

COAL'S ROLE IN SUSTAINING SOCIETY – AN INTEGRATED-MESSAGE APPROACH

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Abstract

The mining industry has searched for a message that will resonate with the public while focusing on the industry's positive contributions to society. Thus far environmental groups remain unconvinced, and the public is still largely uninformed. In the authors' opinion, a number of recent events and experiences have converged to help shape a more effective public communication on mining's important role. This paper presents a fresh and cogent perspective on coal's role in sustaining society by anchoring the message in a transparent material flow analysis that links coal's impacts across a broad range of social and environmental aspects.

Past and Continuing Image Problems

In her 1994 paper, Nancy Bingham outlined what the public thought about mining.¹ In a nutshell, based on extensive interviews, the following results were found:

- The public believed mining harms the environment.
- The public believed mining harms people in nearby communities.
- The public believed mining exploits workers.
- The public believed mining has little personal benefit to the individual.

The past and continuing image problems are now affecting recruitment of new miners in a growing industry that has many workers ready to retire, which exacerbates the labor shortage. Some depth will next be provided in why, beyond anecdotes, the public feels the way it does.

Workforce Issues

Miner health and safety in the 20th century was marred with a public image of death and sometimes deception, especially in the coal sector. From 1900 through the 1920s, over 3000 miners perished at work per year, with two-thirds dying in coal mines.² Grandfathers and fathers discuss the high number of fatalities, and some of them speak of events they survived that were caused by fires and explosions. Major disasters persisted through 1972. The memories and stories are still etched in the minds of families living in coal mining regions, and they are a stigma on the industry's public image as well as a deterrent to recruiting new miners.

Another image stigma and recruitment deterrent is the history of miners succumbing to coal workers' pneumoconiosis and silicosis. Not until the Federal Coal Mine Health and Safety Act of 1969 were these problems significantly combated, and even today the diseases have not been eradicated. The public, especially in coal regions, is well aware of the ordeal.

The great early-century 'war' between owners/operators and miners' unions has not been forgotten either, with some grandfathers still carrying buck shot from ill-fated organization drives. Battles between the two foes carried through the 1970s when strikes occurred during ineffective contract negotiations. These images, including gunfights at places like Matewan, were also indelibly written in history as negative public images of the industry.

Environmental Damage

Beginning in the 1960s and 1970s, environmental damage and indifference to its impacts began taking the forefront as a key issue marring the coal industry's image. Large gob piles dotted the landscape in Appalachia particularly, and acid mine drainage fouled rivers and streams, often robbing the public of fish and recreation. Not until 1977 was any serious federal action taken to coordinate improvement of environmental performance, which is one of the key pillars of the sustainable development movement.

Community Issues

Appalachian towns were poor in the early 20th century, and thousands of coal mines helped change some of that, admittedly sometimes at a large human cost. By the 1960s miners' pay was improving drastically, and today it is excellent. However, the investment in communities was little, except for tax revenues. Thus when coal mines shut down, the revenue source ended, and the towns reverted to poverty. This was a story repeated frequently, and the syndrome led to major stories such as *The Curse of Coal*.³ Some of the press even predicted *The Death of Mining*,⁴ hoping it would come true.

Sustainable Development and Mining

From the foregoing accounts of negative impacts on public image, the coal industry was shunned by most and reluctantly accepted by some who depended on it for a living. Owners/operators largely did not try to change the image, but rather focused on the business of making money. Massive damage was done to the business by focusing on the status quo, and in the 1980s and 1990s the global public drove a cry for significant change in the way business would be allowed to operate. Sustainable development concepts were born and then inexorably locked in.

Evolution of Sustainable Development

The most famous definition of sustainable development came from the Brundtland Commission,⁵ stating it as "... a notion that there may be limits to growth and that society must be reorganized to protect the interest of future generations." This is a simple definition, but it is easily understood by the global public. Many government organizations as well as non-government ones and industry have different, sometimes widely divergent definitions.

