between surface and mineral estates, or characterize the resource system as either water or mineral, indicates an intent, or at least a willingness, that it have a unique category of its own — that it be sui generis.

In a law review article, primarily a criticism of the Union Oil decision, K. R. Bjorge⁴⁹ advocated such an approach for all geothermal resources. He said that such resources should not be classified as either water or mineral, since:

The advantage of declaring geothermal resources to be "of their own kind" is that the geothermal industry will not be bound by an anachronistic body of statutes and court decisions which have no valid relation to present day technology and development of this new energy resource. The issue of ownership (public or private, surface owner or mineral reservation holder) will be left to state legislatures and courts without being confined by the water or mining laws. . . .

Bjorge seemed most concerned with the desirability of applying the same legal principles to all types of geothermal resources, whether they are hot dry rock or fluid systems. This problem seems to arise only if fluid systems are categorized as "water," as the Union Oil court did. Perhaps, his recommended approach is primarily a reaction against the Union Oil holding. He did say:

It is certainly arguable that geothermal resources are properly to be treated as a mineral to which the mineral estate owner is entitled. This result would eliminate the situation in which there might be one owner or lessee of the mineral estate and another of the geothermal resources, which would increase the probability of conflicting claims to subsurface resources. An example would be a controversy over the ownership of by-products produced in conjunction with geothermal operations. Moreover, geothermal resources are a source of energy much the same as fossil fuels such as oil, gas, and coal.

Assuming arguendo, that the courts decide that the geothermal resources of Texas are sui generis, it seems likely they will still feel "confined by the water or mining laws," and the common law precedents. We are not writing on a clean slate. The Texas Gulf Coast region is widely patterned with oil and gas fields, and property transactions for many years have been made with full consideration of the mineral potential. Even the Idaho statute, quoted with approval by Bjorge, illustrates the need for dependence on prior law. The statute says:⁵⁰

Geothermal resources are found and hereby declared to be sui generis, being neither a mineral nor a water resource, but they are also found and hereby declared to be closely related to and possibly affecting and affected by water and mineral resources in many instances.

This statute does not seem to provide better legislative guidance than the Texas Resources Act. Seemingly, the Idaho courts must still decide ownership questions based upon the physical character of specific resource occurrences, and the applicable water and mineral law.

The expected presence of substantial quantities of methane in the Texas geopressed resources is an added complexity. A characterization of these deposits as unique energy resources, neither water nor mineral, could stimulate conflict and litigation. Suppose a fee owner leased his estate for mineral development, as has been done for much of the Texas Gulf Coast onshore property. Under the sui generis categorization, he could lease his property subsequently for geothermal development. The prior mineral lessee could claim the methane in the geopressed deposits as a vested property right which cannot be avoided, constitutionally, by the legislative action without compensation. Prospects of resulting litigation would certainly delay resource development. Uncertainties

raised by the present definition of "by-product" in the Resources Act would be an additional complication. Methane is so vital to economic development of the geopressed resources, that split ownership of the resource would deter, if not prevent development.

Suppose, under the same sui generis categorization, a fee owner had previously conveyed the surface of his estate, but reserved all minerals. This has also been a frequent occurrence. Depending on the specific wording of the deed, and its interpretation by the courts, either party might own the geothermal resources. Litigation would be inevitable.

In Texas, the sui generis approach for classifying the three known types of geothermal resources seems counterproductive. All of Bjorge's objectives could be achieved more effectively, with consistent application of law, by considering all of the resource types as integrated mineral resource systems.

G. Mineral Character of Geopressed Resources

There are several complementary or alternative theories under which a mineral estate lessee could argue the mineral character of the Texas geopressed resources, and his right to develop the entire resource under the leased premises.

