# Analysis of Economic Impacts on the Hopi Tribe and Navajo Nation of a Stringent $NO_x$ BART Decision for the Navajo Generating Station

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**Prepared for:**

**The Hopi Tribe**

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## EXECUTIVE SUMMARY

ICF conducted an analysis of the economic impacts of stringent Best Available Retrofit Technology (BART) $NO_x$ control requirements on the Navajo Generating Station (NGS). The impacts analyzed include: (1) the economic viability and remaining lifetime of the NGS, (2) the economic impacts on the Hopi Tribe and Navajo Nation, which provide the coal for the NGS power plant, (3) the cost benefit analysis of the controls, (4) the short lead time of the BART implementation requirement, and (5) the estimated costs of proposed $NO_x$ controls.

NGS is a large coal-fired power plant located in northeastern Arizona which came on-line in stages in 1974-1976. NGS has three units. Potential BART requirements are discussed in EPA's Advanced Notice of Proposed Rulemaking (ANPR) of August 8, 2009.[1] The goal of the requirements is to improve the visibility in regional Cass I areas, principally the Grand Canyon.

All the coal used by NGS is leased by the Hopi and Navajo Tribes. Also, all the coal mining occurs on the reservations of the two Tribes and coal is delivered via a dedicated rail line. The coal does not have transportation access to other markets and NGS lacks a coal alternative. This situation is additionally unique because only Hopi, Navajo and one other Tribe produces coal (Crow).

The NGS plant already controls emissions of $SO_2$ via a $SO_2$ scrubber installed in response to a previous BACT assessment, and its $SO_2$ emissions are among the lowest emission rates in the United States. The plant is voluntarily installing $NO_x$ controls using Low $NO_x$ Burner (LNB)/Separated Over-Fired Air (SOFA) combustion modifications. The installation will be completed in 2011 at all three units of NGS.

EPA's ANPR proposes that NGS retrofit expensive Selective Catalytic Reduction (SCR) $NO_x$ controls in addition to LNB/SOFA. SCR involves the injection of ammonia in the flue gas of NGS.[2] The capital costs of SCR are 15.8 times higher than the costs of the LNB/SOFA and cost approximately $700,000,000 dollars in real 2008 dollars. SCR costs on an incremental dollar per ton $NO_x$ removed are 13.3 times more costly than LNB/SOFA, using the assumption that NGS has 20 years of remaining useful life. To the extent the remaining useful life is expected to be less, this cost increment rises exponentially above the 13.3 times level.

The key findings of the ICF analysis are:

- **AN EPA DECISION REQUIRING SCR COULD RESULT IN NGS BEING SHUT DOWN AS EARLY AS 2015, AND HENCE, THE LIFETIME DOES NOT SUPPORT THE PROPOSED SCR CONTROLS** – A detailed, model based analysis of the discounted cash flow of NGS was conducted by ICF. It assumed EPA would be implementing: (1) a BART decision requiring SCR by 2015, (2) Waxman Markey or similar $CO_2$ controls (e.g., alternative legislation or

[1] Federal Register/Vol. 74, No. 166/Friday, August 28, 2009/Proposed Rule, page 44313.
[2] LNB/SOFA does not involve the use of ammonia. Hence, many of the ammonia related issues do not exist for these controls.

administrative action by EPA under existing authority with similar impact) by 2012, and (3) stringent mercury MACT regulations by 2015. EPA is well aware of these actions but the EPA ANPR is silent on items 2 and 3 in spite of their being highly relevant to the consideration of the lifetime of NGS and NGS's ability to bear the costs of SCR. This is especially odd given the federal role in these areas. This detailed ICF analysis leads to the conclusion that NGS would likely retire rather than retrofit BART controls under some circumstances. Namely, if average natural gas prices were at or below $5.6/MMBtu (2008$, Henry Hub), the analysis shows that additional investment in NGS would not be economic and the plant could be retired. This natural gas price is below ICF's base case forecast, but is similar to current spot and futures prices for the next ten years and similar to prices over the last ten years. Hence, they are plausible price outcomes. The average natural gas price is a critical metric. This is because in place of NGS, the owners would rely primarily on natural gas generation as a substitute for NGS power. The natural gas price the owners will ultimately use in their own internal analysis is not known. However, the breakeven natural gas price is low enough to create a significant risk to the plant's post-2015 viability. That is, NGS owners could conclude the plant's electricity cost savings relative to their next best alternative will be highly eroded by $CO_2$ and mercury controls, and hence, SCR retrofit costs are not justified. As a consequence, EPA should have considered shorter NGS remaining lifetimes than the assumed 20 year lifetime. Any shortening exponentially increases the average and incremental $/ton $NO_x$ removed cost further reinforcing the conclusion that the SCR is cost prohibitive and not BART.

- **THE SHORT LEAD TIME MAY NOT ALLOW FOR THE RESOLUTION OF CONTRACTUAL ISSUES AND OTHER SPECIAL CIRCUMSTANCES JUST AS IT DID IN THE CASE OF THE RECENTLY CLOSED MOHAVE GENERATING STATION (MGS) PLANT –** A requirement that SCR be installed by 2015 may not allow for enough time to resolve contractual issues even if the owners would otherwise conclude that the plant would remain economic with a SCR requirement. For example, even if the owners were convinced that natural gas prices would be moderately above the breakeven level calculated by ICF, it may nonetheless conclude that it must change existing contracts to justify the risk. A short lead time may make this impossible. The proposed lead time of four to five years is less than that provided to MGS. MGS was the other buyer of Hopi coal and had a lead time of 6 years to meet its retrofit requirement. Unfortunately, MGS's longer lead time was not enough to work out the issues among the many parties involved and MGS was shut down at the end of 2005. Thus, the Hopi Tribe has already experienced the impacts of regulations that are too inflexible regarding lead time. Both MGS and NGS shared a set of unusual arrangements related to the participation of the Tribes in the overall fuel and power complex. The Tribes involvement increases the time needed to accommodate contractual and other changes relative to power plants with less stakeholders. In the case of NGS, the issues to be resolved include: (1) the power plant lease agreement with Navajo which expires in 2019, (2) the coal supply agreement which expires in 2011, (3) the DOI water agreement which expires in 2014, and other items. There is no evidence that EPA

gave consideration to the time needed to accommodate a decision and maintain a reasonable lifetime for the plant. The deep involvement of the Tribes in NGS's future is not mentioned in the EPA ANPR. In the event that EPA nonetheless proceeds on a SCR path, this failure to consider the impacts of Tribal involvement on the time needed to resolve these issues increases the risks.

- **THE SRP BART ANALYSIS CAPITAL COST ESTIMATE FOR INSTALLING SCR IS REASONABLE** – ICF's review of recent BART studies of SCR retrofit costs supports the accuracy of the SRP SCR cost estimate. As noted, the capital costs of SCR are 15.8 times higher than for alternative controls using LNB and SOFA. These higher capital costs cause the $/ton $NO_x$ removed calculation which annualizes the capital costs over the plant lifetime to greatly exceed the costs of LNB/SOFA. The incremental cost on a $/ton of $NO_x$ removed of SCR relative to LNB & SOFA is 13.3 times higher when 20 years is assumed. EPA failed to calculate this incremental cost in the ANPR even though it modified SRP emission estimates and failed to consider the potential for a shorter lifetime. In addition to much higher capital and $/ton costs, SCR also raises issues about whether ammonia slip due to SCR could impair visibility via increased secondary particulates; EPA assumes not and SRP assumes it will occur.[3] Secondary particulate issues are not present with LNB and SOFA. Lastly, SCR creates risks associated with ammonia release during ammonia transportation and storage that do not exist with LNB and SOFA controls.

- **THE INCREMENTAL VISIBILITY IMPROVEMENT ACHIEVED BY INSTALLING SCR IS NOT NOTICEABLE, AND HENCE, THE REQUIREMENT IS NOT ECONOMICALLY OR PRACTICALLY JUSTIFIED** – Relying on the SRP analysis of visibility improvement due to SCR leads to the conclusion that the costs of SCR controls exceed any visibility benefit achieved, even without consideration of the impacts on the Hopi Tribe and Navajo Nation. The improvement in visibility across all 11 Class I areas[4] is not detectable except with specialized equipment with capability exceeding the human eye. The causes of visibility impairment stem largely from other sources including automotive emissions in southern California, forest fires, controlled forest burns and dust from local dirt roads. Power plants like NGS are not the primary contributors to the visibility problem and it is not economic to pursue NGS BART controls. The cost benefit calculation becomes even more unfavorable when the costs of potential release during ammonia transportation and storage are added.

[3] ICF did not review air modeling issues in detail.

[4] Visibility at Grand Canyon will actually be **worsened** if NGS installs SCR. Tables 5-2 on page 5-6 of the SRP BART analysis (Revised BART Analysis for the Navajo Generating Station Units 1-3, prepared for Salt River Project Navajo Generating Station, Tempe, Arizona by ENSR Corporation, January 2009, Document No: 05830-012-300) shows that the 8th highest average visibility over 3 years in Grand Canyon decreased by 0.9 delta-dv. But if measured over all 11 Class 1 areas there is an improvement in visibility of 0.22 delta-dv (See Table 5-1, page 5-4 of the SRP January 2009 BART analysis.

- **THE SHUT DOWN OF NGS WILL HAVE MASSIVE AND DEVASTATING ECONOMIC CONSEQUENCES ON THE HOPI AND NAVAJO TRIBES** – The Hopi and Navajo Tribes are among the poorest and most vulnerable populations in the United States and have already suffered enough from stringent and inflexible environmental regulations. The shut down of the Mohave Generating Station (MGS) has already imposed a highly disproportionate economic burden on the Tribes. The shut down of NGS, the sole remaining buyer of Hopi coal after environmental regulations shut down MGS five years ago, would devastate the Hopi Tribe and greatly harm the Navajo Nation. NGS accounts for 88 percent of the Hopi Tribe's revenues, and hence, the retirement of NGS would be a huge blow to the economic viability of Hopi; the Hopi economy would collapse and the Tribe would effectively be shut down as a functioning government. Relying on legal information provided by the Hopi Tribe regarding the Trust obligations of the United States government, such an outcome is especially unjust and inequitable because the United States holds the coal of the Hopi Tribe and the Navajo Nation in trust for the development of these Tribes and the creation of viable homelands on their reservations. An action that risks NGS shut down for marginal or zero visibility benefit violates the Trust Responsibility of the United States and is highly inimical to the goal of providing viable permanent homelands on their reservations. In spite of this, Hopi and Navajo costs and impacts are not even mentioned in EPA's ANPR. The ANPR appears to show no knowledge of the special circumstances at NGS. The ANPR only mentions the impacts on utility owners of NGS and their ratepayers. This omission is highly inappropriate: the federal government does not fulfill the responsibility of holding these assets in Trust.

# CHAPTER I
# INTRODUCTION

The purpose of this report is to discuss ICF's analysis of the economic impacts of stringent Best Available Retrofit Technology (BART) SCR requirement for $NO_X$ emission control at the Navajo Generating Station (NGS). This potential requirement is discussed in EPA's Advanced Notice of Proposed Rule-making (ANPR) of August 8, 2009. The ICF analysis examined: (1) the useful life of the plant if SCR is required, (2) the direct costs of SCR, (3) the cost benefit analysis of SCR, (4) the impacts of a 2015 lead time, and (5) the impacts on the Hopi Tribe and the Navajo Nation.

One focus of the economic impact analysis is on the viability of NGS in the event that the power plant is required to install SCR $NO_x$ emission control technology rather than combustion modification $NO_x$ controls. This viability directly affects the plants remaining useful life. As the expected life falls below the EPA assumed 20 years, the average and incremental \$/ton $NO_x$ removed costs increase exponentially. Combustion modification controls for lowering $NO_x$ are currently being installed voluntarily by the NGS owners and will come on-line in stages over the 2009 to 2011 period. They pose no viability risk to the plant.

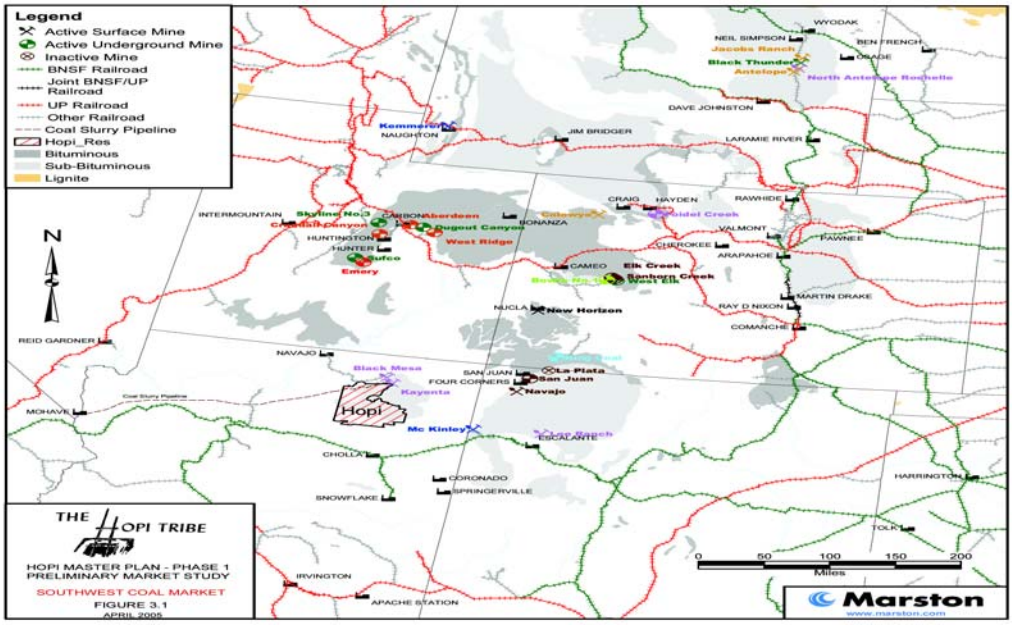
The more stringent SCR BART requirement could be required as early as 2015. Thus, another economic impact issue addressed is the impacts of short lead times on the plant's viability. This short lead time further aggravates the potential impact on the Hopi Tribe, the Navajo Nation and others by increasing the risk of a shut down.

The coal used by NGS is supplied by Hopi and the Navajo Nation. The NGS and coal supply are one integrated operation designed as such. Thus, another economic impact examined in this study is the impact on the Hopi Tribe and Navajo Nation. SCR is much more expensive than LNB/SOFA. The ICF study also examines the direct costs of SCR and reviews the cost benefit analysis of SCR installation.