The concept of sustainable development and its principles grew from early writings on environmental transgressions and land ethics.^{6,7,8} As a growing number of countries responded to the issues, international conferences began to focus on them.

In 1972 the Stockholm Conference⁹ was an early effort aimed at linking ecological conservation with economic development. Largely inspirational in nature, the conference produced a declaration consisting of 26 principles along with a 109-recommendation action plan. The principles and recommendations focused on soil erosion and loss, desertification, tropical ecosystem management, water supply, and human settlements. However with very low representation among less-developed countries, the 'compact' among participating nations was not binding, and thus the action plan failed on a global basis.

The next major conference occurred in Switzerland in 1980¹⁰ with the stated 'central theme' as follows:

"The combined destructive impacts of the poor majority struggling to stay alive and an affluent minority consuming most of the world's resources are undermining the very means by which all people can survive and flourish"

The three primary aims of the gathering were the following:

1. To maintain essential ecological processes and life-support systems,
2. To preserve genetic diversity, and
3. To ensure sustainable utilization of species and ecosystems.

The report, *World Conservation Strategy*, had a mixed response, and was aimed primarily at government policy makers, conservationists, and economic developers.¹¹ Since it didn't involve citizens in general, it didn't create public demand for change nor galvanize action at the grass-roots level. However over 40 nations committed to preparing national strategies aimed at achieving priorities and removing impediments to effective action. Further, some of the countries switched to a conservation orientation.

The greatest impact driving sustainable development was made by the commonly dubbed Brundtland Report, entitled *Our Common Future*, in 1987.⁵ The major outcomes included the following:

1. It proposed long-term environmental strategies for achieving sustainable development by the year 2000 and beyond;
2. It recommended ways in which concern for the environment could be translated into greater cooperation among developing countries and between different countries at different stages of economic and social development, hopefully leading to development of common and mutually-supportive objectives;
3. It considered ways and means by which the international community could deal more effectively with environmental concerns; and
4. It facilitated shared perceptions of long-term environmental issues and the appropriate efforts needed to deal successfully with the problems of protecting and enhancing the environment, a long-term agenda for action during the coming decades, and aspiration goals for the world community.

Although it suffers from vague, multiple definitions of sustainable development, it changed the way governments, environmental organizations, and industrialists view the environment. It no longer was viewed as an externality to economic matters. Since that time more and more businesses have adopted sustainable development and its principles as guiding aspects in their planning and execution of operations. It also galvanized sustainable development on the political agenda of numerous countries. Sustainable development has been at the forefront of global gatherings ever since, e.g., the 1992 Rio Earth Summit and its Agenda 21, and the 2002 World Summit on Sustainable Development in Johannesburg.

Mining Begins to Embrace Sustainable Development

By 1998, nine of the largest mining companies embarked on a new initiative aimed at achieving a serious change in the way their industry deals with ongoing problems, dubbing it the Global Mining Initiative.¹² The joint research project executed by the International Institute for Environment and Development (IIED), focused on finding "a more informed understanding of the industry's actual and potential contribution to sustainable development" since the industry partners agreed "it is no longer enough to argue that because society needs its products, it must tolerate whatever occurs in their production." Further, it is not "enough to play to a public audience conditioned to expect the worst from mining or other minerals industries." Finally the initiative's partners noted that "we need to define what higher performance amounts to, and create sanctions and incentives to achieve it."

A set of guiding principles for the four 'pillars' of sustainable development were specified early in the study and used as a framework of issues to be addressed. The four pillars, each with three or more sub-principles, included the following major spheres, which are to "be applied in an integrated manner in decision-making":

- Economic Sphere
- Social Sphere
- Environmental Sphere
- Governance Sphere

The report specified important key challenges that must be met in order to achieve the major goal. The nine key challenges, worth repeating here, include the following:

- Viability of the Mineral Industry
- The Control, Use, and Management of Land
- Minerals and Economic Development
- Local Communities and Mines
- Mining, Minerals, and the Environment
- An Integrated Approach to Using Minerals
- Access to Information
- Artisanal and Small-Scale Mining
- Sector Governance: Roles, Responsibilities, and Instruments for Change

With sustainable development outlined, the point must now be made that mining cannot have sustainable development of itself; rather mining plays an important role in sustaining society by provision of raw materials. That role must be pursued in consonance with sustainable development principles.