1. Geothermal Kinetics Approach

The first theory is that used by the Geothermal Kinetics court. As stated before, this approach is consistent with that outlined by the Texas Supreme Court in Acker v. Guinn for determining which resources fall within the mineral estate when land has been severed horizontally

into surface and mineral estates. Since the analysis supporting this approach was presented in detail in discussing the judicial theories in the California cases earlier, it will not be repeated here. Only a summary of the conclusions drawn from its application will be made. The valuable substances in the Texas geopressured resources are all contained in geothermal deposits which lie at great depth below the surface of the earth, and which are distinct from the surrounding soil. These valuable substances must be obtained by mineral drilling techniques similar to those used in regular oil and gas recovery, and there is no requirement for open quarrying or strip mining which would essentially destroy the surface, or prevent its use by the surface estate owner for natural purposes. The substances obtained have substantial value for their own sake, not as fill material, or as common rock or gravel. The water in the geopressured deposits is not part of, and does not affect, in any practical sense, the supply of the percolating underground water which belongs to the surface owner, and is needed by him for enjoyment of his estate. In fact, the source of the geopressured fluids is mineral in character, since Dr. P. H. Jones says:⁵¹

The energy resources of the northern Gulf of Mexico basin - petroleum hydrocarbon and geothermal waters - are both derived from clay by the thermal metamorphism of two mineral components. This metamorphism occurs in the same temperature range, producing a solvent (fresh water) and a solute (petroleum hydrocarbons) that immediately become a solution.

Of course, the moderate salinity of the geopressured waters indicates there has been a mixing of the fresh water from the thermal metamorphism

with dissolved minerals, and with other water entrapped in sediments at the time of their deposition. Since this connate water has, for long geological periods, been unassociated with percolating ground water, it should also be considered as mineral because of its association with the geothermal process. Finally, the value of the geopressured fluids is in their energy and mineral content, and, as withdrawn from the wells, they are not useful to natural development of the surface estate. All of these are characteristics which have caused courts in Texas and other states to declare other deposits to be part of the mineral estate, and included within a grant of "oil, gas, and other minerals." Presumably, the geopressured waters and their energy would be included within the "other minerals" term under this theory of mineral characterization.

2. Valuable Substances — a Counterargument

An argument has been raised by proponents of surface ownership of geothermal resources that the use of the words "valuable substances" in cases like Acker v. Guinn, or in law articles like the often quoted Kuntz article,⁵² is significant. These terms are used in describing the character of a mineral estate. The surface ownership proponents take these words out of context, and argue that energy is not a substance, thus not a mineral. This "valuable substances" argument was circumvented by the Geothermal Kinetics court when it said that the characteristic of a mineral estate, traditionally followed by courts, was the removal of "valuable resources" from the earth. Certainly, this is the sense of the Kuntz article. Further, he stressed the need to determine the general intent of the parties, when they did not have specific substances

in mind. The same general intent approach should be applied to his article, since he did not have the specifics of geothermal energy resources in mind when he wrote it. The "valuable substances" argument is also two-edged, since Kuntz said the enjoyment of the surface estate is "through retention of such substances as are necessary for the use of the surface," (emphasis added). If energy is not a substance, to carry the same argument a point further, then it is not needed for surface enjoyment.

Supplementary to the "valuable substance" argument, it is said that the energy of the geothermal waters is only a natural characteristic of the water which increases its value to its owner in the same way that the elevation head of an upland body of water, or the pressure head of an artesian aquifer would do for its owner. Clearly, this extension of the argument is useful to the surface owner only if he can show that the geopressured waters of the resource belong to the surface estate. There would be difficulty in showing this surface ownership of the Texas geopressured resources in light of the legislative direction in the Geothermal Resources Act and in the Water Code, and the previous analysis in this paper.⁵³