NGS is a 2,250 MW coal-fired power plant with three units located in northern Arizona (see Exhibit I-1). The plant has five owners including the United States.[5] The plant came on line in stages between 1974 and 1976. In 1999, NGS installed $SO_2$ scrubbers, and now has one of the lowest $SO_2$ emission rates in the United States. At the time, prospects for $CO_2$ regulation and other stringent regulations applicable to coal power plants were either remote or highly remote. This facilitated investments in pollution control relative to today's environment where EPA intends to regulate $CO_2$ and is considering tighter mercury and solid waste controls. $CO_2$ regulations generally decrease the economic viability of coal power plants. Thus, it is inappropriate to extrapolate prior assessments of remaining useful life and plant economic viability to current conditions. A serious consideration must be assigned to greatly shortened useful life in light of potential EPA regulatory actions.

[5] The US Bureau of Reclamation owns a 24.3% share, Salt River Project (SRP), 21.7%; Los Angeles Department of Water and Power, 21.2%; Arizona Public Service, 14.0%; Nevada Power, 11.3%; and Tucson Electric Power, 7.5%.

**Exhibit I-1**
**Hopi Reservation and the Navajo Generating Station**




NGS purchases all of its coal from the Hopi Tribe and the Navajo Nation, and was designed for use of these tribally owned resources. This coal has very low sulfur content and results in low $SO_2$ emissions even in the absence of $SO_2$ scrubbers.[6] Most of the coal is jointly owned by the Hopi Tribe and Navajo Nation with the rest owned solely by the Navajo Nation[7]. Neither the plant nor the mine has alternative coal transportation options, and hence, NGS essentially has a dedicated coal supply and the Hopi and Navajo have only one customer. Both the mine and the plant are very remote from the United States rail transportation network[8]. Thus, this is one of the only plants with a single dedicated supply and one of the few mines with only one feasible buyer. No analysis of cost impacts can ignore the costs to the Hopi Tribe and the Navajo Nation of a disastrous loss of revenue needed to sustain the viability of the homeland.

The Hopi and Navajo Tribes, together with the Crow Tribe of Montana, are the only coal producing Tribes in the nation. The coal is held as a trust asset by the United States for the economic benefit and development of the Hopi, Navajo, and Crow Tribes. It is our understanding based on legal material provided by the Hopi Tribe, the United States acts as a trustee in the case of these three coal producing tribes and has special fiduciary obligations to the tribes as beneficiaries of this Trust relationship and responsibility.[9]

In its ANPR of August 2009, EPA asserts its authority to regulate air emissions from sources located on reservation land derives from its Tribal Authorized Regulations (TAR) which in turn

[6] Peabody Coal Company mines the coal under a long term lease for use at NGS from the Kayenta mine located on the Hopi and Navajo reservations. The coal is delivered via a dedicated rail line.
[7] NGS also purchases coal wholly owned by the Navajo Nation for about one-third of its needs; all coal is from the same mine.
[8] The mine supplying NGS is approximately 110 miles from the Burlington Northern railroad.
[9] ICF relies throughout this document on this legal information as well as the SRP BART visibility analysis.

derives from the 1990 Clean Air Act Amendments. However, there is no claim that there is an explicit waver of trust obligations, and hence, no basis for failure to balance Trust obligations and air quality protection. In this case, this balancing of interests is blatantly compelling in light of the large potential for extremely adverse impacts on the Tribes, and the fact that plants serving others face less control requirements. The circumstances surrounding NGS and its coal fuel supply are therefore fundamentally different from those of other coal producers and users in the United States. Proponents of SCR have paid little or no attention to the legal obligations of the United States in this regard, and have acted as if the Hopi-NGS relationship is indistinguishable from situations where federal trust obligations are not involved, and where parties have alternative coal purchase and sale options. The unique situation of Hopi and Navajo and economic impacts of EPA's BART decision on the two Tribes are not mentioned in the ANPR even though impacts on utility owners and their ratepayers who are not trustees are discussed and analyzed.

The Hopi and Navajo Tribes are among the most economically vulnerable populations in the United States. They have economies closer to those found in the developing Third World. The Hopi Tribe, located in a highly remote location, is a non-gaming Tribe without other economically viable resources. Hopi also lacks viable renewable alternative resources and under no reasonable circumstances could the Tribe replace the economic loss resulting from an NGS closure with renewables[10]. Actions that jeopardize a permanent viable Hopi homeland are exactly those prevented under the Trust relationship.[11]

Nonetheless, less consideration has been given to the economic impact on the Hopi and Navajo Tribes of environmental regulations than similarly situated third world communities where the United States lacks Trust obligations[12]. Furthermore, the Hopi and Navajo have already carried a dramatically disproportionate burden of compliance with environmental regulations. One of the two historic consumers of coal jointly owned by Hopi and Navajo, the MGS in Laughlin, Nevada was shut down in 2005 due to inflexible environmental constraints and in spite of requests by the Hopi and Navajo Tribes for an extension of the closure deadline. Many of the same environmental groups involved in the MGS shut down are also involved in the pending NGS BART proceeding. Nonetheless, the Hopi and Navajo once again face very large economic risks due to environmental regulations. This is in spite of highly marginal benefits to be achieved by SCR technology, including non-detectable changes in visibility. As noted, the proposed rule decreases visibility at the Grand Canyon.

This report has five chapters (including the Introduction). The second chapter summarizes the findings of the ICF analysis. The third chapter discusses the economics of EPA's BART decision in terms of its impact on the viability and remaining expected life of NGS, the required balancing of costs and benefits, and the direct costs of SCR. The fourth chapter discusses the impacts on the Hopi Tribe and Navajo Nation of NGS shut down. The fifth presents ICF conclusions.

[10] See ICF study of the renewable potential of the Tribe available from the Hopi Tribe.

[11] As noted, ICF relied on legal information about Trust obligations provided by the Hopi Tribe. This caveat applies to all Trust related comments and conclusions.

[12] See later discussion on proposed $CO_2$ regulations where third world $CO_2$ emissions do not lead to border adjustments in spite of the right of the United States under WTO rules to do so, and on the sole major United States coal power plant closure in recent decades, MGS, with disproportionate impacts on the vulnerable Hopis.

# CHAPTER II
# SUMMARY OF FINDINGS

## II.1 INTRODUCTION

EPA is considering requiring additional environmental controls at NGS as a measure to improve visibility in Class I areas.[13] EPA is required to conduct a Best Available Retrofit Technology (BART) analysis for NGS. At a minimum, EPA must give weight to economic considerations including the benefit of the controls, and the costs and associated impacts, and the lifetime of the plant. A stringent BART ruling by EPA related to $NO_x$ controls at the NGS would require installation of expensive Selective Catalytic Reduction (SCR). The alternative is low $NO_x$ Burners (LNB)/Separated Over-Fired Air (SOFA) combustion modifications (already installed on unit 3 in September 2009 and installations on units 1-2 will be on-line by 2011). SCR controls are 15.8 times more costly in terms of capital costs compared to LNB/SOFA[14].

Proponents of stringent controls are not properly analyzing the economic impacts of SCR stringency in the application of BART to NGS. This is because they examine the proposed regulations as if there is only one regulatory process under way. This has the effect of minimizing the apparent effect of stringency in the application of BART to NGS. This approach is incorrect. Also, the proponents are well aware that BART is only one of several actions pending as they are also involved in these other regulatory actions.

The threat to the viability of NGS and the potential for a shortened lifetime comes in part from the combination of a BART SCR requirement combined with stringency in two other highly active regulatory arenas: (1) mercury emissions where MACT regulations are expected to be in place by 2015, and (2) federal $CO_2$ regulations which could be in place as early as 2012. In the past – e.g., when NGS last made expensive retrofits in the 1990s, these issues were highly remote. Therefore extrapolating past utility responses to environmental controls is highly inappropriate in light of the new more challenging circumstances facing coal power plant owners. Also, assuming 20 year remaining life without assessment of the potential for shortened lifetime is inappropriate. Giving weight to a potentially shortened lifetime causes the average and incremental \$/ton $NO_x$ removed to increase exponentially from already very high levels.

Another threat to the viability of NGS and its ability to have an additional 20 years of lifetime is the short time frame for compliance. Requiring retrofit by 2015 provides NGS owners only 4 to 5 years of lead time. During this period, the owners may require resolution of various contractual issues such as the coal mining agreement with Peabody, land use lease from Navajo, access to the water and coal, etc. in order to manage the risks facing the plant. This short lead time may make this impossible. Thus, NGS may have a much shorter lifetime, i.e., a decision to shut down by 2015. Thus, the NGS situation may have similarity to the MGS situation where the short deadline was very problematic in light of the unusually large number of parties

[13] See EPA ANPR August 28, 2009, Federal Register.

[14] Source – Revised BART Analysis for the Navajo Generating Station Units 1-3, prepared for Salt River Project Navajo Generating Station, Tempe, Arizona by ENSR Corporation, January 2009, Document No: 05830-012-300. Pages ES-5 to ES-8.

involved including two Tribes. Requests for MGS extension by the Tribes were rejected, and hence, this problem has occurred already one time too many.

The ICF analysis set out in this report was conducted using ICF's IPM® model, a very widely used and accepted model of the North American power sector. EPA has been using this model or its predecessors for 35 years. The economic assumptions used were ICF's including the important assumptions related to:

- $CO_2$ emission offsets availability and cost
- $CO_2$ allowance prices
- Electricity demand growth, and
- Natural gas prices.

ICF's assumptions differ from EPA's. The modeling minimizes the discounted costs of meeting electricity demand reliably. The model also accounts for regulatory constraints on the power industry. Regulatory constraints include complying with a potential future United States cap and trade $CO_2$ control program. This modeling does not address the potential for short lead times to adversely affect the economics and does not address such complexities as Tribal involvement in key decisions that involve highly complex technical, legal, and economic issues.

ICF conducted the type of analysis NGS owners are expected to conduct when considering their options in the event of a potentially stringent BART ruling. The owners will give large weight to a discounted cash flow analysis accounting for both the investment costs of SCR, and the benefits of continuing to produce electricity at NGS. The benefits of NGS are primarily the avoidance of the costs of buying power from other sources. The ICF analysis focused on one specific set of outcomes which are very plausible: (1) Waxman Markey $CO_2$ controls (or similar legislation or EPA regulations), and (2) stringent mercury MACT controls. In this analysis, if the discounted cash flow of the cost savings from operating NGS including BART compliance costs are negative, the plant is not economic using this important metric. The owners could retire the plant rather than installing the SCR controls and obtain power from alternative sources.

Note, EPA is considering other regulations which could increase the costs of operating NGS that were not considered. For example, EPA may reclassify the solid waste of coal power plants and require more costly ash and scrubber waste disposal. This was not addressed explicitly in the model, and hence, the analysis may be conservative.

However, there is some uncertainty about what assumptions the NGS owners will use, what scenarios they will analyze, the probabilities they assign to scenarios, and how much weight they give to various other factors, e.g., year-by-year volatility of costs. Thus, ICF estimated the breakeven price for natural gas to provide a method of assessing the magnitude of the risk BART is imposing in terms of a possible NGS shut down. Natural gas prices below this breakeven level would likely cause the plant to be retired rather than install the SCR, and vice versa. This approach was taken because natural gas prices are uncertain and highly influential on the economics of NGS. The more plausible the breakeven average natural gas price, the greater risk of shut down. This is a risk that should not be placed on the Hopi and Navajo economies by EPA in light of their economic vulnerability and the United States Trust responsibility.

The following are key findings of the ICF analysis:

- **AN EPA SCR DECISION COULD RESULT IN NGS BEING SHUT DOWN AS EARLY AS 2015**

ICF's analysis concludes that $5.6/MMBtu (Henry Hub in Real 2008$) is the breakeven average natural gas price for NGS over the decision horizon of 2010 to 2039. Put another way, in the event that average natural gas prices were assumed to be $5.6/MMBtu over the remaining life of the NGS plant, in combination with the other three assumptions (Stringent SCR BART requirement, $CO_2$ and MACT environmental control requirements), ICF analysis indicates that the plant would be uneconomic in terms of discounted cash flows, and the conclusion would likely be to shut down the plant. This price is below the ICF Base Case gas price forecast. However, the $5.6/MMBtu natural gas price is sufficiently high to be a plausible outcome, and therefore, the decision to pursue SCR could lead to the retirement of the NGS plant. These risks are large, not justified by the very marginal visibility benefits of SCR and are inconsistent with the Trust responsibility owed by the United States government to the Hopi and Navajo. An NGS SCR requirement by EPA could result in the plant being shut down as early as 2015. Thus, the remaining useful life of the SCR would be four to five years, not 20 as assumed.

Thus, each application of environmental stringency is another "straw" which could "break the camel's back" – i.e., cause the plant to shut down. This will also be the straw that breaks the back of the Hopi Tribe's prospects for a viable permanent homeland. The real immediate revenues needed to transition to a non-coal-based economy would be lost. Furthermore, this would be the second time in five years Hopi and Navajo would experience the economic hardship of one of the only retirements of large coal power plants in the history of the United States history – both retirements having been brought about by inflexible EPA regulatory requirements. Facilitating such dire economic harm to the Tribes is not consistent with Trust responsibility or the estimated costs and benefits.

- **THE LEAD TIME MAY CAUSE THE PLANT TO RETIRE EVEN IF THE ECONOMICS OF LIFE EXTENSION ARE CLOSE**

A 2015 deadline may cause retirement even in cases in which the economics may be moderately favorable. This is due to the potential need the owners may feel to resolve contractual and related uncertainties before committing to large investments. These negotiations involve a larger number of parties than at other power plants due to the unique design of the NGS complex. These parties also include the Hopi Tribe and the Navajo Nation. The lead time of four to five years may not be adequate. MGS had more lead time than proposed for NGS. Even so, the inflexible time limit contributed to MGS's shut down.

