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POSSIBLE ENVIRONMENTAL EFFECTS OF INCREASED  
COAL USE IN CALIFORNIA

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ABSTRACT

If coal is to be utilized in California it must be made compatible with the State's drive toward restoring environmental quality. The impacts resulting from coal's mining and transportation, or from water consumption, water quality degradation and electric transmission line routing can probably be adequately mitigated through strong and early planning efforts, the use of improved control and process technologies, and sincere utility commitment. The socioeconomic impacts may prove somewhat more difficult to satisfactorily mitigate. Of greatest concern is adequate control of generated air pollutants and disposal of solid and liquid wastes since acceptable technologies or handling techniques have yet to be conclusively demonstrated.

I. INTRODUCTION

Coal definitely has the reputation of being a "dirty fuel," and, in many cases, that reputation is not without good reason. We need not look too far into the past to remember scenes of skies darkened by clouds of ash from coal-fired power plants. Things have changed somewhat in the recent past, for there has been a lot of improvement in technologies, in regulations and in commitments that have resulted in a significant clean-up of the newer facilities. If one looks at the future with some optimism there may indeed be even greater chance of cleaner, less environmentally destructive coal-burning facilities. In fact, there have been statements already that that future is now, that this "clean coal" future is already available. Most of the other papers in these proceedings be discussing these "clean" technologies, and this paper will leave it to those proponents who know more about the technologies to attempt to demonstrate that they are in actuality now feasible. It is our belief, however, that no matter how it is undertaken coal utilization is going to result in a large number of environmental impacts, many of which cannot be adequately mitigated through the use of any type of advanced technology. This paper will mention many of these environmental impacts, specifically those which may result from an effort to utilize coal in California.

It has been pointed out that California does not have any economic coal reserves. This does not change the fact that coal mining, wherever it occurs, will cause detrimental environmental effects which should be evaluated. California cannot externalize the environmental disbenefits of other segments of the fuel cycle by discussing only the impact of coal use within the state. This is just as one must assess the environmental and economic impacts of the entire fuel cycle of any other generation technology. Thus we have need to consider the impacts resulting not only from the utilization of coal but from its mining and transportation as well.

II. THE MINING SEGMENT

Impacts can occur from either subsurface or surface mining, and they can be large-scale impacts. The size of today's large coal mines can range from one to three million tons per year for individual underground mines, to nearly ten million tons per year for the very large surface mines. These large mines require a tremendous number of workers, both in the mine itself and in the beneficial on cycle. The introduction of these new workers can result in tremendous disturbances to the local socioeconomic system, a system which is often unstable enough in already established districts, but which can be essentially nonexistent in some of the remote, unpopulated areas where new mines may be opening in the near future. These small rural economies can expect a population influx that would completely change their entire socioeconomic system.

Surface mining will require a direct and substantial commitment of land to a use whose impacts are usually not totally reversible. Landscape modifications, surface and ground water disturbances and pollution, and significant wildlife and vegetation disruptions can result. Ecological network alterations can require decades to reestablish, and even with restoration we are not always convinced that complete reestablishment is possible. In subsurface mining, subsidence of the surface and disruption to ground water are both significant impacts. Since only

approximately fifty percent of the coal in any seam mined underground can be recovered, a lot of that coal resource is left in the ground. Significant water pollution can also occur from underground mining. Underground mining is still one of the most hazardous occupations in the United States today. The beneficiation process that takes place at the mine can produce large quantities of solid waste. Sometimes ten to twenty percent or more of the mined product has to be discarded. These discarded wastes, as well as the beneficiation process itself, could lead to additional air and water pollution.

### III. THE TRANSPORTATION SEGMENT

The over-water movement of coal, from either Alaska or Washington via seagoing barges, has been considered as a viable coal transportation option. Any establishment of a large seagoing traffic in coal could result in the need for additional port facilities and the destruction of coastal resources.

The environmental impacts that may result from the use of a coal slurry system are generally more benign. Some air quality degradation will result from the preparation process. The water that is used in the slurry is not consumed in the slurry and can be reclaimed and used at the power plant. This would, however, result in interbasin or interstate water transfers, which are likely to be politically, if not environmentally, significant. Slurry transportation does result in a higher energy cost in that the residual water left in the coal after drying does result in a one to two percent decrease in the amount of available heat from the burning process. Coal slurries, of course, do have a fixed throughput which allows very little flexibility in altering the amount of coal delivered to the utilization site. Construction impacts are generally minimal in that from two to six weeks from the first impact the land can be restored (or at least attempted to be restored) to its original condition. Coal slurries are also generally safe.