3. Doctrine of Guffey v. Stroud

There is a second theory for considering the resource as mineral, or at least subject to mineral development, which would not have been applicable to the geothermal resources in The Geysers, but is applicable to the Texas geopressured resources. If technical expectations are substantiated, solute methane in the Texas geopressured geothermal

fluids will contribute the major part of the economic value of the resources, and also the major part of the recoverable energy.⁵⁴ Net energetics analyses of possible electrical generating facilities, which compare the total amount of energy required to construct, operate, and maintain an energy generation facility with the total energy generated throughout the facility's lifetime, indicate that the energetics are dominated by methane recovery. On the other hand, if technical expectations for the quantity of methane in the geopressed deposits are not substantiated, and prove to be significantly overstated, it would be highly unlikely that the resources, which are located at great depth, can be exploited economically. Thus, while these geothermal deposits have been characterized by the legislature as an energy resource, which must be exploited in an efficient manner that avoids waste of the energy, they are also substantially a methane resource. Nevertheless, efficient use of the internal energy of the geopressed waters is required for lawful recovery of the methane. Of course, the methane is natural gas, and would be included in a normal mineral grant, reservation, or lease of oil and gas, without need of reference to other minerals. Since the mineral owner is required by law to make efficient use of the energy of the geopressed waters in order to enjoy his ownership right in the gas, and since the Geothermal Resources Act speaks of "geothermal energy and associated resources" as a resource system, it seems probable that the doctrine of Guffey v. Stroud⁵⁵ could be argued successfully. In that case, which involved production of "gas" under an "oil" lease, the court said:

The grant of the oil carried with it a grant of the way, surface, soil, water, gas, and the like essential to the enjoyment of the actual grant of the oil The rule in Shylock's case is not

controlling The bond for a pound of flesh, if valid, did carry with it by necessary implication of law as much Christian blood as was necessary to be shed in the operation.

This is a colorful statement of a broad legal principle that any grant carries with it by implication all things reasonably necessary to the enjoyment of the rights granted.

Clearly, under any lease which provides for the recovery of gas, the solute methane is a specifically granted substance. Considering the expert opinion as to the mineral source of the geopressured waters and their energy, and the systemic legislative definition of the resource, these waters could also be considered as specifically granted substances under the "other minerals" category if the lease includes that term. If the lease does not, or if the courts should consider the geopressured waters as "water" (using the broad term as in Robinson) and determine that it is part of the surface estate, the Guffey doctrine might be applied.

To bring his methane to the surface, the mineral lessee must also produce the geopressured waters in which the methane is dissolved. Having done this, he is required by law to avoid waste of their energy. Under these circumstances, it would be logical for the court to consider the geopressured waters as "Christian blood" which is "necessary to be shed in the operation" in order to recover the granted "pound of flesh" — the methane.

This doctrine implies more than reasonable use of the geopressured waters and their energy. In effect, it is a grant of other substances, such as water, which are essential to the enjoyment of the actual grant. Thus, their taking is not wrongful, although it may or may not be a cost free grant. This latter aspect will be discussed in a subsequent section.

4. Reasonable Use by the Mineral Lessee

Lastly, even if a mineral characterization of the resource were rejected by the courts, the mineral lessee might still be permitted to use the geopressured water under a doctrine similar to Guffey, but less sweeping in its effect. This is discussed in different ways, in two other cases. The lessee could argue the implied grant of reasonable use of the water which was recognized in Sun Oil.⁵⁶ Reasonable use of the water itself can easily be shown. As discussed above, the methane, as gas, is clearly a part of the mineral estate under an ordinary oil and gas lease. To bring it to the surface and extract it, the geopressured waters in which it is dissolved must also be brought to the surface. Having done this, the Geothermal Resources Act requires recovery of their energy to avoid its waste. However, under this theory, it is not clear that the legislatively required recovery of the energy of the waters would be considered as a part of their reasonable use by the mineral lessee. Under Guffey, there would be a grant of the waters. Under Sun Oil, there is only a right of reasonable use of them.

Alternatively, under the dictum of Robinson,⁵⁷ the lessee could argue that he was using the water, not as water, but for the value of its mineral content. The methane is a solute mineral, and the lessee would be using the water to recover it. Again, however, the recovery of the energy of the waters might not be considered a mineral recovery, depending on how energy itself is categorized.