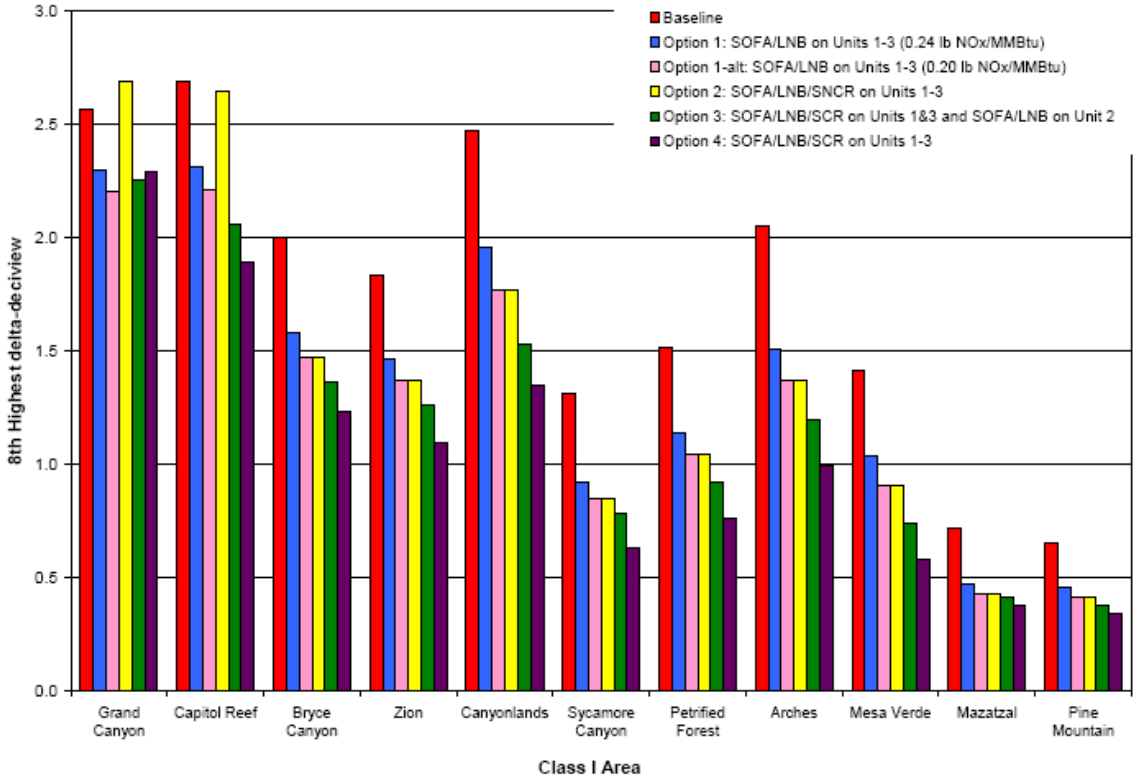
- **THE INCREMENTAL VISIBILITY IMPROVEMENT BY INSTALLING SCR IS NOT NOTICEABLE AND HENCE THE REQUIREMENT IS NOT JUSTIFIED**

ICF has reviewed SRP's BART analysis in connection with preparing this report.[15] Based on SRP's analysis, the incremental visibility improvement achieved by installing SCR in addition to LNB/SOFA is only 0.33 delta-decivie (DV) from Option 1 – LNB+SOFA only across 11 class I areas. A change of more than 1.0 DV is considered noticeable by the human eye, and hence, the incremental improvement achieved by installing SCR at NGS is not noticeable. This finding is contained in SRP's January 2009 Update of their BART Analysis of NGS (Exhibit II-1). On pages ES-5 to ES-8, the study analyzes the impact of installing LNB+SOFA (Option 1) and LNB+SOFA + SCR (Option 4). Furthermore, requiring SCR actually decreases visibility at the Grand Canyon though the effect is small relative to the 1.0 DV threshold. The Hopi Tribe and ICF agree with the SRP analysis though we did not analyze the visibility modeling underlying this conclusion. It is particularly disturbing that EPA would consider SCR, worsen visibility, and ignore the impacts on the Tribes while giving weight to the impacts of entities that are not subject to Trust obligations. The summary of the SRP visibility findings is:

- Baseline (no control option): 1.75 delta-deciview
- Option 1: 1.38 delta-deciview (A change of 0.37 DV from baseline)
- Option 4: 1.05 delta-deciview (A change of 0.7 DV from baseline and 0.33 from Option 1-LNB+SOFA)

[15] Salt River Project, Revised BART Analysis for Navajo Generating Station Units 1-3, January, 2009, Document No. 05830-D12-300. Table ES-2, page ES-5.

**Exhibit II-1**
**8th Highest Regional Haze Deciview Changes from NGS BART Control Options**




Source: Salt River Project, Revised BART Analysis for Navajo Generating Station Units 1-3, January 2009: Figure ES-1, Page ES-3.

ICF did not independently analyze the detailed visibility modeling underlying this conclusion[16]. The fundamental problem appears to be that visibility impairment is primarily caused by other haze and particulate sources such as automobiles in Los Angeles. If this finding is accurate, the costs of the NGS SCR proposal are not justified by the small incremental benefits achieved.

These costs do not include the potential for ammonia release during transportation and storage and associated emission during transportation. EPA calculations on visibility assume no ammonia slip and may have understated secondary particulate risks. These issues do not exist for the alternative of LNB and SOFA.

There is also no evidence supporting the view that even larger improvements would justify the economic devastation imposed on the Hopi homeland by an EPA SCR requirement at NGS. This is especially the case given the potential catastrophic economic outcome for the Tribes and in light of the Trust responsibility of the United States' to protect the Tribe and its assets from outright destruction or other harm.

[16] SRP BART analysis shows an improvement of 0.33 in deciviews from Option 1-LNB+SOFA by installing SCR at NGS and this change is not detectable by the human eye. NPS disagrees with the extent of the improvement. ICF did not analyze changes in light extinction.

## ➢ THE SHUT DOWN OF NGS WILL HAVE MASSIVE AND DEVASTATING ECONOMIC CONSEQUENCES ON THE HOPI AND NAVAJO TRIBES

The shut down of NGS would effectively collapse the Hopi economy and close down the Hopi Tribe's government operations which include provision of basic human services to a Tribe already in dire economic circumstances. Coal and other revenues related to NGS account for 88 percent of the annual Hopi tribal governmental operating budget. Hopi is a non-gaming tribe without alternative resources. The Hopi Tribe lacks viable renewable energy resources capable of offsetting this impact. Unemployment and poverty levels are already approximately 50%, and many Hopi families lack basic amenities like running water and flush toilets.

In spite of being one of the most economically and socially vulnerable United States populations, Hopi has already suffered from the recent shut down of the MGS on December 31, 2005 due in part to EPA and other parties not agreeing to a request of the Tribes to modify an inflexible consent decree regarding the timing of MGS's environmental air emission requirements. The shut down of MGS is the only shut down of a major coal plant in the United States in the last 35 years[17] and resulted in the layoff of tribal employees, and a reduction of the basic service provided by the Hopi Tribal Government. Historically, Hopi had two buyers for its coal – MGS, and NGS; with the premature regulatory shut down of MGS in 2005, NGS is now the Tribe's only remaining coal customer.

The shut down of NGS would have massive economic consequences on both the Hopi Tribe and the Navajo Nation. As shown in Exhibit II-2, about 1,400 to 1,900 Hopi jobs will be lost permanently if NGS is shut down. According to a 2008 report prepared for the Arizona Department of Water Resources, total Hopi employment was 2,722 in 2008[18]. The Hopi job loss estimate represents 50 to 70 percent of the Hopi employment in 2008. The situation could be worse considering that employment on the Hopi Reservation has declined since 2004. The job loss estimate is approximately 9 to 13 percent of the total Navajo employment[19].

[17] MGS was the only greater than 1,000 MW coal power plant ever to have been retired in the United States. Note NGS is scrubbed for $SO_2$ unlike MGS which did not have a FGD system in place.

[18] Socioeconomic Study in Support of a Hydrographic Survey Report for the Hopi Indian Reservation, submitted to Arizona Department of Water Resources, prepared by SWCA Environmental Consultants, April 2008.

[19] Estimated using total employment reported by Arizona Department of Commerce in its report, Economy of the Navajo-Hopi Region, January 2008. Table 1 shows total employment in 2004 was 24,338. Assumes the employment stays flat through 2008. Total Navajo employment = 24,338 – 2,722 = 21,616.

**Exhibit II-2**
**Tribal Job and Revenue Loss if NGS Shuts Down**

| | PERMANENT JOB LOSS (#) | | |
|---|---|---|---|
| | **HOPI** | **NAVAJO NATION** | **TOTAL** |
| Tribal Government[1] | 400 | N/A | 400 |
| Hopi Villages[2] | 144 | N/A | 144 |
| NGS[3] | - | 436 | 436 |
| Kayenta Mine[4] | - | 380 | 380 |
| Other Office[5] | N/A | N/A | N/A |
| Total Direct Job Loss[6] | 544 | 816 | 1,360 |
| Indirect Job Loss | 816 – 1,360 | 1,224 – 2,040 | 2,040 – 3,400 |
| Total Job Loss | 1,360 – 1,904 | 2,040 – 2,855 | 3,400 – 4,759 |
| | | | |
| | **ANNUAL REVENUE LOSS (Million $)** | | |
| | **HOPI** | **NAVAJO NATION** | **TOTAL** |
| NGS[7] | 14 | N/A | N/A |
| Payrolls & Benefits[8] | 8 | N/A | N/A |
| Indirect Payrolls & Benefits[9] | 12 - 20 | N/A | N/A |
| Total[10] | 34 - 42 | 140 | 174 - 182 |
| CAP Water Repayment to Both Tribes (Million$/Year)[11] | | | $60-$90 (2016-2023) |

[1] Hopi Tribal government employees totaled about 475. If NGS shuts down it assumes that the government would require 75 employees to maintain basic service. No information available for the Navajo Nation
[2] There are 12 Hopi Villages and assumes 12 employees from each village would lose jobs.
[3] 80% of 545 NGS employees are Navajos. (Source: Bureau of Reclamation /DOI comments to EPA date October 28, 2009, page 3)
[4] 90% of 422 Kayenta mine employees are Navajos. (Source: Bureau of Reclamation /DOI comments to EPA date October 28, 2009, page 3)
[5] Hopi Flagstaff offices
[6] Assumes multiplier effect of 1.5 to 2.5.
[7] Includes royalties, bonus, scholarships, and water payments. Annual Hopi revenue is projected for the period of 2019-2039. Navajo Nation revenue loss is estimated by subtracting payrolls & benefits from the total revenue and payrolls & benefits loss reported in the AZ governor's comments to EPA dated October 13, 2009.
[8] Hopi payrolls & benefits are estimated assuming Hopi per capita income in 2008 of $11,364 (Source: city-data.com) , 2.5% inflation, 30% benefits. For the Navajo Nation, information is not available.
[9] Assumes multiplier effect of 1.5 to 2.5.
[10] AZ Governor's comments to EPA dated October 13, 2009 on page 4 stated that NGS and Kayenta mine provide $140 MM in revenue and wages to the Navajo Nation and its tribal members. No breakdown is given.
[11] Source: CAP

- **SRP BART ANALYSIS CAPITAL COST ESTIMATE FOR INSTALLING SCR IS REASONABLE**

This SRP SCR cost estimate of $663 million or $295/kW is approximately consistent with the cost estimates in recently (since 2007) conducted utility BART studies (see Exhibit II-3 and Appendix A). The SRP capital cost estimate includes the costs of replacement power during the

outage required for installation[20]. It should be noted that capital costs have risen in recent years for utility investments generally and for SCR in particular, i.e., 2007 to 2009 relative to early 2000 estimates. The average SCR capital cost in recent BART studies reviewed by ICF for unit size greater than 500 MW is $285/kW versus the $295/kW estimated by SRP.

SCR capital costs are 15.8 times the capital costs of LNB and SOFA. Total SCR costs including O&M are also 13.3 times higher on an incremental $/ton $NO_x$ controlled basis when using EPA assumptions on baseline and a twenty year life. SRP's analysis of incremental cost for SCR based on cost effectiveness calculations also reached the same conclusion[21] (Exhibit II-4). This incremental cost was not calculated in EPA's ANPR in spite of EPA recommendations to perform these calculations. The average and incremental $/ton removed calculations strongly depend on capital costs. Furthermore, they increase exponentially if the expected lifetime is less than 20 years. Giving consideration to shortened lifetimes highlights the lack of cost effectiveness of SCR.

Lastly, SCR increases other issues that do not exist with LNB/SOFA including risks of release during ammonia transportation and storage.

**Exhibit II-3**
**Average SCR Capital Cost**

| Installation/BART Study Year | Average SCR Cost (2008$/kW) |
|---|---|
| 2007 | 326 |
| 2008 | 334 |
| 2009 | 336 |
| Average 2007-2009 | 332 |
| **Size** | **Average SCR Cost (2008$/kW)** |
| >500 | 285 |
| 200 < MW < 500 | 454 |
| <200 | 584 |

Source: ICF review of recent BART studies.

[20]Source: Revised BART Analysis for the Navajo Generating Station Units 1-3, prepared for Salt River Project Navajo Generating Station, Tempe, Arizona by ENSR Corporation, January 2009, Document No: 05830-012-300. Page 4-8, Table 4-2.
[21] SRP Comments on BART ANPR, Docket No. EPA-R09-OAR-2009-0598. Table 1.1. October 27, 2009.

**Exhibit II-4**
**Cost Effectiveness of Control Options**

| Scenario | Control Technology | Average Cost ($/ton) | Incremental Cost ($/ton) | Basis for Incremental Cost |
|---|---|---|---|---|
| 1 | Baseline | -- | -- | -- |
| 2 | LNB/SOFA on Units 1-3, $NO_x$ = 0.24 lb/MMBtu | $484 | $484 | Scenario 2 – 1 |
| 3 | LNB/SOFA on Unit 2, $NO_x$ = 0.24 lb/MMBtu<br>LNB/SOFA and SCR on Units 1 & 3, $NO_x$ = 0.08 lb/MMBtu | $3,443 | $6,262 | Scenario 3 – 2 |
| 4 | LNB/SOFA and SCR on Units 103, $NO_x$ = 0.08 lb/MMBtu | $4,107 | $6,440 | Scenario 4 – 2 |

Source: SRP Comments on BART ANPR, Docket No. EPA-R09-OAR-2009-0598. Table 1.1. October 27, 2009.

# CHAPTER III
# ICF ECONOMIC ANALYSIS OF A SCR BART DECISION ON THE VIABILITY OF NGS – ASSUMPTIONS AND APPROACH

## III. 1 INTRODUCTION

The purpose of this chapter is to describe the ICF economic analysis of the impacts of an EPA requirement that NGS install SCR $NO_x$ emission controls in addition to LNB/SOFSA by 2015 or retire the plant. The emphasis is on the assumptions and modeling approach. Many of the key results have been discussed in Chapter One and the Executive Summary.

This chapter is organized into the following sections:

- BACKGROUND ON NGS AND THE DECISION FACING NGS OWNERS
- SCR CAPITAL COSTS AND RELATED ISSUES
- MERCURY MACT REGULATIONS AND CONTROL COSTS
- $CO_2$ REGULATIONS
- $CO_2$ EMISSION ALLOWANCE PRICES
- MODELING APPROACH
- NATURAL GAS PRICES
- RESULTS – BREAKEVEN NATURAL GAS PRICES
- RESULTS – CCS

## III.2 BACKGROUND ON NGS AND THE DECISION FACING NGS OWNERS

NGS is a coal-fired power plant with a capacity of 2,250 MW consisting of 3 units (see Exhibit III-1). NGS is located near Page, Arizona. NGS came on-line in stages between 1974 and 1976. NGS was designed to use Hopi and Navajo owned coal and is served by a dedicated rail line linking the plant with a coal mine sited on the Hopi and Navajo reservations in northeastern Arizona. Neither the plant nor the mine has alternative transportation access. The plant has several decades of remaining useful life in the event stringent environmental controls are not imposed.[22]

[22] Base case ICF modeling without stringent environmental controls shows continued and high utilization through at least 2043 when currently leased coal is exhausted. The Hopi and Navajo coal resources are massive and could provide enough coal to extend the life of the plant for many decades past 2043.