Coal transportation, on the other hand, can result in a much larger number of safety and environmental impacts. As an advantage, it does have a variable throughput. It does not lose heat to the combustion process through the addition of water, but requires energy to move those locomotives, either electric or diesel. Relatively large amounts of air pollution can result from coal transport by rail via losses in transit. The movement of a large quantity of coal by rail can lead to quite significant social impacts to the areas through

which it runs. A 1000 Mw coal plant will probably require about 300 unit trains per year to supply it with coal. That is 600 trips through every town along the route, a tremendous impact to any local rail community.

### IV. THE UTILIZATION SEGMENT

The list of the possible impacts from coal utilization could be enormous, so herein will be described only those considered most significant. These most conveniently fall into the categories of impacts to air quality, water quality and supply, socioeconomic systems and land use. Since others in these proceedings will be specifically discussing the impacts to and constraints of air quality and water quality and supply, these topics will be only lightly touched upon below.

Possible degradation to air quality has so far received the most attention, and it appears that this is rightfully so, as it is probably the most critical and yet undefinable constraint. It must be said that we cannot afford to compromise California's progress toward achieving compliance with the Clean Air Act and its amendments as the price of meeting a portion of the State's energy demand with coal, and that it appears necessary to have at a minimum those recently described advanced control technologies and processes correctly incorporated into any California coal-fired power plant before it will be capable of meeting our air standards.

Water is a constraint to any large power project and coal, of course, is no exception. We do believe that the State's existing policy correctly places the consumptive use of fresh water by power generation facilities as the lowest possible priority, and that this does restrict the alternatives that coal-fired power plants can utilize for their water.

The term "land use" impacts is used here as a catch-all phrase to describe any impact to land-based systems. For example, a 1000 Mw power plant will probably utilize anywhere from one to two thousand acres for structures, transportation facilities, coal storage, water storage and liquid and solid waste storage or disposal over the life of the plant. Many of these are going to be irreversible land commitments in that restoration is going to be a very difficult task. Tremendous quantities of solid and liquid wastes are going to have to be disposed of, and, at present, the techniques utilized to dispose of these wastes are very crude. As an example, the current technology for

liquid waste disposal is in open storage ponds. Most biologic communities can be tremendously affected by not only the siting of a power plant itself, but by the increased activity of man in the surrounding environment. Impacts resulting from the emission of trace elements is an often overlooked and poorly understood result of coal burning. The visual impacts of the project, with its gas stacks over 700 feet high, along with the plant itself, the storage ponds, cooling towers, transmission lines, etc., can be tremendous. Finally, there are the possible conflicts with existing and planned other land uses. For example, the desert wilderness area in California is being evaluated by the BLM for wilderness areas and there are plans for a Mojave national park.

Some very direct socioeconomic impacts result from the construction of a coal-fired power plant in a generally remote area. The primary concern is over the boom and bust cycle of intense employment in construction activities, followed by a very reduced employment opportunity in the actual operation of the plant. Large plants mean, of course, large booms and large busts. One possible mitigation option may be to try to limit the size of these units to smaller, more moderately-sized facilities, thus limiting the size of the amplitude of the cycle. We could also then possibly try to locate these facilities closer to our load centers. This system would allow us to tailor the construction of new plants to better meet our incremental power needs. With smaller plants we would also be able to more rapidly utilize advanced coal combustion technology or methods, or control technology or methods, as these advanced processes became available.

#### V. CONCLUSIONS

We believe that improved coal utilization and pollution control technologies can help to alleviate impacts, but technology alone cannot solve all of the anticipated impacts. The new technologies cannot solve the socioeconomic impacts, and they cannot completely solve the air and water quality impacts. Good planning can help to alleviate many impacts, specifically those arising from coal mining and transportation, from water consumption and water quality degradation, or from electric transmission line routing. The staged construction of relatively moderate sized facilities can help to alleviate socioeconomic impacts but cannot eliminate them. Our primary concern is that the potential problems of air quality degradation and waste disposal as solutions to these problems have not yet been adequately developed or tested.

In summary, if coal is to be utilized in California, it must prove itself to be an environmentally viable energy source, as must any other energy source. All effects of the entire coal fuel cycle must be considered and weighed against the perceived benefits, and these costs and benefits compared with other alternative generating sources. Coal utilization in California, or anywhere else, does have inherent in it a large number of environmental impacts which need to be mitigated before it can be rationally used. Although a maximum diversity in our energy production mix can assist us in meeting California's energy needs, we cannot rely on going with coal as a big way for it is not a panacea for our problems. Coal utilization can only be considered as an intermediate term measure, necessary only to provide electric power until such time as other advanced systems utilizing renewable resources are fully capable of supplying our energy requirements. We cannot expect coal to be both clean and cheap, nor can we afford to utilize anything but clean coal.

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