Nevertheless, to reach this questionable point, involving recovery of the energy of the geopressured waters, the courts must have made all of the following preliminary determinations:

- a. Percolating underground water, as defined in the Water Code, is not the only type of sub-surface water privately owned by the surface estate owner after severance of the mineral estate.
- b. All sub-surface water, which is not state water, is privately owned by the surface estate owner after severance of the mineral estate.
- c. Expert opinion as to the hydrologic separation of the geopressed deposits from the ground water system is not determinative.
- d. Expert opinion as to the mineral origin of the geopressed deposits is not determinative.
- e. Energy of the geopressed waters, although they are products of geothermal processes, is not mineral in character, but only a characteristic of the water with which it is associated.
- f. Arguments that the legislature intended a systemic definition of an energy resource, mineral in character, are not persuasive.
- g. The doctrine of Guffey v. Stroud is not applicable in favor of a mineral owner who is recovering his methane gas, the principal value component of the geopressed resources.

IV. ROYALTY CONSIDERATIONS

A. Determination of Royalty Amount

If a geothermal lease is given by a fee owner of land, the character of the geopressured deposits is not material, and the terms of an arms-length agreement between the parties will determine royalty payments. Even in this simple case, however, there can be unusual problems. It seems likely that geopressured waters will have to be used within about five or ten miles of the well from which they are drawn in order to avoid significant waste of their heat and pressure energy. Prior to drilling a deep well or series of wells, a geothermal developer will have to assure himself of an adjacent, long-term market for his geopressured water production in order to justify developing his wells. The market value of the fluids will depend on the type of facility which uses them. Under the federal geothermal leasing program, (which excludes hydrocarbons), royalties are to be established at 10% to 15% of the value of the energy derived from production.⁵⁸ This is a recognition of the fact that recoverable energy cannot be measured solely in terms of pressure, volume, temperature, velocity, etc., at the wellhead. Consideration must also be given to plant efficiencies, fluid characteristics at plant exit, and fluid disposal requirements. For many of the geothermal wells at The Geysers in California, contracts have been made, after proving resources, but prior to development, with an electric generating company. The electric company undertakes to build a turbine-generator facility, agrees to take the well production of steam at a relatively steady rate, and to provide additional turbine-generator capacity as well development

justifies. There are complex pricing provisions which are based upon net electrical power generated, with consideration of what the costs to the generating company would have been using alternative fuel sources.⁵⁹

The flexibility of energy utilization is based upon conversion of the heat and pressure energy into electricity, and its distribution through a complex electrical power network. For the methane in the Texas resources, there is no critical problem since it can be introduced into gas pipelines after separation from the rest of the geothermal fluids. Royalty will be based on the market price of the gas. For use of the other fluid energy, it must be evident that royalty computation will be more complex.

For new geothermal leases in Texas, presumably the price of geopressured waters delivered to an electric generating facility, to a manufacturer for process heating, or for other uses such as heating or air conditioning, would be determined by contract negotiations. The royalty could then be based upon a share of the proceeds of sale, so long as the resource field developer and the geothermal water buyer were dealing on an arms-length basis. If a single organization, or closely related ones, performed both functions of resource field development and resource utilization, it might be better to base royalties on net profit from sale of electrical output, or perhaps on costs of alternative energy sources. This latter measure would be applicable for both electrical and other kinds of uses.

B. Effect of Judicial Determinations

If an attempt should be made to develop geothermal wells under an

existing mineral lease for "oil, gas, and other minerals," the problems could be substantial. First, the ownership of the resources would probably be challenged in the courts by the surface estate owner. Unless a clear test case can be developed, and decided conclusively in the courts to resolve ownership questions, no mineral lessee, or his prospective buyer of geopressed waters, would dare to invest the large sums which will be required for geothermal development. To do so would risk injunctions against further development, or challenges of wilful, or involuntary trespass with possible loss of the gross or net value of the energy produced and sold. To try to secure permission of the surface owner for geothermal development in advance of an ownership determination by the courts would require an agreement to pay additional royalties, or some escrow arrangement for deposit of royalties until a court determination establishes the proper owner. However, even the characterization of the geopressed resource by the courts can have a significant effect on the amount of the royalties, depending upon which legal theory is used for determining rights.