**Exhibit III-1**
**NGS**

| Parameter | Value |
|---|---|
| Capacity | 2,250 MW |
| On-Line Date | 1974 – 1976 |
| Units | 3 |
| $SO_2$ Scrubbers | Yes |
| Location | Page, Arizona |
| Coal Supply | Dedicated Rail from Kayenta Coal Mine |
| Coal Consumption | 8 Million Tons/Year |
| Operator | Salt River Project (SRP) |
| Ownership | United States Bureau of Reclamation 24.3%<br>SRP 21.7%<br>LADWP 21.2%<br>Arizona Public Service 14.0%<br>Nevada Power 11.3%<br>Tucson Electric Power 7.5% |

In 1999, NGS installed Flue Gas Desulfurization (FGD) equipment (i.e., $SO_2$ scrubbers) as a result of a previous BART proceeding[23]. This was in addition to the fact that NGS already uses low sulfur coal. As a result, the plant has one of the lowest emission rates for $SO_2$ in the United States.

The NGS plant was built in the early 1970's as a compromise aimed at reducing the environmental impacts of needed power production; the alternative to NGS was several new hydro-electric power plants. In the case of at least one group involved in the current NGS BART proceeding, the Sierra Club, was involved in that compromise but is now pursuing stringent controls as part of the current BART process. This group was also involved in the shut down of the Mohave Generating Station (MGS). Sierra Club refused to modify the MGS consent decree in spite of requests by the Tribes and MGS proceeded to shut down, [24] and this resulted in huge economic harm to the Hopi and Navajo Tribes, including lost jobs and badly needed operational revenues.

[23] Revised BART Analysis for the Navajo Generating Station Units 1-3, prepared for Salt River Project Navajo Generating Station, Tempe, Arizona by ENSR Corporation, January 2009, Document No: 05830-012-300. Page I-1.
[24] SRP's Comments on BART ANPR, October 27, 2009.

NGS is already in the process of installing SOFA $NO_x$ controls[25]. These $NO_x$ controls are expected to be on line in stages from 2009 to 2011. These controls are also referred to as Low $NO_x$ Burners (LNB + SOFA).

EPA is considering whether SCR $NO_x$ emission controls should be required in addition to LNB/SOFA. In the event SCR is required, the likely decision making tree of the NGS owners is presented in Exhibit III-2. Once the BART requirement is announced, the decision makers would estimate cash flows for all the branches of the decision tree, apply probabilities to each branch and determine the net expected value of the plant. If the expected value is negative after including the costs of SCR, the plant would likely be retired. If there is significant potential for retirement by 2015, the 20 year lifetime assumption is too long. A short lifetime raises average and incremental $/ton costs of SCR $NO_x$ control exponentially. EPA gave no thought to this issue in light of recent developments affecting lifetime.

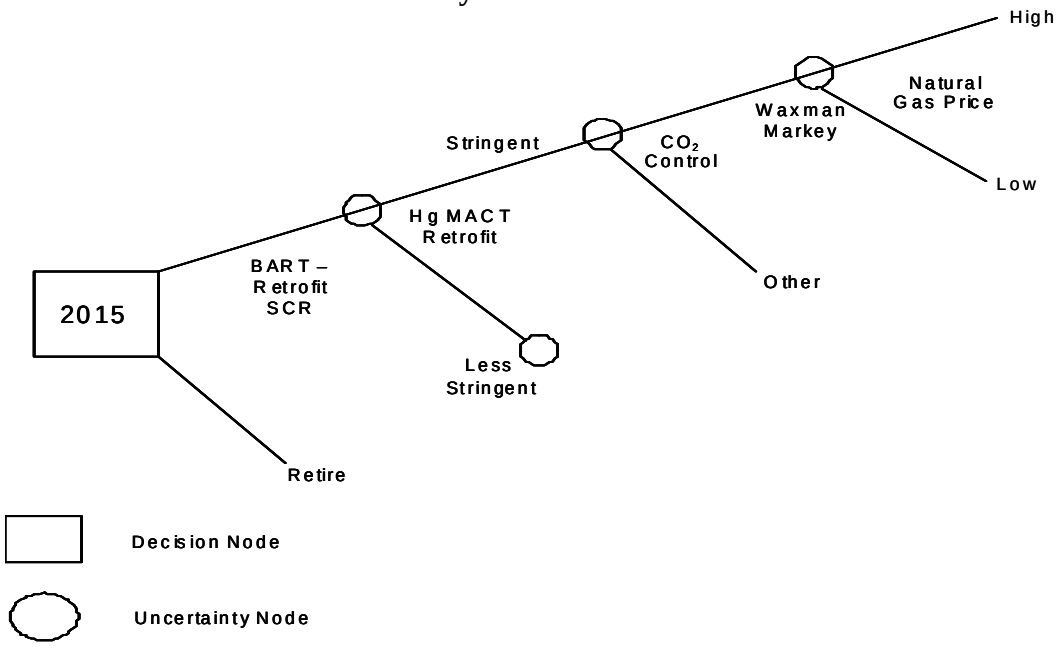
More specifically, the owners would be forced to choose between paying approximately $1.31[26] billion in 2015 dollars for SCR and mercury controls, and endure a $CO_2$ control regime which favors natural gas over coal, or retire the plant saving $1.31 billion and obtain power from other sources. The lower the natural gas price, the lower the cost of purchasing alternative power.

The ICF analysis focuses on the discounted cash flow of a key branch of the tree. This branch has a combination of stringent $CO_2$ and mercury controls. As discussed, depending on the natural gas price, under stringent controls, the plant may not be economic. In ICF's experience, the consideration of this branch will be the single most important consideration for NGS owners. This experience includes ICF's detailed review of the analysis by the owners of MGS when they faced similar issues in the years leading up to the 2005 plant closure.

[25] Revised BART Analysis for the Navajo Generating Station Units 1-3, prepared for Salt River Project Navajo Generating Station, Tempe, Arizona by ENSR Corporation, January 2009, Document No: 05830-012-300.

[26] Total investment for SCR and mercury controls is $1.113 billion in 2008$ (see Exhibit III-5). Inflation in 2009 was 1.19% and assumes 2.5% per year inflation thereafter,
$1.13 billion = ($1.113)*(1.0119)*(1.025)^(2015-2009) = $1.31 billion in 2015.

**Exhibit III-2**
**Decision Analysis View of NGS Future**




## III.3 ASSUMPTIONS: SCR CAPITAL AND RELATED ISSUES

The capital cost of SCR is a critical parameter and assumption in the ICF analysis. The ICF analysis assumes that the incremental cost of the proposed SCR controls is $663 million or $295/kW (see Exhibit III-3). This estimate is in 2008 dollars, and hence, the cost escalates with general inflation. The source of this estimate is SRP[27]. In the SRP analysis, Option 1 (LNB+SOFA) costs $42 million (capital cost) compared to Option 4 (LNB+SOFA + SCR) which costs $705 million in capital cost. Thus, the capital costs of SCR are 15.8 times higher than the LNB & SOFA. This is an incremental $663 million in 2008 dollars (The document did not provide the year for the dollars. ICF assumes it is in 2008 dollars because of the date the revised BART analysis was released). The variable costs of SCR include ammonia which when injected in the presence of catalyst converts $NO_x$ to $N_2$.

[27]Revised BART Analysis for the Navajo Generating Station Units 1-3, prepared for Salt River Project Navajo Generating Station, Tempe, Arizona by ENSR Corporation, January 2009, Document No: 05830-012-300. Page E-5, Table ES-1.

**Exhibit III-3**
**SCR Costs for NGS (2008$)**

| Parameter | SCR |
|---|---|
| Capital Cost (Millions 2008$) | 663 |
| Capital Cost – ($/kW) | 295 |
| Fixed O&M ($/kW-yr) | 5.7 |
| Variable O&M ($/MWh) | 0 |
| Heat Rate and Capacity Penalty (%) | 0.5 |
| Note: SRP's BART Analysis did not specify year dollars for costs. ICF assumes 2008$. O&M costs and heat rate penalties are ICF assumptions. | |

This SRP SCR capital cost estimate is consistent with the cost estimates in recently (since 2007) conducted utility BART studies (see Appendix A). The SRP capital cost estimate includes the costs of replacement power during the outage required for installation[28]. It should be noted that capital costs have risen in recent years for utility investments generally and for SCR in particular. Thus, out of date estimates would significantly under-estimate costs as would estimates not addressing situations in which the installation requires an extension of plant maintenance outages and the purchase of replacement power costs.

The total incremental costs of SCR $NO_x$ control (e.g., annual capital non-fuel O&M) relative to LNB/SOFA are also very high when measured on a $/ton removed. These costs are 13.3 times higher. This calculation assumes 20 years remaining lifetime for NGS as EPA assumed. SCR incremental $NO_x$ costs are approximately $6,300/ton to $6,400/ton.[29] These costs also understate the actually $/ton costs. As noted, these costs calculations assume 20-year remaining useful life for NGS. Because there is a significant risk that the plant may shut down as early as 2015, the expected lifetime is less. This causes the $/ton $NO_x$ control cost to increase exponentially.[30]

EPA did not calculate incremental $/ton $NO_x$ removed in its ANPR in spite of BART guidelines recommending the consideration of this cost.[31] EPA did not give consideration to the potential for early shut down and less than 20 years of useful life.

[28]Source: Revised BART Analysis for the Navajo Generating Station Units 1-3, prepared for Salt River Project Navajo Generating Station, Tempe, Arizona by ENSR Corporation, January 2009, Document No: 05830-012-300. Page 4-8, Table 4-2.
[29] See Comments on Advanced Notice of Proposed Rulemaking, Docket #: EPA-R09-OAR-2009-0598, SRP, October 2009, page 5.
[30] See SRP, October 2009, op. cit. page 8.
[31] See Table 14, Federal Register/Vol. 74/No. 1551, Friday, August 28, 2009/Proposed Rules, page 44322.

SCR also has potential costs associated with ammonia release during storage and transportation that were not assessed.[32] Ammonia transportation via truck also results in emissions. EPA calculations on visibility do not assess the impacts of ammonia slip as it is assumed to be zero. Ammonia slip is the release of ammonia from the plant after injection into the flue gas. These issues do not exist for LNB and SOFA.

If EPA decides to require SCR, these controls would be required by 2015[33]. The decision to install these controls as opposed to shutting down the NGS plant would have to take into account the range of developments affecting the economics of the NGS plant in the post 2015 period. Specifically, NGS owners will conduct a discounted cash flow analysis of continuing NGS versus relying on alternative sources of power.

EPA did not give consideration to the potential for early shut down and less than 20 years of useful life.

## III.4 MERCURY MACT REGULATIONS AND CONTROL COSTS

EPA is currently developing Mercury MACT regulations which are expected to be provided for public comment in 2011, and be in place by 2015. These regulations should be considered when deciding on the stringency to be applied to NGS vis~a~vis BART. ICF assumes that EPA will pursue a stringent approach though a much less stringent approach is technically available. Thus, NGS owners may face two plant specific requirements with a 2015 date plus a $CO_2$ program starting in 2012.

A stringent mercury MACT regulation could result in the requirement that NGS retrofit a bag house (also referred to as a fabric filter) and Activated Carbon Injection (ACI) system. An alternative could be to simply have an ACI and Electro-Static Precipitator (ESP) upgrades.

The costs of the stringent mercury MACT investments are $450 million or $200/kW (Exhibit III-4). The source of this cost estimate is ICF. In the event that EPA opts for stringent BART $NO_x$ emission controls, NGS owners need to give extra weight to the likelihood of a stringent MACT scenario.

[32] SRP, October 2009, op cit., page 5.
[33] SRP comments on BART ANPR, October 27, 2009. Page 55.

**Exhibit III-4**
**Mercury MACT Controls**

| Parameter | Mercury – Fabric Filter – Advanced Carbon Injection (ACI) |
|---|---|
| Capital Cost (Millions 2008$) | 450 |
| Capital Cost – (2008$/kW) | 200 |
| Fixed O&M (2008$/kW-yr) | 0.7 |
| Variable O&M (2008$/MWh) | 0.6 |
| Heat Rate and Capacity Penalty (%) | 0.5 |

The combined costs of stringent BART $NO_x$ and mercury MACT investment is $1,113 million or $495/kW (2008$ See Exhibit III-5).

**Exhibit III-5**
**Combined Costs – BART and Mercury MACT**

| Parameter | SCR $NO_x$ | Mercury – Fabric Filter – Advanced Carbon Injection (ACI) | Total |
|---|---|---|---|
| Capital Cost (Millions 2008$) | 663 | 450 | 1,113 |
| Capital Cost – ($/kW) | 295 | 200 | 495 |
| Fixed O&M ($/kW-yr) | 5.7 | 0.7 | 6.4 |
| Variable O&M ($/MWh) | 0 | 0.6 | 0.6 |
| Heat Rate and Capacity Penalty (%) | 0.5 | 0.5 | 1.0 |
| Source: SCR cost from SRP BART Analysis; Fabric Filter, ACI, and Penalties are ICF assumptions; All dollar values expressed in 2008 dollars. | | | |

## III.5 ASSUMPTIONS: CO2 REGULATORY SCENARIOS

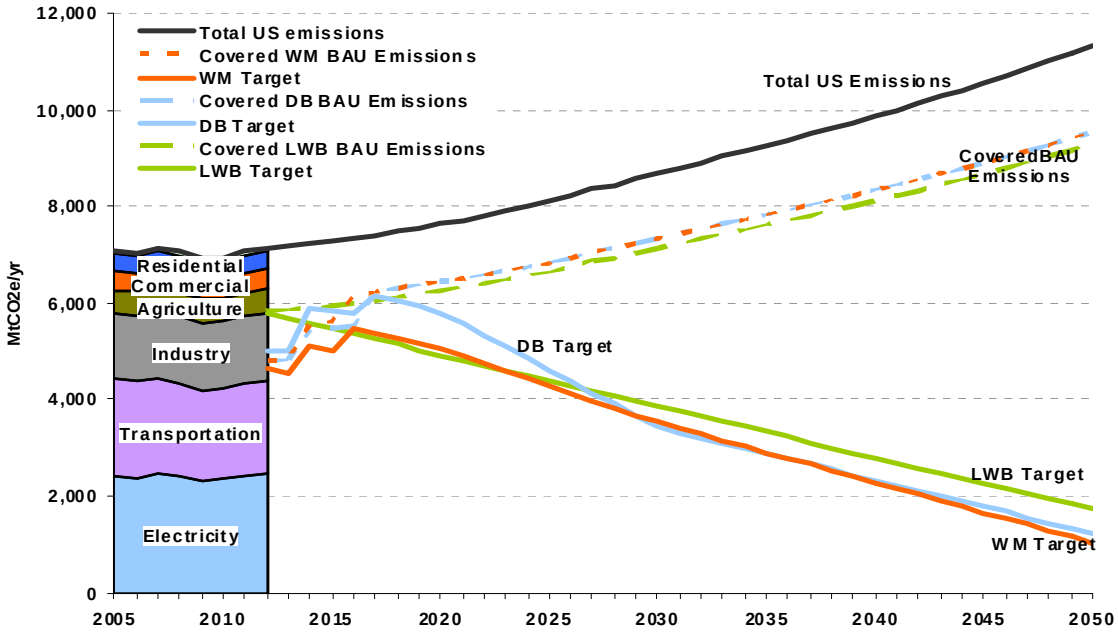
The BART analysis conducted on behalf of the NGS owners calculates that the improvement in visibility from requiring SCR installation is small or negative.[34] In contrast, the risks to the viability of the plant and the potential negative economic consequences to the Tribes are very

[34] SCR installation reduces visibility at the Grand Canyon rather than increasing.

large. These risks come from a combination of stringent regulatory decisions and very plausible economic outcomes which together with EPA BART action could lead to the premature shut down of NGS.