The New Social Responsibility

Breaking New Ground outlines a new social responsibility for the mining industry that is consistent with the sustainable development framework. Importantly it bases the approach to achieving sustainable development on "clearly defined objectives and incentives to change towards better practice," with actions anchored aimed at being "specific, monitorable, achievable, realistic, and time-bound." It aims the new approach to mining business as "moving towards higher levels of trust and cooperation" with all constituencies, and, as practicable, "it is built on existing structures and institutions."

Building Transparency and Trust

Since the commitment of many mining companies to the Mining, Minerals and Sustainable Development (MMSD) Project, their web sites have now become avenues for revealing progress through downloadable progress reports. By doing this, they are engaging all constituencies impacted by their business with transparent data and information, and working toward the important goal of building trust. A few of the web sites follow:

- Anglo American plc - <http://www.angloamerican.co.uk>
- BHP Billiton - www.bhpbilliton.com
- Newmont Mining Corporation - www.newmont.com
- Phelps Dodge Corporation - www.phelpsdodge.com
- Rio Tinto plc - www.riotinto.com

Coal's Role in Sustaining Society

The public perceptions of the coal industry in the U.S. are replete with historical accounts built on deaths from fires and explosions, labor strife, serious adverse environmental impacts, economic cycles of highs and lows marred with huge retrenchments, and abandonment of community support post-mining. The press captured all of the negative impacts, and seared the stories indelibly in the public's mind. In essence, the public believed that the industry sustained itself at the expense of people and the environment. There is much to be done to reverse the negative perceptions, and build trust among all constituencies. There are ways of doing it, but obviously it will take time. Placing the new message in the context of the nine key

challenges outlined in Breaking New Ground could make a difference, and there is some evidence that it works in changing the image of the coal industry.

Viability of the Industry

When presented the facts on coal's role as an energy source (23%), no one will deny it. Most of the population doesn't realize how much coal is used, or that it often has the competitive advantage. On the other hand, most of the population is familiar with the emissions from coal, calling it 'dirty', but not with clean coal technology. When told that over 1 billion tons of coal are produced in the U.S., primarily to generate over 50% of our electricity, people are often stunned. If presented in a picture similar to Figure 1, which shows the 'materials

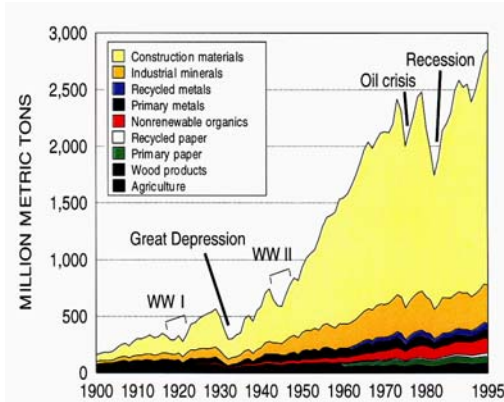


Figure 1. Measurement of the raw materials consumed in the United States, 1990 to 1995.¹³

mountain' infused into the U.S. economy, coal's role would quickly come into perspective. Adding coal and other energy sources to this figure will emphasize its role in the economy, and build the case of its economic viability, which can be reinforced by Figure 2, especially when the coal production states are highlighted.