1. A Mineral Characterization

If the resource is characterized as being entirely mineral, following the Geothermal Kinetics or Acker v. Guinn approach, the methane would almost certainly be regarded as gas, and royalty payments made under the specific lease provisions for that element. Frequently, under mineral leases in existence for some time, this may be a cost free payment of 1/8 of the market value of the gas sold. However, as mentioned earlier, much of the property along the Texas Gulf Coast is already

covered by an active oil and gas lease, and royalty clauses in such leases have varied considerably over the years. Further, under this approach, the energy recovery from the geopressured waters, as well as the recovery of any other unspecified minerals, would probably be considered as a recovery of "other minerals" under the lease. Royalty payments for "other minerals" are normally specified in the lease as a share of the proceeds from their sale.

2. Guffey v. Stroud Doctrine

Should the courts decide that the energy of the geopressured waters is not mineral in character, but apply the doctrine of Guffey v. Stroud, the energy recovery would not be of "other minerals", but rather through an implied grant of "other substances" which must be produced in order to enjoy the right to the methane. Under that doctrine, it could be argued that the "other substances" should be taken without compensation, and no royalty clause would be applicable, even under a lease which provides for "other minerals" royalty payments. It is not clear what the result would be. The Guffey court spoke of an implied "grant of the way, surface, soil, water, gas and the like essential to the actual grant." No question of payment arose in the case since Guffey's well produced no oil, but only gas. He was enjoined from producing the gas alone, since it belonged to Stroud under his separate lease.⁶⁰ Two old, out-of-state cases support a no-compensation result in comparable circumstances. While not overruled, they seem to have been weakened by dictum in later cases.⁶¹

3. The Helium Cases

Another theory for compensation, which may be applicable to some geothermal disputes, is suggested by the more recent helium cases. For example, in Northern Natural Gas Co. v. Grounds,⁶² there was a dispute as to the ownership and compensation for helium found in natural gas production. This involved both gas leases and sales contracts. In this federal interpleader case, the opinion stated that the landowners could not exempt the helium from the gas leases they had given, since they could not produce it for themselves. The only way to obtain value for it was to produce it in conjunction with the natural gas, pipe the entire product away from the wellhead, and separate and market the helium subsequently. The court held that the producer-lessees could recover from the sales contract purchasers the reasonable value of the helium at the time of its delivery. Although not in this case, the court stated in dictum that the lessors were entitled to royalty on the payments made to the lessees by their purchasers.

Perhaps, this reasoning would be persuasive for a Texas court because geothermal energy production under a gas lease has closely comparable features. The geopressured waters, which must be produced with the methane, have to be delivered to a facility which can utilize their energy before their value can be realized. Even though this conversion facility is relatively close by to avoid waste of the energy in transport, it is separate and distinct in functional character from resource field production. Although a lease might not cover the geopressured waters, per se, they must be produced and their energy used in order to produce the methane lawfully. Under the approach of the Northern Natural

Gas case, the lessee should receive value from the energy converter for producing the geopressed waters, and he should compensate the lessors by a royalty payment on the value he receives on delivery. In a related case, Texaco v. Phillips,⁶³ the U. S. Supreme Court held that a suit for the reasonable value of the helium produced was in effect an action in quantum meruit, whose source is state law. Federal question jurisdiction was denied. Perhaps the quantum meruit theory would be applicable to a Guffey v. Stroud situation. In these helium cases cited, the reasonable value for the helium is still being litigated.

4. Surface Ownership

If the courts should decide that the geopressed waters are the property of the surface owner, it would be difficult to see, even under the Geothermal Resources Act, how the methane could also be considered his property, particularly if there is an active lease for oil and gas under the premises. If technical expectations of the relative net values of the methane and the recoverable energy of the geopressed waters are substantiated, the methane will have to carry the major burden of resource development. A divided ownership decision by the courts would probably seriously jeopardize the chances for any extensive geothermal resource development. In many cases, the surface owner is generally opposed to mineral development of the property since he normally does not have any mineral royalty interest unless he was the original fee owner. Even if he is given a royalty interest in the energy of the geopressed waters by such a court decision, this is only a minor part of the net resource value, and it will probably not significantly affect

his attitude. Thus, the prospects of his joinder with the mineral owner in the grant of a geothermal lease do not seem good. On the other hand, the prospect of substantial methane recovery, and a ready market, seem to offer the best promise of the earliest development of the entire resource without waste of its energy potential, as the Geothermal Resources Act requires, if there is an integrated mineral ownership of the resource.