A recent regulatory development in this area includes the potential for stringent $CO_2$ emission Controls. The decision facing the NGS owners when making additional investment in the plant given BART requirements is also affected by potential $CO_2$ emission regulation requirements. While the potential for stringent $CO_2$ controls is a relatively new development, with the potential increasing significantly since the start of 2009, there are many reasons why the NGS owners must now factor in potential $CO_2$ emission controls. The most prominent include recent administrative and legislative activity that would require stringent $CO_2$ emission controls. The Waxman Markey bill (HR 2454) was passed by the United States House of Representatives in June 26, 2009 and contains cap and trade provisions for $CO_2$ emissions. This was the first $CO_2$ control bill to pass either House of Congress. A similar bill, the Kerry Boxer bill, was approved by the Senate Environment and Public Works committee in late 2009. The bills would require an 83% reduction in $CO_2$ emissions by 2050; this represents close to 100% reduction from 2050 levels in the absence of $CO_2$ controls (Exhibit III-6).[35] As such, this is a very stringent environmental program. Full senate consideration of Kerry Boxer is pending. The administration has been a leading proponent of this type of legislation.

**Exhibit III-6**
**Emission Caps under Various Climate Change Legislative Proposals Including WM**




There are no ameliorative components of either bill directly addressing NGS and the situation of the two Tribes. For example, there are approximately 20 programs providing free $CO_2$ emission allowances for various purposes; none address the unique position of Hopi and Navajo. The bills

[35] The bill does allow for the purchase of offsets allowing US emission reductions in the controlled sector to be less.

contain provisions related to Carbon Capture and Sequestration (CCS) which have the potential to provide support for coal power plants generally. The bill's CCS provisions are discussed later.

The ICF analysis assumes that the Waxman Markey bill or similarly restrictive legislation is passed. In the event that NGS owners could assume there was no probability of $CO_2$ controls, ICF concludes that the economic viability of the plant would not be threatened by BART. If the likelihood of $CO_2$ controls was high but not certain, it is still possible that the plant's viability could be threatened by lower gas prices or inadequate time to conclude the necessary arrangements such as revised contracts. Indeed, some of the parties in the BART proceeding are acting as if $CO_2$ controls are not a key factor in the economic assessment of NGS. As a matter of fact, neither EPA nor any of the parties supporting EPA's ANPR on NGS analyzed the economic impact that $CO_2$ controls would have on the Hopi and Navajo Tribes via its impact on NGS.

EPA is active in analyzing these bills and hence very aware of the compounding effect of $CO_2$ controls on the viability of the NGS plant. The EPA has endorsed similar $CO_2$ controls.[36] In addition, EPA has also recently announced that it plans to consider pursuing $CO_2$ controls on sources emitting more than 25,000 tons per year independent of the outcome of pending legislation. NGS is in this category. EPA also asserts that this program is authorized by the existing provisions of the Clean Air Act, and hence, in its view, does not require additional legislation. Thus, the potential for Waxman-Markey controls or similar controls is very significant. The potential for legislative or regulatory imposition of $CO_2$ emission controls will affect the decision of the NGS owners regarding whether to proceed with the major investment required by SCR technology.

Hence, consideration by the United States (e.g., EPA and the National Park Service) of whether to require NGS to install stringent SCR technology through BART, without even mentioning much less giving full consideration of the combination of BART and $CO_2$ initiatives is particularly inappropriate given EPA's publicly acknowledged active involvement with these other non-BART initiatives, especially when one takes into account the Trust responsibilities of the United States to the Hopi and Navajo.

## III.6 $CO_2$ ALLOWANCE PRICES

The forecasts of $CO_2$ allowance prices used in this analysis are ICF's forecasts. Prices equal $102/ton expressed in nominal average dollars for the 2012 period when Waxman-Markey starts through 2039 (Exhibits III-7 and III-8). In comparison, the $CO_2$ allowance prices in EPA's January 2010 analysis of Waxman-Markey are less than one-half the ICF forecast at $47.1/ton (average of EPA's ADAGE and IGEM $CO_2$ prices). This average price is also in nominal $/ton for 2012 to 2039. Thus, ICF's forecast is 117 percent higher or equivalently EPA is 54 percent lower.

[36]Administrator Lisa P. Jackson, Remarks to the United Nations Climate Change Conference in Copenhagen, December 9, 2009, "…… we will work closely with our Congress to pass comprehensive clean energy reform through the U.S. Congress – reform that will promote clean energy investments and lower U.S. greenhouse gas emissions by more than 80 percent below current levels by 2050. A strong program of reforms and incentives can help the market get to work – making clean energy the profitable kind of energy."

Surprisingly, EPA's $CO_2$ allowance price is much lower than ICF's in spite of having much higher natural gas prices. Higher natural gas prices decrease the economic competition facing coal, but typically raise $CO_2$ prices, all else being equal. Natural gas price issues are discussed later. This occurs in part because EPA assumes lower electricity demand growth and greater supply of international emission offsets. It should also be noted that there appears to be a difference in the natural gas prices assumed in the various models EPA uses including IPM.

ICF's forecast of $CO_2$ allowance prices is more similar to that of the United States' Energy Information Administration (EIA) analysis. This comparison requires examination of a different time period because EIA analysis is through 2030 only. The EIA analysis has 2012 to 2030 $CO_2$ prices equal to $49.9/ton on average in nominal dollars or 22 percent lower than ICF prices of $64/ton over the same period (see Exhibit III-7). EPA prices over the same period are $30.9/ton or 52% lower. The derivation of ICF prices are discussed further below.

**Exhibit III-7**
**Comparison of ICF. EPA, and EIA $CO_2$ Allowance Prices**

| Source | Period | Nominal Allowance $CO_2$ price ($/ton) |
|---|---|---|
| ICF | 2012 – 2039 | 102.3 |
| EPA | 2012 – 2039 | 47.1 |
| ICF | 2012 – 2030 | 64.1 |
| EPA | 2012 – 2030 | 30.9 |
| EIA[1] | 2012 – 2030 | 49.9 |

[1] EIA prices only available through 2030. Assumes 2.5% general inflation per year.

**Exhibit III-8**
**$CO_2$ Allowance Prices and Natural Gas Prices**

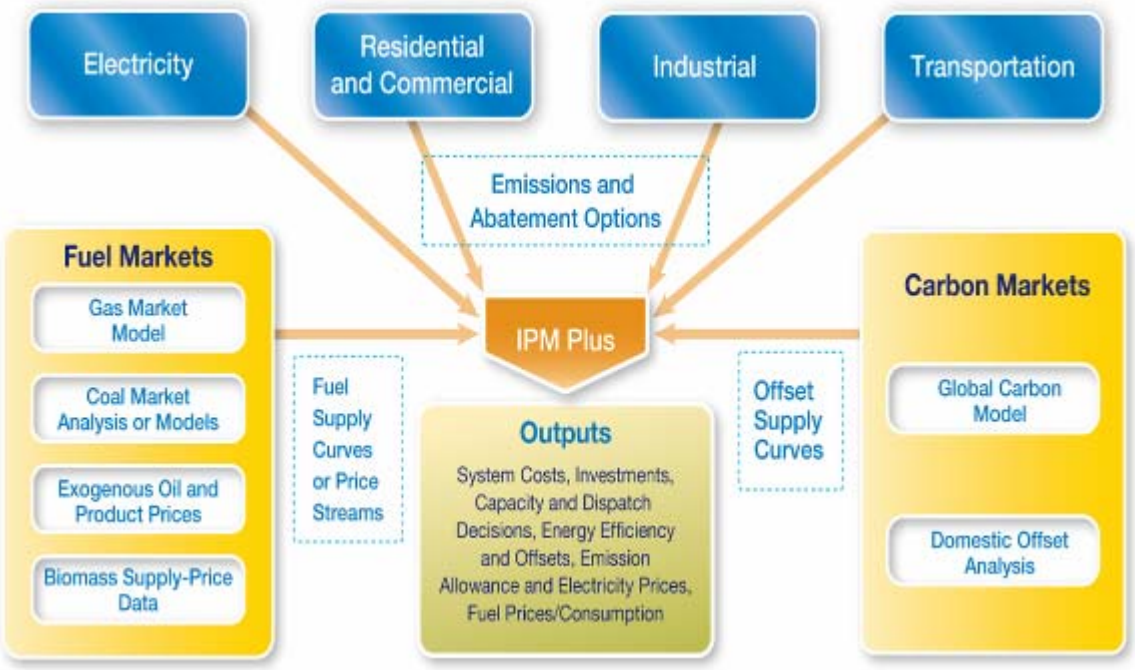
| Parameter | Value |
|---|---|
| $CO_2$ Allowance Prices – Assumption | ICF's Analysis of Waxman-Markey |
| $CO_2$ Allowance Prices – Simple Average – Nominal dollars - 2012 to 2039 | $102/ton $CO_2$ |
| Henry Hub Natural Gas Prices – Simple Average - 2010 to 2039 Real 2008$/MMBtu – Base – Waxman-Markey | 8.20 |
| Henry Hub Natural Gas Prices – Simple Average - 2019 to 2039 Real 2008$/MMBtu – Base – Waxman-Markey | 8.75 |

## III.7 MODELING APPROACH

The modeling approach used by ICF for this analysis is based on ICF's IPM® Plus model (see Exhibit III-9). The model was used to determine: the decision providing the least expected cost for the NGS owners, grid operational parameters such as plant utilization, capacity expansion and retirement, transmission flows, offset use, banking of allowances, coal and natural gas prices and $CO_2$ emission allowance prices.

The IPM® modeling simultaneously determines for power plant dispatch and fuel use, capacity expansion, environmental retrofitting, modernization/re-powering, inter-regional transmission, electric energy and capacity prices, fuel prices, and emissions costs using linear optimization methodology to achieve a least cost solution. It also captures the unique performance characteristics and limitations of conventional and unconventional generation technologies including natural gas-fired steam turbines, combined cycle, co-generation, nuclear, hydro, wind, solar, and other renewables. Energy efficiency and demand side management programs are properly evaluated in an integrated framework with other resource options recognizing their limited capacity value and non-dispatchable characteristics.

**Exhibit III-9**
**IPM® Plus**




The IPM® replicates the discounted cash flow approach used by power plant developers, regulatory personnel, and energy users when reviewing investment options. In order to forecast demand for different fuels in a consistent manner, a full assessment is required of future requirements of the electricity supply industry, decisions regarding the building and/or retirement

of power stations, and future dispatch patterns. The IPM® achieves this by taking into account several additional pieces of information. First, the growth in electricity demand from year to year, and, second, the reserve margin defining the requirement for back-up reserve capacity in the hours of highest demand across all years.

To define the supply side of the problem, the contribution of existing and future power stations to this reserve margin must be defined. The reserve margin contribution of a power station is its capacity that can be reliably called upon in the hours of highest demand. If, as in the example of a wind turbine, we cannot be sure of its output in the peak, we can adjust our estimate of its useable capacity downwards to reflect its unreliability. This adjustment can also be used to differentiate the risk of a failure from, for example, fuel supply disruptions or technical malfunctions. If the reserve margin contribution of existing plants is low, more power stations will need to remain on stand-by in case their output is required. The model ensures that this adequate reserve margin is maintained by delaying the retirement of any existing power stations and/or choosing to build new technologies to make up any shortfall from existing capacity.

## III.8 ASSUMPTIONS: NATURAL GAS PRICES

Natural gas prices affect the likelihood of NGS shut down. This is because natural gas generation is a key alternative to coal generation for the owners. They have the ability to contract for or build natural gas generation.

As the $CO_2$ allowance prices rise over time, the costs of coal generation increase at 2.5 times the rate of a new combined cycle natural gas-fired power plant. This occurs because the emission rate of coal power plants is approximately one ton of $CO_2$ per MWh compared to new combined cycles which emit at approximately 0.4 tons per MWh. The higher the natural gas prices for a given $CO_2$ allowance price, the more competitive existing coal is and vice versa.[37]

In the period of 2019 to 2039, Waxman Markey controls raise expected $CO_2$ allowance prices to high levels leading to increased natural gas demand and prices. In this period, ICF's base case forecasts that under Waxman Markey natural gas prices will average $8.75/MMBtu (2008$/MMBtu, Henry Hub natural gas prices, Summer 2009 vintage ICF analysis). In comparison, in the no $CO_2$ case (Base Case), natural gas prices are forecast to be $8.02/MMBtu for the same forecast period. Thus, natural gas prices are higher under $CO_2$ controls in this period. The breakeven analysis examines a situation in which all else is equal but natural gas prices are lowered.