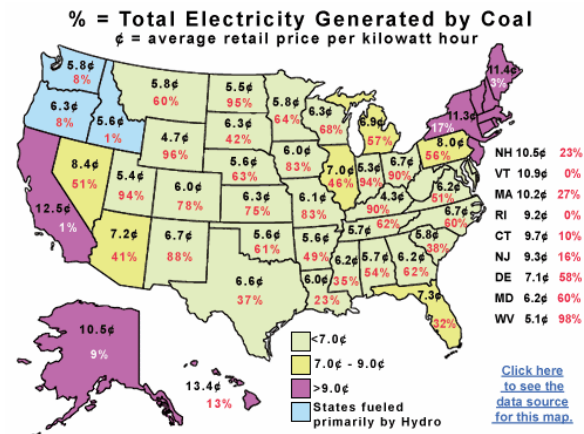


Figure 2. Cost of electricity by state. Source: DOE (EIA)

The case is made definitively when a strong negative correlation (-0.801) is noted between the cost of electricity in a state and the percentage of coal used for generating it in a state. Of course, handling the environmental impacts effectively will need to be discussed to convince the public that it is the right choice without significant negative trade-offs. The crowning point, and possibly the most persuasive argument for its sustained use, is the vast reserves which can fuel electric power in the U.S. for another 200 to 250 years. Inevitably a stable supply will maintain a stable price and therefore a stable economy.

Coal and the Environment

Using pictures to illustrate how coal is used can also be helpful (see Figure 3). Coupling the picture with facts on emissions reductions and other pictures on new clean coal technology makes the convincing

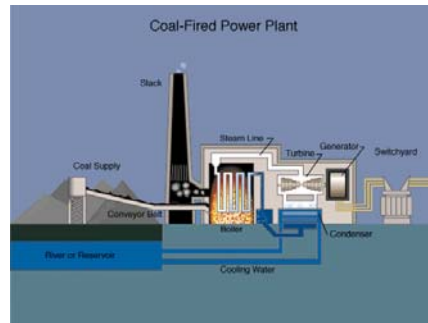


Figure 3. Schematic of coal-fired power plant. <http://www.eas.asu.edu/~holbert/eee463/ENERGY.HTML>

case that air quality does not have to be compromised when coal is used for electric power generation. For example, the reduction of criteria emissions (carbon monoxide, lead, nitrogen oxides, ozone, particulate matter, and sulfur dioxide) since 1970 has been tremendous despite dramatic growth in coal consumption (see Figure 4).

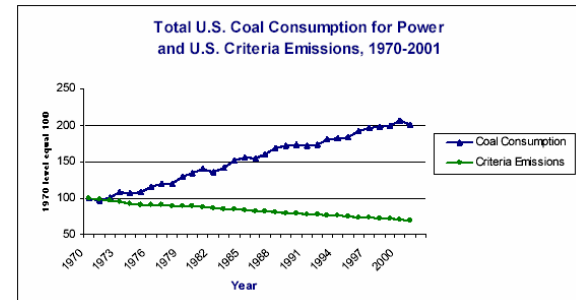


Figure 4. Emissions reductions from coal utilization. Source: DOE (EIA)

Another convincing illustration of emissions reductions is dramatically shown in Figure 5.

ENVIRONMENTAL BENEFITS DURING THE CCTP ERA

Year	Coal Use for Electricity Generation	Coal NOx Emissions	Coal SO ₂ Emissions
1980	569	6.12	16.1
1985	694	5.24	15.6
1990	783	5.64	15.2
1991	784	5.56	15.1
1992	795	5.58	14.8
1993	832	5.74	14.5
1994	838	5.64	14.3
1995	850	5.58	11.6
1996	897	5.60	12.2
1997	921	5.64	12.6
1998	937	5.44	12.5
1999	941	4.91	11.8
2000	986	4.56	10.7
2001	954	4.21	10.6
2002	978	4.10	9.7
2003	1,005	n/a	n/a

Annotations: A red arrow points up from 1980 to 2003 with text 'COAL USE UP 77%'. A black arrow points down from 1980 to 2003 with text 'COAL NOx EMITTED DOWN 33%'. A black arrow points down from 1980 to 2003 with text 'COAL SO₂ EMITTED DOWN 40%'.