C. Policy Considerations

In summary, consideration of royalty interests indicates that the greatest promise for geothermal resource development would be offered if the geopressured resources were held to be entirely mineral in character. Further, if the energy of the geopressured waters is held to be embraced by the standard term "other minerals," this would probably insure the most equitable result in royalties, and might decrease the extent of litigation. Since the rapid and orderly development of geothermal energy and associated resources is a declared policy of the state of Texas, that should be a consideration in resource characterization by the courts of the state.

V. SUMMARY ASSESSMENT

Until ownership questions are resolved for geothermal resources, their development will be inhibited in some degree, wherever they are located. This is particularly true for the Texas geopressured resources. The economics of their development, without waste of their energy, or adverse environmental consequences, appear somewhat marginal, based upon current resource assessment, existing technology, and near-term energy

prices. For major energy recovery from the resources, if that is possible, large-scale and long-term capital investment will be needed. The risks for such investment must be reduced from present unfavorable levels to attract private capital. An initial deterrent to investment is the unresolved question of resource ownership.

The analysis in this report from a technical, policy, and, most particularly, a legal viewpoint, strongly indicates that a characterization of the geopressed resources as mineral resources would be most correct, and also most beneficial for possible early development.

Arguments for surface ownership of the entire resource, based upon a water resource characterization, are very weak, at best. Such a determination would seem to be contrary to existing Texas law, and the public interest. A divided ownership of the resource, according to water and mineral components, would appear to deter development possibilities, unless an integrated development by a mineral interest lessee were permitted under a Guffey⁶⁴ or Northern Natural Gas⁶⁵ approach.

The methane in the geopressed resources should be considered as natural gas in existing leases for that mineral, and royalties paid according to the lease. The energy of the geopressed waters, and any other minerals recovered from them, should be considered as "other minerals," if such a generalized term is included in an existing lease, and royalties paid accordingly. For leases, state or private, which are for specific minerals only, without a generalized term covering other minerals, additional compensation should be expected by a lessor for a lease extension covering the geothermal portion of his residual mineral estate.

It may be advantageous to the potential development of any geothermal

industry to characterize all types of geothermal resources within the state in the same way, from an ownership standpoint. However, this report considered only the geopressured resource. No extensive technical analysis and resource assessment of hot-rock or hot-water systems, which probably exist in some parts of West Texas and the Rio Grande Valley, have been available to, or considered in this report.

As stated before, the legislature abstained from any ownership determination in passing the Texas Geothermal Resources Act in 1975. Clearly, such an ownership determination might be expected to have only a limited effect. It would not be conclusive in disputes as to rights arising out of private transactions, but it might be persuasive to the courts when such rights are litigated. Nevertheless, such a policy determination would be controlling for future leases of state lands for geothermal development. Of course, legislation whose purpose is within the legislative prerogative, such as conservation of natural resources, may also have a controlling effect over the exercise of private rights. Further, some legislation is merely an "embodiment of well settled rules" as the court stated in Bartley v. Sone,⁶⁶ when they cited a definition for underground water from the Water Code in settling a question of private rights. Similarly, in Griffith v. Taylor,⁶⁷ the court used definitions of the word "royalty" from cases decided subsequent to the date of a deed in the case being heard. This was justified on the basis that the legal meaning in the later cases reflected only what was previously regarded as the usual and ordinary meaning.

In considering the ownership of geopressured resources, the legislature should determine that: (1) these resources are not water resources;

(2) they have never been so considered in establishing or confirming the vested rights of the surface owner in underground water, as that term is defined in the Texas Water Code; and (3) geopressured waters are not suitable for the natural development of a surface estate. Such determinations would be entirely consistent with existing Texas law, as interpreted by the courts.