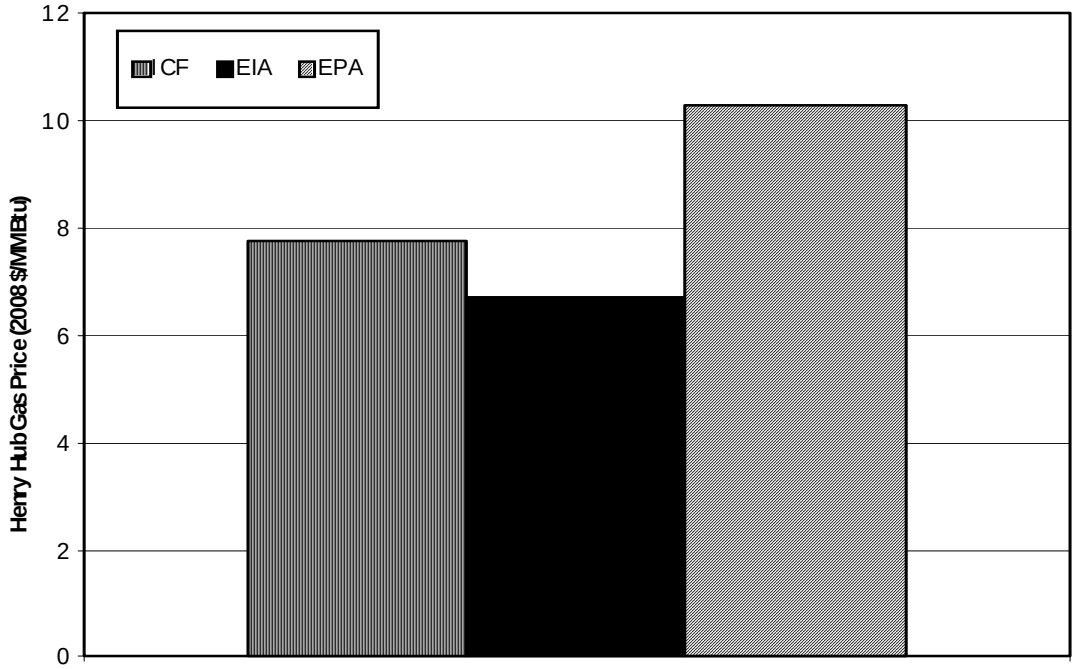
ICF natural gas prices are lower than the prices in EPA's Waxman Markey analysis by 25 percent (in the ADAGE model) between 2010 and 2030. This is shown in Exhibit III-10 for a time period for which natural gas price forecasts are available for EPA, ICF, and EIA. ICF's forecasts are close to EIA's (see Exhibit III-10).

The ADAGE gas supply characterization used by EPA is considered out of date. Developments in shale gas have lowered expected natural gas prices. In addition, it is ICF's understanding that

[37] Higher prices for natural gas eventually have little effect because gas generation becomes less competitive with alternatives such as renewables, nuclear, etc.

the ADAGE modeling uses ICF's IPM® modeling for inputs even though the gas prices in the two models are inconsistent. Therefore, ICF believes the risks to NGS are more substantial than indicated by the EPA analysis.

**Exhibit III-10**
**Forecasts of Henry Hub Natural Gas Prices**
**2010-2030 Average (2008$/MMBtu)**




**Notes:**

- Prices are simple averages.
- EIA gas prices from EIA's Energy Market and Economic Impacts of H.R. 2454, the American Clean Energy and Security Act of 2009, August 2009. Prices reflect EIA's Basic Case. EIA forecast is available through 2030 only.
- EPA gas prices from January 2010 EPA Updated H.R. 2454 Case (Scenario 8) from EPA's ADAGE model analysis of the American Clean Energy and Security Act of 2009 - H.R. 2454 in the 111th Congress.

## III.9 ASSUMPTIONS: MARKET AND POWER PLANT

The Arizona, Southern Nevada, and New Mexico region has had the fastest growing electricity demand of any major United States area. Between 1990 and 2007, Arizona-New Mexico-Southern Nevada demand grew 5.6 percent per year versus 2.2 percent per year on average in the U.S.[38] Forecasts of future demand in this region are also above the United States average (Exhibit III-11). United States demand growth is forecast to be approximately 1.7 percent per year compared to forecasts for Arizona of 3.3 percent.

[38] Source: NERC ES&D

**Exhibit III-11**
**AZ, NM, Southern NV Peak Demand Growth Rate**

| Year | Peak Demand (MW) | Annual Growth Rate (%) |
|---|---|---|
| 2000 | 21,724 | - |
| 2001 | 23,360 | 7.5 |
| 2002 | 24,222 | 3.7 |
| 2003 | 25,547 | 5.5 |
| 2004 | 25,634 | 0.3 |
| 2005 | 27,974 | 9.1 |
| 2006 | 30,111 | 7.6 |
| 2007 | 30,642 | 1.8 |
| 2008 | 28,865 | -5.8 |
| Average | 26,453 | 3.7 |

Source: NERC ES&D 2007 & 2008

NGS is a mine-mouth operation with its coal supply delivered under a long-term coal supply contract that expires by the end of this decade. The plant consumes approximately 8 million tons of low sulfur coal annually. The delivered coal price is approximately $1.6/MMBtu in real 2008 dollars.

Availability of the NGS plant is assumed to be 89 percent (Exhibit III-12) and the forced outage rate is assumed to be 4.2 percent. The plant's non-fuel variable O&M is $2.76/MWh (2008$). In addition, the plants fixed O&M is $38/kW year.

The NGS plant's heat rate is 10,674 Btu/kWh versus approximately 7,000 Btu/kWh for a new natural gas-fired combined cycle.

In the ICF model, we assume a lower discount rate based on SRP type of financing. This is an attempt to assess the risk-adjusted expected return required for SRP to compensate for the opportunity cost of its capital. The weighted average cost of capital i.e., the nominal discount rate, is the weighted return on equity, plus the weighted debt interest rate. The capitalization share of equity and debt determine the weights. SRP is not a tax payer, and hence, there is no tax shield effectively decreasing interest costs.

**Exhibit III-12**
**NGS and Regional Input Assumptions**

| Parameter | Value |
|---|---|
| 2010-2039 Average Arizona Demand Growth (%) | 3.3 |
| NGS Annual Coal Consumption (Million Tons) | 8.1 |
| NGS 2010-2039 Coal Price (2008$/Ton) – Simple Average | 34 |
| NGS Heat Rate (Btu/kWh) | 10,674 |
| NGS Plant Non-Fuel Variable O&M (2008$/MWh) | 2.76 |
| NGS Plant Fixed O&M (2008$/kW-yr) | 37.8 |
| NGS Availability (%) | 89 |
| NGS Forced Outage Rate (%) | 4.2 |
| NGS $CO_2$ Emission Rate (lbs/MMBtu) | 205 |
| NGS $SO_2$ Emission Rate (lbs/MMBtu) | 0.03 |
| NGS $NO_x$ Emission Rate (lbs/MMBtu) | 0.45 |
| NGS Hg Emission Rate (lbs/TBtu) | 2.61 |
| NGS Real Discount Rate (%) | 5.73 |
| Inflation Rate (%/Year) | 2.5 |

## III.10 RESULTS – BREAKEVEN NATURAL GAS PRICE

In the event that average natural gas prices were $5.6/MMBtu (Henry Hub in Real 2008$) over the remaining life of the NGS plant, in combination with the other three environmental control assumptions, the plant would be uneconomic – i.e., the breakeven natural gas price is $5.6/MMBtu.

As noted, the $5.6/MMBtu natural gas price case was the breakeven price identified by testing the effect of a scenario less favorable for continued NGS operation than the base case. The concern about SCR is heightened by the high exposure of the Hopi Tribe to very adverse consequences and the history of natural gas prices below ICF forecasts.

In spite of ICF base case forecasts, NGS owners may conclude that there is a high likelihood of natural gas prices at $5.6/MMBtu. Year-to-date 2010 (through February 22) spot natural gas prices are similar at $5.65/MMBtu. This breakeven gas price is only 12 percent below the historical 2000-2009 average natural gas price of $6.35/MMBtu (Henry Hub in 2008$; see Exhibit III-13). 2009 prices were considerably lower than $5.6/MMBtu at $3.90/MMbtu (30 percent lower). Also, the breakeven natural gas price of $5.6/MMBtu is similar to NYMEX futures prices through 2021 of $5.91/MMBtu (i.e., the breakeven price is 5 percent lower, see Exhibit III-14).

**Exhibit III-13**
**Historical Natural Gas Prices - Henry Hub**
**2000 - 2009**

| Year | 2008$/MMBtu |
|---|---|
| 2000 | 5.26 |
| 2001 | 4.74 |
| 2002 | 3.97 |
| 2003 | 6.33 |
| 2004 | 6.62 |
| 2005 | 9.63 |
| 2006 | 7.07 |
| 2007 | 7.11 |
| 2008 | 8.89 |
| 2009 | 3.90 |
| 2000-2009 Average | 6.35 |

Source: Bloomberg and ICF converted to real 2008$ using NIPA (National Income and Product Accounts) Table 1.1.9. Implicit Price Deflators for Gross Domestic Product

**Exhibit III-14**
**Natural Gas Futures - Henry Hub**
**(2008$/MMBtu)**

| Year | NYMEX Futures as of 1/8/2010 |
|---|---|
| 2010 | 5.69 |
| 2011 | 5.96 |
| 2012 | 5.92 |
| 2013 | 5.90 |
| 2014 | 5.90 |
| 2015 | 5.92 |
| 2016 | 5.93 |
| 2017 | 5.93 |
| 2018 | 5.94 |
| 2019 | 5.94 |
| 2020 | 5.95 |
| 2021 | 5.96 |
| Average 2010-2021 | 5.91 |

Source: Bloomberg and ICF converted to real 2008$ assuming 2.5% per year inflation

If ICF used the EPA natural gas price, in spite of our belief that EPA's forecast is inappropriate, it would not show the NGS shut down because EPA's forecasts are even further above the break even price.

In the ICF analysis, average natural gas prices were assumed to be $5.6/MMBtu over the remaining life of the NGS plant combined with the other three assumptions (Stringent SCR BART requirement, $CO_2$ and MACT environmental control requirements), NGS would be uneconomic in terms of discounted cash flows, and causing the plant to shut down in 2015 (Exhibit III-15).

**Exhibit III-15**
**NGS Retires in 2015**

| Parameter | Value |
|---|---|
| $CO_2$ | Waxman-Markey |
| Natural Gas Price Henry Hub (2008$) | $5.6/MMBtu |
| Mercury MACT | 2015 |
| SCR | 2015 |
| NGS Decision | Retire in 2015 |

## III.11 RESULTS - CCS

In this analysis, NGS is assumed not to retrofit Carbon Capture and Sequestration (CCS). Under the Waxman Markey Bill, ICF forecasts a total of 120.7 GW of coal power plants will retrofit CCS. Lower CCS forecasts would raise $CO_2$ allowance prices and increase the risk of NGS shut down.

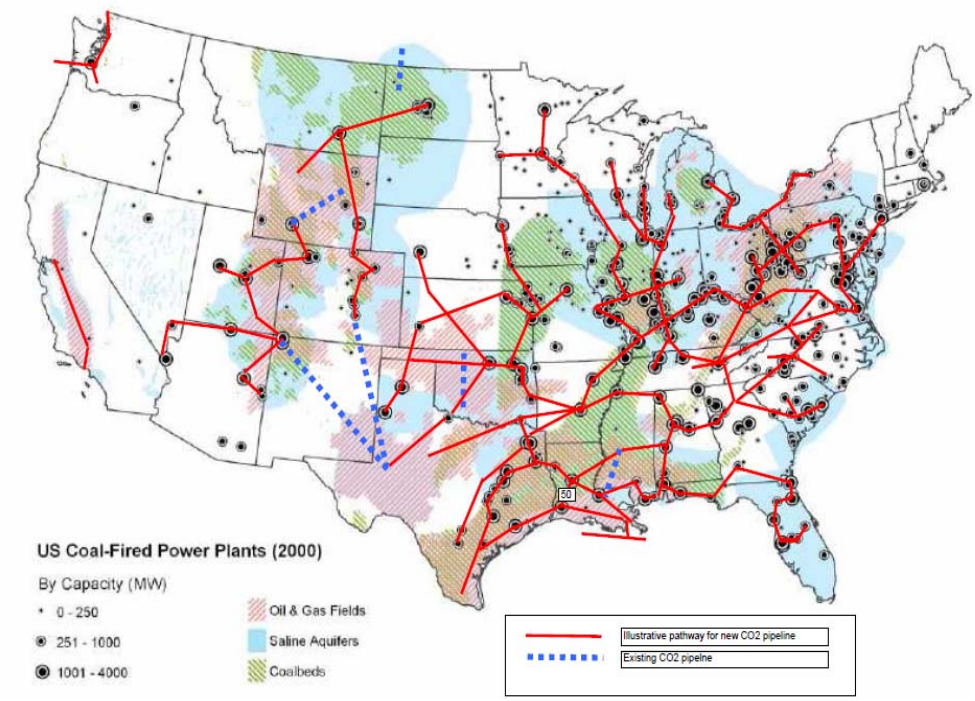
This Bill contains incentives forces installation. However, the Bill does not resolve the legal, regulatory, or technical uncertainties of CCS. There is no full scale utility use of CCS anywhere in the world. These issues may be especially problematic for NGS as the plant is near the N-Aquifer, the main source of Hopi and Navajo water supply.

The decision to install CCS is based in part on the existing $CO_2$ pipeline network and the potential to expand that network that is exemplified by the pipeline network contained in IPM® (see Exhibits III-16 and III-17). This analysis includes the assumption that legal, regulatory and other technical issues surrounding CCS are resolved, but not in time and or not for NGS.

**Exhibit III-16**
**Coal Power Plants Retrofit CCS (MW)**

| Year | Waxman-Markey | Waxman-Markey With 20% Lower Gas Price | Base Case and Base Case with 20% Lower Gas Price |
|---|---|---|---|
| 2020 | 28,001 | 28,001 | 0 |
| 2026 | 7,401 | 21,426 | 0 |
| 2033 | 85,279 | 37,130 | 0 |
| Total | 120,681 | 86,557 | 0 |

**Exhibit III-17**
**CCS Transportation Network as Modeled in IPM® Plus**




Source: ICF International, "Carbon Sequestration and Storage: Developing a Transportation Infrastructure", prepared for the INGAA foundation, 2009.

# CHAPTER IV
# IMPACT ON HOPI AND NAVAJO

## IV.1 INTRODUCTION

The purpose of this chapter is to describe the impacts that a BART decision requiring SCR would have on the Hopi and Navajo. Note, the cost impact analysis in the EPA ANPR ignore this issue.

## IV.2 INTRODUCTION TO HOPI AND NAVAJO SITUATION

The unique features of Hopi's situation are:

- **One of the only Three Tribes Producing Coal** – Hopi is one of three coal producing Tribes. The Hopi and Navajo Tribes, together with the Crow Tribe of Montana, are the only coal producing Tribes in the United States.

- **Trust Assets of United States Government** – The Hopi coal that fuels NGS is held in trust by the United States for use in developing the Hopi economy and ensuring the viability of the Hopi reservation as a permanent Hopi homeland. The United States acts as a trustee to protect the value of the Hopi coal as a trust asset. Because the United States acts as a Trustee for Hopi and the other two coal producing tribes, the United States has special obligations to protect the interests of the trust beneficiaries against federal actions that would de-value the trust asset.[39] This situation is therefore fundamentally different than for other coal use situations in the United States. EPA in ANPR and proponents of SCR at NGS have paid little or no attention to the legal obligations of the United States in this regard, and have acted as if it is indistinguishable from the general situation in the coal industry where federal Trust obligations are not involved.