Note: All data in million short tons. Figures are rounded. Total emissions reductions are due to several factors, which include increased commercialization and deployment of clean coal technologies. (Sources: Energy Information Administration, Environmental Protection Agency)

Figure 5. Effective graph for emissions reductions. Source: DOE (EIA)

Further assuring the public that good science is directed at even better reductions is important. Showing diagrams of new clean coal

technology plants and the associated pilot project outcomes gives a clear picture of progress and protection of public health. For example, Figure 6 shows an Integrated Gasification Combined Cycle (IGCC) plant that was tested in Florida, achieving a 95% removal of SO₂ and keeping NOx below 0.27 lb/106 BTU.

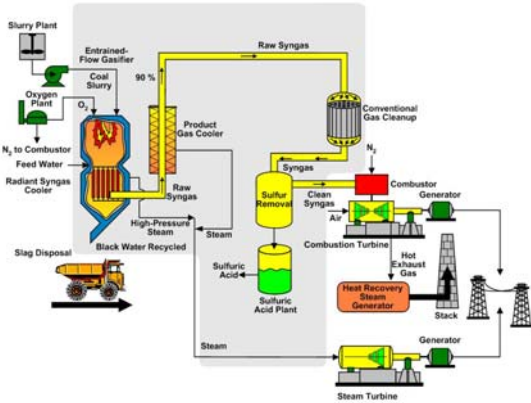


Figure 6. Tampa Electric IGCC process flow diagram
Source: DOE

Ultimately public awareness of various treatments and their ultimate effects provide the comprehensive information need to build confidence in coal as the primary source for power generation. For example, we now know that limestone injection, low-NOx burners, selective catalytic reduction, dry precipitators, wet scrubbers, and wet precipitators can give the following results:

- 98% removal of SO₂ (0.167 lbs/MMBtu)
- >80% removal of NOx (0.09 lbs/MMBtu)
- Particulate removal of 99.9%
- Mercury removal up to 90% (more work needed)
- Sulfuric mist removal of 98%

Although a tougher effort to demonstrate clear improvements, the reduction of coal waste disposal and acid mine drainage are important points to be made as well. Ensuring that news items on new power generation facilities that use coal waste and remove gob piles can help. Demonstrating through facts the return of fishing to once-polluted streams and rivers is also needed. Success stories like the vast improvement of the Monongahela River in Pennsylvania and West Virginia will make the case very well. Numbers are needed.

Coal's Role in Economic Development and Relationships with Local Communities

In the past we focused on showing the correlation of coal production with growth in the GDP (see Figure 7). Quite frankly this doesn't resonate with the public, which focuses on what the industry will do for its local economy.

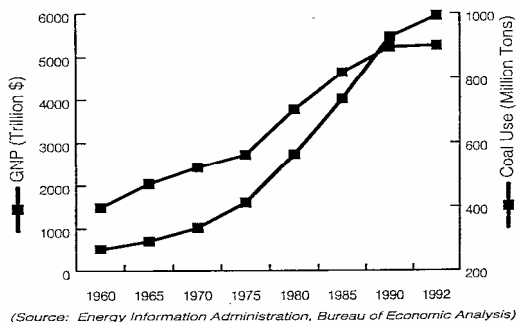


Figure 7. Correlation between increased coal use and Gross National Product, 1960-92.
Source: DOE (EIA)

The current efforts by Peabody Energy and Arch Coal, which are focusing on building energy campuses with utilities, resonate strongly locally. The economic multipliers for the region are clearly delineated and generate buy-in by the communities involved. Permitting at the state level is another matter, and still difficult, but the community buy-in creates an atmosphere of support, which has clear political influence. By embracing the long-term existence of the energy campus and its synergy through community building, the case is made convincing of a community-based partnership.

An Integrated Approach to Using Coal

Data and information exchanged on the various aspects discussed thus far is helpful, but if provided alone there are gaps in understanding by the average citizen. Without an integrated linking of the economic, environmental and social impacts, gaps in knowledge and understanding ultimately occur and lead to gaps in acceptance and mistrust. Thus presenting information in a way that cultivates full understanding of the issues pays huge dividends.