Following these determinations, the legislature should amend the Geothermal Resources Act to include a policy statement that:

Since geopressured geothermal resources in Texas are an energy resource system; and, since an integrated development of all components of the resources, including recovery of the energy of the geopressured waters without waste, is required for best conservation of these natural resources of the State of Texas; therefore, all of the resource system components, as defined in this Act as amended, shall be treated and produced as mineral resources.

In making this declaration of policy, there is no intent to make any changes in the substantive laws of the State of Texas. The purpose is to restate the law in clearer terms to make it more accessible and understandable.

Further, to be consistent with the above, and remove a possible ambiguity, Section 3(b) of the Act should be amended to read:

(b) The term "by-product" means any other element found in a geothermal formation, and which is brought to the surface, whether or not it is used in geothermal heat or pressure induced energy generation;

NOTES

1. See I M. Dorfman & R. Deller, Proceedings, Second Geopressed Geothermal Energy Conference, Feb. 23-25, 1976. (Center for Energy Studies, Univ. of Texas at Austin). Hereinafter cited as Proceedings, Second.
2. V Proceedings, Second, pt. 1, at 15. Id. note 1.
3. Geothermal Resources Act of 1975 (S.B. 685, 1975), V.A.C.S. art. 5421s, §§ 1-5.
4. Id. at § 2, S.B. 685 (1975).
5. Geothermal Steam Act of 1970, 30 U.S.C. § 1001 et seq (1970); 84 STAT. 1566 (1970).
6. Supra note 3 at § 3, S.B. 685 (1975).
7. Supra note 5, 84 STAT. 1566.
8. See supra note 5.
9. Minutes, Tex. Senate Natural Resources Committee on S.B. 685, Apr. 2, 1975; testimony of Sen. Sherman. Supra note 3.
10. Tapes of House and Senate committee hearings on S.B. 685 and companion H.B. 1162. Supra note 3.
11. Supra note 9.
12. Stephens County v. Mid-Kansas Oil & Gas Co., 113 Tex. 160, 254 S.W. 290 (1923).
13. United States v. Union Oil Co. of California, 369 F. Supp. 1289 (N. D. Cal. 1973), appeal docketed No. 74-1574, 9th Cir., Jan. 11, 1974.
14. Fleming Foundation v. Texaco, Inc., 337 S.W.2d 846 (Tex. Civ. App. 1960, writ ref'd).
15. Acker v. Guinn, 464 S.W.2d 348 (Tex. 1971).
16. Kuntz, The Law Relating to Oil and Gas in Wyoming, 3 WYO. L. J. 107 (1949).
17. 27 BAYLOR L. REV. 353, 356 (1975).
18. Cain v. Neumann, 316 S.W.2d 915 (Tex. Civ. App. 1958, n.w.h.).