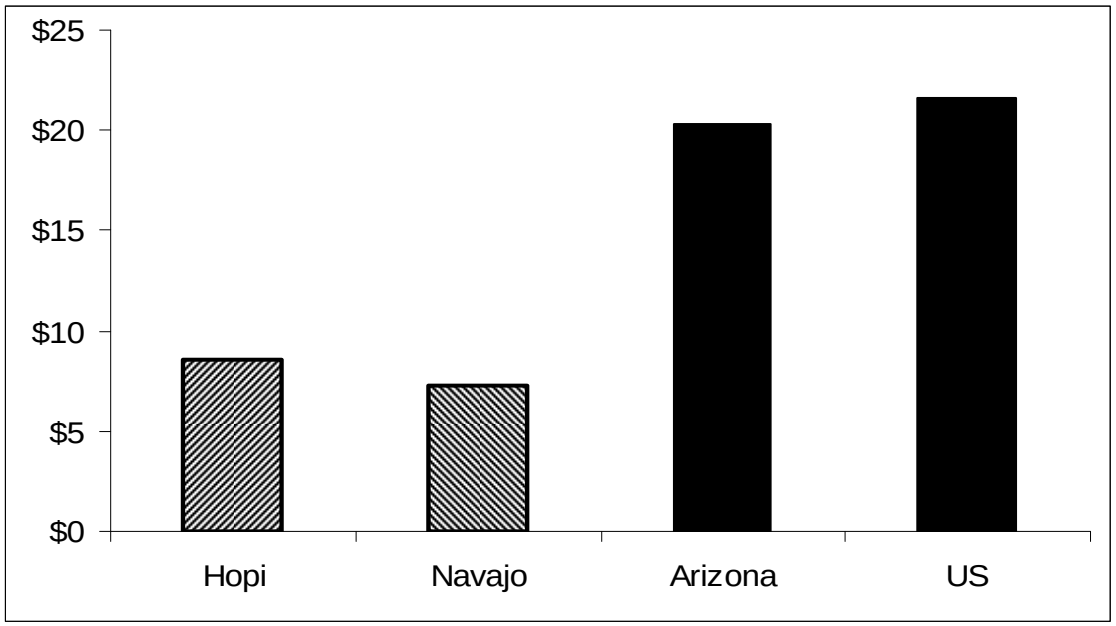
- **Dire Economic Circumstances** – The Hopi Tribe and Navajo Nation are among the most economically vulnerable populations in the United States (see Exhibits IV-1 through IV-3) and have already suffered enough from stringent and inflexible environmental regulations – see the Mohave Generating Station shut down of 2005. The Tribes have economies closer to those found in the developing Third World. Unemployment and poverty levels are approximately 50 percent, and many Hopi and Navajo families lack basic amenities like running water and flush toilets, amenities that almost every other American takes for granted.

  According to the 2000 Census, Hopi and Navajo housing units were approximately *forty times* more likely than the average American home not to have complete plumbing. Thirty-five percent of Hopi-occupied households

[39] As noted earlier, ICF relies on legal information on Trust responsibility provided to it.

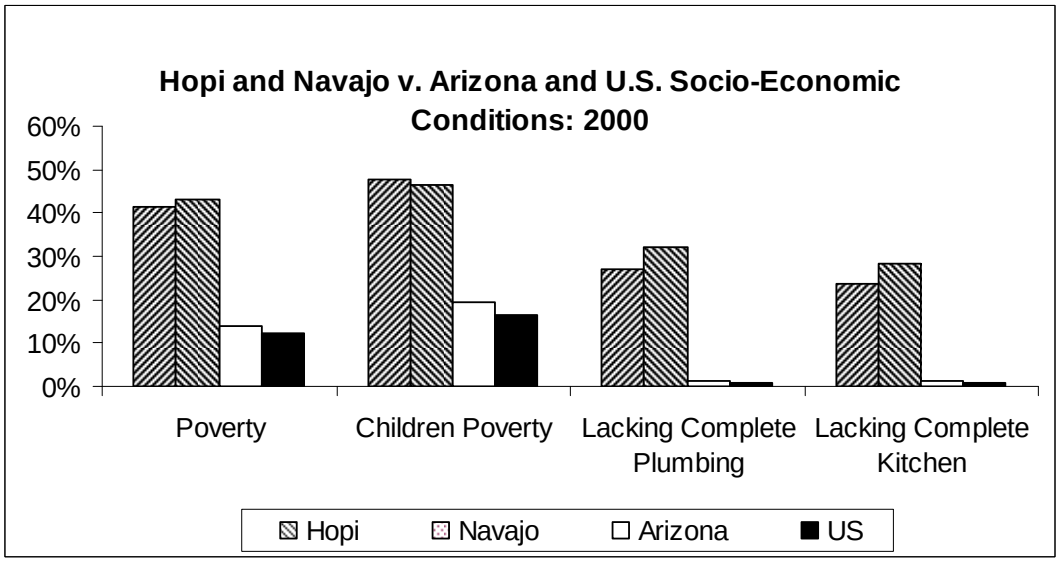
lacked complete kitchens. Nearly 42 percent of Navajo-occupied households lacked complete kitchens. Again, these conditions contrast starkly with conditions found throughout the United States, where about 1 percent of United States households lacked complete kitchens. In the State of Arizona, less than 2 percent of households lacked complete kitchens, and these households were commonly found on Indian reservations.

**Exhibit IV-1**
**Per Capita Income**
**Hopi and Navajo vs. Arizona and United States**



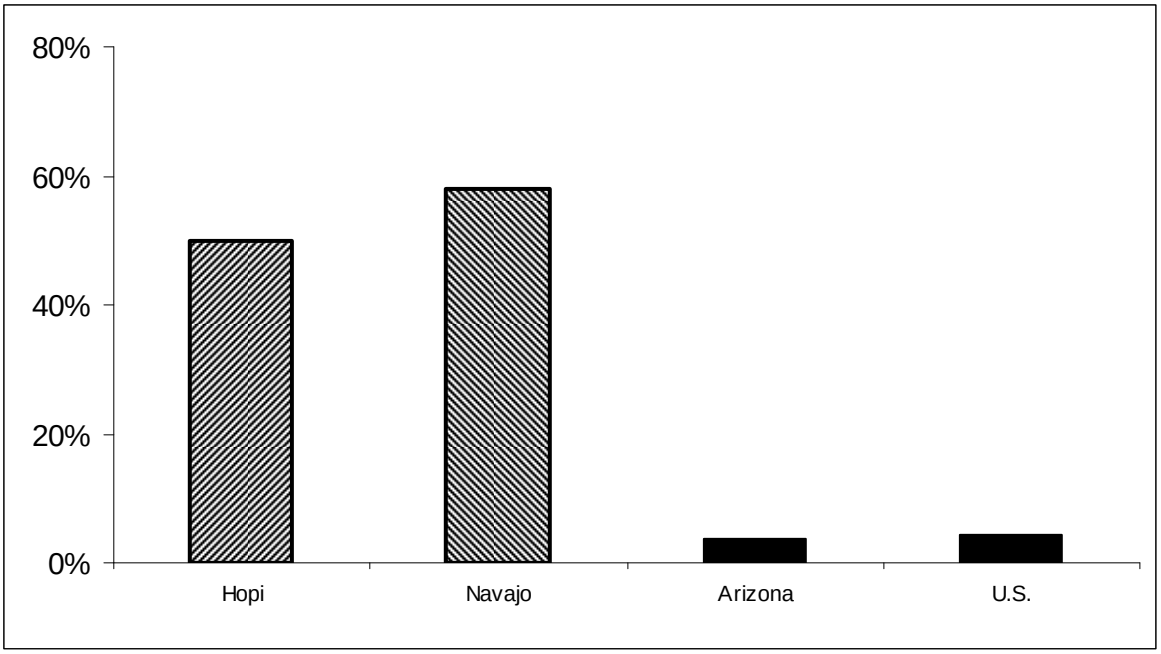

Source: 2000 Census

**Exhibit IV-2**
**Hopi and Navajo vs. Arizona and United States Socio-Economic Conditions**
**2000**




Source: 2000 Census

**Exhibit IV-3**
**Rates of Unemployment**
**Hopi and Navajo vs. Arizona and United States 2008**




Source: The Hopi Tribe and Testimony of Dr. Joe Shirley, Jr., President, The Navajo Nation Provided to the Senate Committee on Indian Affairs Concerning Law and Order in Indian Country, March 17, 2008, and Bureau of Labor Statistics.

The disparities between Hopi and Navajo wealth and infrastructure and general United States and Arizona wealth and infrastructure that were evident in the last Census do not show signs of disappearing or even narrowing in more recent data. While the economy of Arizona has boomed through most of the 1990s and 2000s, 1997 figures for Hopi show that approximately 78 percent of owner-occupied housing units within the categories of "Low Income" and "Very Low Income" were experiencing serious structural deficiencies as of the late 1990's.[40] Navajo water service data indicate that, on average, 40 percent of homes lacked piped water.[2] In fact, it is a common practice for citizens of the affected communities to truck water (often at extremely high cost) from distant sources, including Gallup, New Mexico, convenience stores, chapter houses, and Navajo Tribal Utility Authority facilities. Particularly indicative of the desperate lack of water and water infrastructure, tribal citizens also routinely truck water from storage tanks at stock ponds, raising serious public health concerns.[3]

[40] *The Hopi Tribe and the US Environmental Protection Agency Clean Air Partnership Report*, September 2004

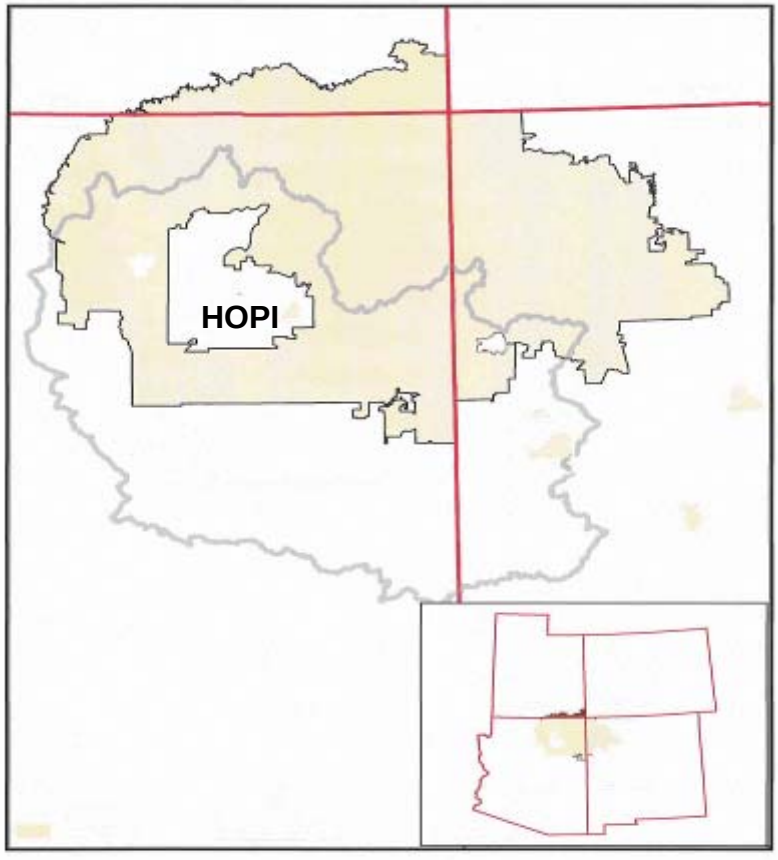
- **Non-Gaming** – Hopi is a non-gaming Tribe; Hopi having twice voted against gaming as an economic development option.

- **Lack of Alternative Resources** – Hopi is located in a highly remote location and lacks other resources and development opportunities.

- **Lack of Renewable Resources** - Hopi also lacks viable renewable resources and under no reasonable circumstance could the Tribe replace the economic loss of an NGS shut down through an emphasis on renewables.[41]

- **Mine is Physically Isolated** – Hopi is the only Tribe selling all of its coal from isolated mine without any rail access and with only one buyer (see Exhibit IV-4).

**Exhibit IV-4**
**Location of the Hopi Reservation**

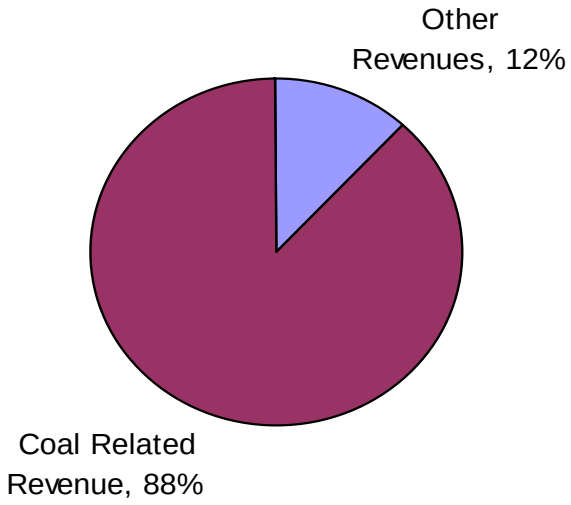



- **Economically Dependent on Coal** – The Hopi Tribe is the tribe most dependent on a single source of coal revenues in the United States. NGS accounts for 88 percent of the Hopi Tribe's revenues, and hence, the retirement of NGS would be

[41] See ICF study of the renewable potential of the Tribe. Available from the Hopi Tribe.

a huge blow to the viability of Hopi; the Hopi Tribe would effectively be shut down as an effective Tribal government (Exhibit IV-5).

**Exhibit IV-5**
**Hopi Revenue Sources**




- **Non-Profit Use** – The Hopi Tribal government using its NGS coal revenues for the provision of basic human services and other essential governmental services such as health, education, housing, law enforcement, social services, etc..

- **Many Hopi lack basic amenities including running Water**

- **Tribe needs time to transition to a non-coal economy** – A deadline of 2015 provides too little time to accommodate the need to investigate CCS, arrange coal mining extension, and transition to a non-coal or clean coal economy.

## IV.3 HOPI AND NAVAJO ARE ALREADY DISPROPORTIONATELY CARRYING THE BURDEN OF UNITED STATES ENVIRONMENTAL REGULATIONS

The shut down of the Mohave Generating Station in December 2005 already imposed a highly disproportionate economic burden on the Hopi and Navajo Tribes. The shut down of NGS, the only remaining buyer of Hopi coal after environmental regulations shut down the Mohave Generating Station, would devastate the Hopi Tribe and greatly harm the Navajo Nation. Such an outcome is unfair because the United States government holds the coal of Hopi and Navajo in trust for the development of these Tribes and the creation of viable homelands for these Tribes. An action that risks NGS shut down for marginal or zero benefit violates the Trust Responsibility of the United States government and is highly inimical to the goal of providing viable homelands to Hopi and Navajo. The impact of the loss of MGS sales is shown in Exhibits IV-6 and IV-7.