Material flows analysis is a way of presenting interrelations among physical aspects of coal flows in the U.S. economy and their potential impacts. The impacts may be quantified as well in an associated analysis of flows to the environment. Economic impacts may be quantified by linking the physical flows with associated monetary flows. In essence a material flows accounting system is an analog of a monetary flows system, which is called an economic input-output model and has been in existence for decades to help guide governmental fiscal policy-making. Linking material flows accounts with associated financial flows accounts expands the understanding of non-financial impacts on the nation.

A general economy-wide material flows accounting system is shown in Figure 8.¹⁴ The key focuses are on physical inputs to and outputs from the economy, but diagrams also track the build-up of materials in stock (in infrastructure primarily). Imports, exports, both used and unused extractions, and indirect (or hidden) flows associated with material extractions are shown. Such diagrams may be modified to show exactly where flows go to the environment (air, land, and water). Of course, environmental disturbances generally occur on the materials extraction and storage side as well.

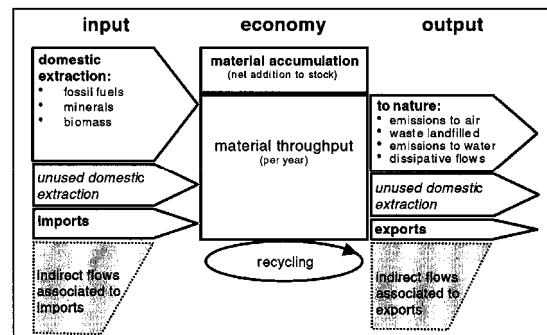


Figure 8. General scheme for economy-wide material flows accounting illustration.¹⁴

Figure 9 shows an early (1993) material flows analysis for the U.S. coal industry done by Ayres and Ayres.¹⁵ It shows the paths of consumption as well as various emissions that occur. Added to the diagram are colors representing the potential impact on the environment, while realizing the level of monitoring and control that can be exercised by various operations, both extraction and utilization types. Much of the data is generally available through the Energy Information Administration, but much of it is not. For example, considerable work is required to make a reasonably accurate calculation of the coal mine overburden disturbed, other emissions from extraction, the amount of refuse generated from coal cleaning, and the emissions from coking and power generation. In fact

Warneke¹⁶ noted several discrepancies from the previous 1993 analysis.

Beyond the material flows analysis picture, which the public generally will understand, is a description of the ultimate impacts the flows have on people. These impacts can be illustrated through the use of Driving Force-Pressure-State-Impact-Response models.¹⁷ Figure 10 shows one possible model for emissions from coal utilization. The driving force is this instance is the production of coal itself, while pressures are exerted on the environment by acidifying, global warming, and other polluting (CO, NO_x, SO₂, PM, etc.) emissions. The state resulting from the pressures relates to the total amount of substances in the air as well as the mean temperature and other effects of the various emissions. The ultimate impacts people and society care about relate to their survivability, their health, availability of food and potable water, and aesthetically pleasing recreational areas. As negative impacts occur to an unacceptable level, then the public response eventually influences government policy, and laws are passed or regulations revised to reflect the desire for reduced negative impacts.

Transparency of Information

For the entire integrated approach to work in building trust among the public constituencies, information must be available for anyone to examine, if desired. One of the best examples of this approach is the commodity flow information developed are shared by the United States Geological Survey.^{18,19} This data is open for public access, but at the same time it protects proprietary information of data providers.

Companies wishing to build public trust and indicate social responsibility as stewards of the communities in which they work, the environment, and of sustainable development principles will need to

share their data and information, too. Transparency of data equates to absolute trust that the data and information will tell the true state of affairs, and misuse of the data will reveal itself.