19. M. LINDSEY & P. SUPTON, GEOTHERMAL ENERGY, LEGAL PROBLEMS OF RESOURCE DEVELOPMENT 81-92 (Stanford Environmental Law Society, 1975).
20. Bjorge, The Development of Geothermal Resources and the 1970 Geothermal Steam Act, 46 U. COL. L. REV. 1 (1974).
21. Geothermal Kinetics, Inc. v. Union Oil Co. of California, et al, No. 75314 (Super. Ct., Sonoma County, Cal., Intended Decision filed Jun. 1, 1976. Findings of Fact and Conclusions of Law, and Judgment filed Aug. 31, 1976).
22. Robinson v. Robbins Petroleum Corp., Inc., 501 S.W.2d 865 (Tex. 1973).
23. T. Edwards, O. Atty. Gen., State of Texas, Governor's Energy Advisory Council. Report on Project L/R-9, The Impact of State and Federal Law on Development of Geothermal Resources in Texas, Oct. 15, 1974.
24. Definition 25, RULES HAVING STATEWIDE GENERAL APPLICATION TO OIL AND GAS OPERATIONS WITHIN THE STATE OF TEXAS, THE RAILROAD COMMISSION OF TEXAS.
25. Supra note 22.
26. Proceedings, First Geopressured Geothermal Energy Conference, 7-12, Jun. 2-4, 1975 (M. Dorfman and R. Deller eds. 1975). (Center for Energy Studies, Univ. of Texas at Austin). Hereinafter cited as Proceedings, First.
27. Houston & T. C. Ry. Co. v. East, 81 S.W. 279 (Tex. 1904).
28. City of Corpus Christi v. City of Pleasanton et al, 276 S.W.2d 798, 805-809 (Tex. 1955).
29. S. Snyder, Ground Water Management: A Proposal for Texas, 51 TEXAS L. REV. 289 (1973). R. Tyler, Underground Water Regulation in Texas, 39 Tex. BAR J. 532 (Jun. 1976).
30. TEX. WATER CODE ANN. (1972); V.T.C.A. WATER CODE.
31. Sun Oil Co. v. Whitaker, 483 S.W.2d 808 (Tex. 1972).
32. Supra note 14. But see 49 CALIF. L. REV. 763 (1961), and 40 TEXAS L. REV. 163 (1961).
33. Genevra O'Brien v. United States, 8 OIL & GAS REPORTER 845.
34. Bartley v. Sone, 527 S.W.2d 754 (Tex. Civ. App. 1974, n.w.h.).
35. Sec. 1.001(c), TEX. WATER CODE ANN. (1972).

36. Supra note 28.
37. Frazier v. Brown, cited by the court as 12 Ohio St. 294.
38. BLACK'S LAW DICTIONARY 1761 (Rev. 4th ed. 1968).
39. Hudson, Salt Water is a Mineral, 50 TEXAS L. REV. 448, 450-451, n. 12 (1972).
40. Ambassador Oil Corp. v. Robertson, 384 S.W.2d 752 (Tex. Civ. App. 1964, writ refused n.r.e. on other grounds, sub nom 390 S.W.2d 472).
41. Supra note 39, at 450. But see 52 TEXAS L. REV. 781.
42. Supra note 22; Chappell, Oil and Gas, 28 SW L.J. 95 (1974). But see supra note 17.
43. Supra note 17.
44. Supra note 31; Young, Oil and Gas, 27 SW L.J. 56 (1973).
45. Supra note 38, at 1762.
46. Proceedings, First, at 15. Supra note 26.
47. Supra note 30, at §§ 52.001(3) and 5.021.
48. Supra note 14.
49. Supra note 20.
50. IDAHO CODE § 42-4002(c) (Supp. 1973).
51. Proceedings, First, at 85. Supra note 26.
52. Supra note 16.
53. See pages 6-7, 16-18, and 19-28 supra.
54. IV Proceedings, Second, at 47, 50. Supra note 1.
55. Guffey v. Stroud, 16 S.W.2d 527 (Tex. Comm. App. 1929, opinion adopted).
56. Supra note 31.
57. Supra note 22.
58. 84 STAT. 1566, 1567. Supra note 5.
59. See supra note 19, at 14-20, 37-44.

60. Supra note 55.
61. Kier v. Peterson, 41 Pa. State Rep. 357 (Pa. Sup. Ct. 1861); Kitchen v. Smith, 101 Pa. State Rep. 452 (Pa. Sup. Ct. 1882); Wood County Petroleum Co. v. West Virginia Transportation Co., 28 W. Va. 210 (1886); Williamson v. Jones, 39 W. Va. 231, 19 S.E. 436 (1894).
62. Northern Natural Gas. Co. v. Grounds, 441 F. 2d 704 (C.A. 10th, 1971); and HUIE, WOODWARD & SMITH, OIL & GAS, at 688-690 (2d ed. 1972).
63. Texaco Inc. v. Phillips Petroleum Co., 415 U. S. 125 (1974).
64. Supra at 34-36.
65. Supra at 43-44.
66. Supra at 20-21.
67. Griffith v. Taylor, 156 Tex. 1, 291 S.W.2d 673 (1956).