**Exhibit IV-6**
**Impact of Mohave Shut Down on Coal Sales (34% Decrease)**

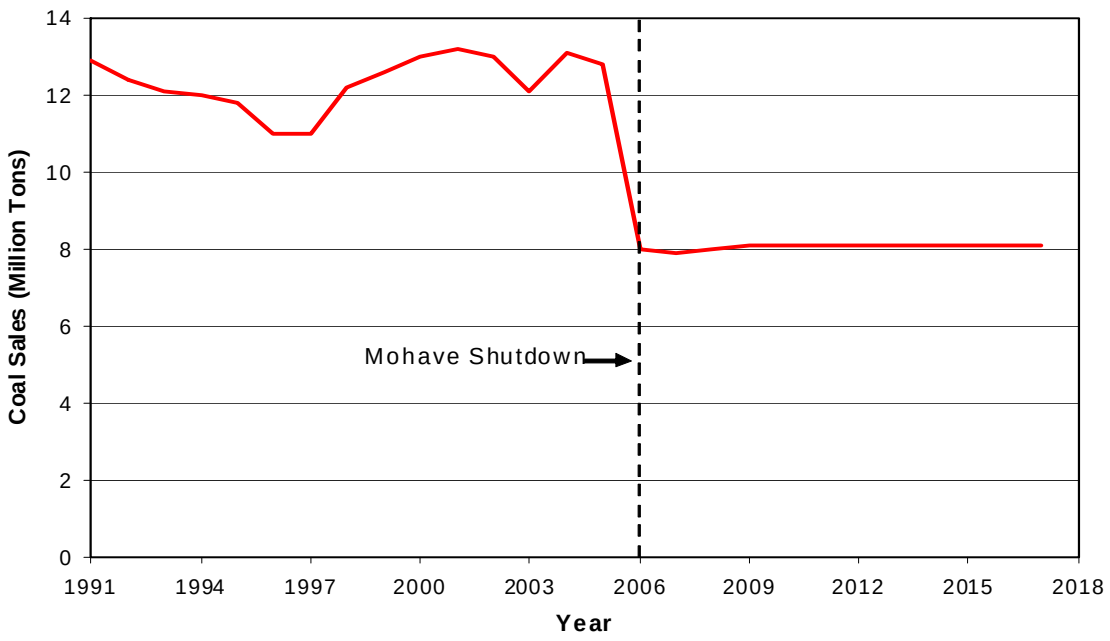



**Exhibit IV-7**
**Hopi Revenues – Effect of MGS Shut Down – Pre-2007 Negotiation Royalty Agreement ($MM)**

| Year | MGS Business As Usual[1] | MGS Shut Down[2] | Difference |
|---|---|---|---|
| 2008 | 16.02 | 9.61 | -6.41 |
| 2009 | 16.08 | 9.72 | -6.36 |
| 2010 | 16.13 | 9.82 | -6.31 |
| 2011 | 16.19 | 9.93 | --6.27 |
| 2012 | 16.25 | 10.03 | -6.22 |
| 2013 | 16.31 | 10.14 | -6.17 |
| 2014 | 16.37 | 10.25 | -6.13 |
| 2015 | 16.44 | 10.36 | -6.08 |
| 2016 | 16.50 | 10.47 | -6.03 |
| 2017 | 16.57 | 10.59 | -5.99 |
| Cumulative | 162.9 | 100.9 | -61.97 |
| NPV 5% | 125.6 | 77.6 | -48.0 |
| NPV 10% | 99.8 | 61.5 | -38.3 |

[1] $14 million per year average for 1999 to 2004. Coal (royalty and bonus) escalates at 1.0 percent which is the 1999 to 2004 escalation. Water escalates at 2.5 percent, the 1999 to 2004 rate. No change in coal or water volume. JUA share increases from 58.8 percent 1999 to 2004 to 67 percent. Royalties and bonus increase an additional 14 percent due to higher JUA.
[2] Same as BAU except no bonus, 38% less coal sales volume, JUA share 61 percent, 75% less water volume. NPV = Net Present Value.

## IV.4 CONSEQUENCES OF NGS SHUT DOWN

The shut down of NGS would have massive debilitating economic consequences on both the Hopi Tribe and the Navajo Nation. As shown in Exhibit IV-8, about 1,400 to 1,900 Hopi jobs will be lost permanently if NGS is shut down. Both of the Hopi and Navajo Tribes will have combined permanent job losses of 3,400-4,800 and combined annual revenue losses of $174 to $182 million if NGS is shut down. According to a 2008 report prepared for the Arizona Department of Water Resources, total Hopi employment was 2,722 in 2008[42]. The Hopi job loss estimate represents 50 to 70 percent of the Hopi employment in 2008. The situation could be worse considering that employment on the Hopi Reservation has declined since 2004. The job loss estimate is approximately 9 to 13 percent of the total Navajo employment[43].

[42] Socioeconomic Study in Support of a Hydrographic Survey Report for the Hopi Indian Reservation, submitted to Arizona Department of Water Resources, prepared by SWCA Environmental Consultants, April 2008.

[43] Estimated using total employment reported by Arizona Department of Commerce in its report, Economy of the Navajo-Hopi Region, January 2008. Table 1 shows total employment in 2004 was 24,338. Assumes the employment stays flat through 2008. Total Navajo employment = 24,338 – 2,722 = 21,616.

**Exhibit IV-8**
**Job and Revenue Loss if NGS Shuts Down**

| | PERMANENT JOB LOSS (#) | | |
|---|---|---|---|
| | **HOPI** | **NAVAJO NATION** | **TOTAL** |
| Tribal Government[1] | 400 | N/A | 400 |
| Hopi Village[2] | 144 | N/A | 144 |
| NGS[3] | - | 436 | 436 |
| Kayenta Mine[4] | - | 380 | 380 |
| Other Office[5] | N/A | N/A | N/A |
| Total Direct Job Loss[6] | 544 | 816 | 1,360 |
| Indirect Job Loss | 816 – 1,360 | 1,224 – 2,040 | 2,040 – 3,400 |
| Total Job Loss | 1,360 – 1,904 | 2,040 – 2,855 | 3,400 – 4,759 |
| | | | |
| | **ANNUAL REVENUE LOSS (Million $)** | | |
| | **HOPI** | **NAVAJO NATION** | **TOTAL** |
| NGS[7] | 14 | N/A | N/A |
| Payrolls & Benefits[8] | 8 | N/A | N/A |
| Indirect Payrolls & Benefits[9] | 12 - 20 | N/A | N/A |
| Total[10] | 34 - 42 | 140 | 174 - 182 |
| CAP Water Repayment to Both Tribes (Million$/Year)[11] | | | $60-$90 (2016-2023) |

[1] Hopi Tribal government employees totaled about 475. If NGS shuts down it assumes that the government would require 75 employees to maintain basic service. No information available for the Navajo Nation

[2] There are 12 Hopi Villages and assumes 12 employees from each village would lose jobs.

[3] 80% of 545 NGS employees are Navajos. (Source: Bureau of Reclamation /DOI comments to EPA date October 28, 2009, page 3)

[4] 90% of 422 Kayenta mine employees are Navajos. (Source: Bureau of Reclamation /DOI comments to EPA date October 28, 2009, page 3)

[5] Included in Tribal Government.

[6] Assumes multiplier effect of 1.5 to 2.5.

[7] Includes royalties, bonus, scholarships, and water payments. Annual Hopi revenue is projected for the period of 2019-2039. Navajo Nation revenue loss is estimated by subtracting payrolls & benefits from the total revenue and payrolls & benefits loss reported in the AZ governor's comments to EPA dated October 13, 2009.

[8] Hopi payrolls & benefits are estimated assuming Hopi per capita income in 2008 of $11,364 (Source:city-data.com) , 2.5% inflation, 30% benefits. For the Navajo Nation, information is not available.

[9] Assumes multiplier effect of 1.5 to 2.5.

[10] AZ Governor's comments to EPA dated October 13, 2009 on page 4 stated that NGS and Kayenta mine provide $140 MM in revenue and wages to the Navajo Nation and its tribal members. No breakdown is given.

[11] Source: CAP

# CHAPTER V
# CONCLUSIONS

The proposal that NGS be required to install SCR to meet BART requirements is not supported and should be rejected. This is because:

- There was no consideration or mention of the economic impacts on the Hopi Tribe and Navajo Nation. This is in spite of examination of the impacts on the utility plant owners and their ratepayers. The Hopi Tribe and Navajo Nation are key stakeholders. This oversight understates the costs is a fatal flaw in the process.

- The Hopi Tribe and the Navajo Nation are among the most vulnerable populations in the United States. The mining and power production are fully integrated as the plant is an isolated minemouth operation. The failure to explicitly factor in the impacts on the Tribes is therefore inexplicable.

- There was no mention of the obligation to factor in the Trust responsibility of the United States. There is no explicit evidence identified in the ANPR that the United States believes that the Trust responsibility should be ignored.

- There was no evidence that a balancing of these two interests, visibility and the interests of the Trustee, was even considered.

- The economic impacts on the Hopi Tribe would be catastrophic and the ability of the Hopi Tribe to have a viable permanent homeland would be eliminated or greatly impaired.

- The analysis of the lifetime of NGS and its ability to carry the costs of SCR was fundamentally flawed since it ignored EPA's own actions in the areas of $CO_2$ and mercury.

- A proper consideration of the impacts of SCR costs in combination with $CO_2$ and mercury show a significant risk that the plant would choose to shut down.

- Even if the economics of continued NGS operation are considered by the owners as moderately favorable, they may require changes in contracts and other arrangements to be willing to make large investments in NGS. The timeline of the BART process may prevent the restructuring of various contracts and negotiations among the many parties involved at NGS. Thus, the plant could be shut down because the regulation has inflexible timing.

- The evidence of SRP BART analysis shows little improvement of visibility. The improvement is not detectable by the human eye. The visibility problems are derived from other sources. The SRP analysis shows SCR worsens visibility at

the Grand Canyon relative to LNB/SOFA. The incremental costs of the proposed SCR controls greatly exceed the benefits.

- There is no evidence that even if the benefits were larger the costs including the devastation to the Hopi Tribe are justified.

- The capital costs of SCR are 15.8 times higher than LNB/SOFA.

- The incremental dollar per ton $NO_x$ removed costs are above $6,000/ton and are 13.3 times higher than that of LNB/SOFA. These $/ton costs assume 20 year lifetime for SCR. The capital costs are the other key input into the $/ton calculation.

- Because the expected lifetime could be much shorter due to the potential for shut down as early as 2015, the incremental $/ton costs of SCR could be much higher than EPA estimated. Thus, the economics of SCR are even worse than shown.

- There are costs associated with ammonia transportation, storage and slip caused by SCR that do not exist with LNB/SOFA. These costs were not fully included in the EPA calculations and reinforce the already strong conclusion that BART should not be defined as SCR.

# APPENDIX A
# BART SCR COST ESTIMATES

## APPENDIX A – SCR COSTS
## Source: ICF Compilation of BART Analyses

| Plant Name | Unit(s) | Unit Size (MW) | SCR Cost (2008 000$)[11] | SCR Cost (2008$/kW)[11] |
|---|---|---|---|---|
| Navajo Generating Station | 1-3 | 2250 | 663,000 | 295 |
| San Juan[1] | 1 | 350 | 160,150 | 458 |
| | 2 | 360 | 172,815 | 480 |
| | 3 | 544 | 220,026 | 404 |
| | 4 | 544 | 203,913 | 375 |
| Plant Average | | 1,798 | 756,903 | 421 |
| Boardman[2] | 1 | 617 | 194,726 | 316 |
| Jim Bridger[3] | 1 | 530 | 175,457 | 331 |
| | 2 | 530 | 175,457 | 331 |
| | 3 | 530 | 175,457 | 331 |
| | 4 | 530 | 175,457 | 331 |
| Plant Average | | 2,120 | 701,828 | 331 |
| Dave Johnston[4] | 3 | 230 | 128,191 | 557 |
| | 4 | 330 | 150,011 | 455 |
| Plant Average | | 560 | 278,202 | 497 |
| Lamarie River[5] | 1 | 550 | 121,748 | 221 |
| | 2 | 550 | 121,748 | 221 |
| | 3 | 550 | 121,748 | 221 |
| Plant Average | | 1,650 | 365,243 | 221 |
| Naughton[6] | 1 | 160 | 93,445 | 584 |
| | 2 | 210 | 114,554 | 545 |
| | 3 | 330 | 135,336 | 410 |
| Plant Average | | 700 | 343,335 | 490 |
| Oak Creek[7] | 5 | 261 | 106,637 | 203 |
| | 6 | 264 | | |
| | 7 | 298 | 93,504 | 153 |
| | 8 | 312 | | |
| Plant Average | | 1,135 | 200,142 | 185 |
| Edgewater[8] | 5 | 430 | 154,994 | 360 |
| Belews Creek[9] | 1-2 | 2,320 | 382,737 | 165 |
| **BART Average[10]** | | **427** | **155,308** | **355** |

**Notes:**

Source of NGS: Salt River Project, January 2009 Revised BART Analysis.

1 - Cost is for Unit 1 (350 MW) and Unit 3 (544 MW). Plant also has Unit 2 - 360 MW and Unit 4 - 544 MW. New Mexico Department of Environment BART analysis for San Juan.

2 - BART decision is to install LNB + OFA, but in case this does not meet EPA's standards, SNCR is to be installed as well. State of Oregon DEQ BART report on Boardman.

3 - Units 1 and 2 do not have to install SCR. Cost calculation shown is based on calculation as described in the first note. Note, this does not match NPS summary of $NO_x$ cost spreadsheet (314 $/kW). State of Wyoming DEQ BART Report on Jim Bridger.

4 - State of Wyoming DEQ BART Report on Dave Johnston.

5 - State of Wyoming DEQ BART Report on Lamarie River.

6 - State of Wyoming DEQ BART Report on Naughton.

7 - WE Energies South Oak Creek Units 5, 6, 7 and 8 $NO_x$, and $SO_2$, Emissions Reduction Study. Volume 1 Technical and Appendices Addendum August 20, 2007. Part of application to install SCR.

8 - Wisconsin Power and Light Company, Certificate of Authority Application Edgewater Generating Station Unit 5 $NO_x$ Reduction Project. November 13, 2008.

9 - "SCR = Supremely Complex Retrofit." Steve Blankinship, Power Engineering, November 2008. Belews Creek capacity from SNL Financial.
http://pepei.pennnet.com/display_article/162367/6/ARTCL/none/none/1/SCR-=-Supremely-Complex-Retrofit/

10 - Average Cost (2008$/kW) is capacity weighted average. Average only includes of BART analysis plants.

11 - 2008$ cost figures are calculated using BEA's GDP Deflator Index.