Small-Mine and Contractor Issues

A lingering issue in the U.S. and elsewhere is the small-mine and contractor health and safety performance. Worker health and safety is one dimension of sustainable development, but it is an important one that cannot be neglected. Elevated fatality rates for small mines and contractors operating in the U.S. are now a pressing human rights issue, and they must be addressed soon. This issue is addressed extensively in another paper at this 2006 SME Annual Meeting.²⁰ Other countries, for example Australia, are taking action now to solve the problem with contractor safety.²¹

Addressing Sector Governance

In a perfect industry world, no government intervention would be necessary to ensure that sustainable development principles are addressed effectively. Instead the industry would 'police' itself, and work with government to rid the industry of 'bad players', including those who blatantly pollute the environment, subject workers to poor work conditions or exploit workers, and/or are devoid of any community responsibility (alienate the social contract). Unfortunately, no perfect industry world exists, and self-policing at present is only a good idea. Consequently, government intervention through regulation and enforcement will continue until the time that industry truly begins to self enforce.

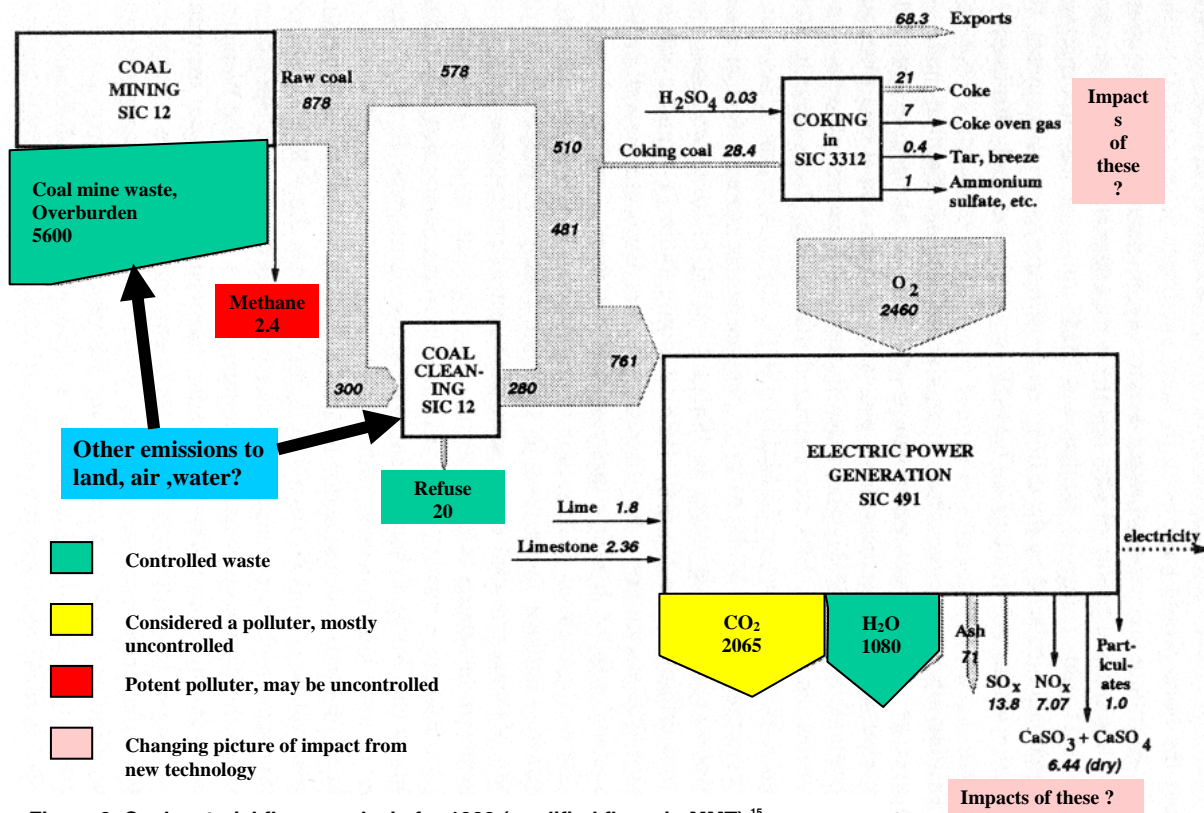


Figure 9. Coal material flows analysis for 1993 (modified flows in MMT).¹⁵

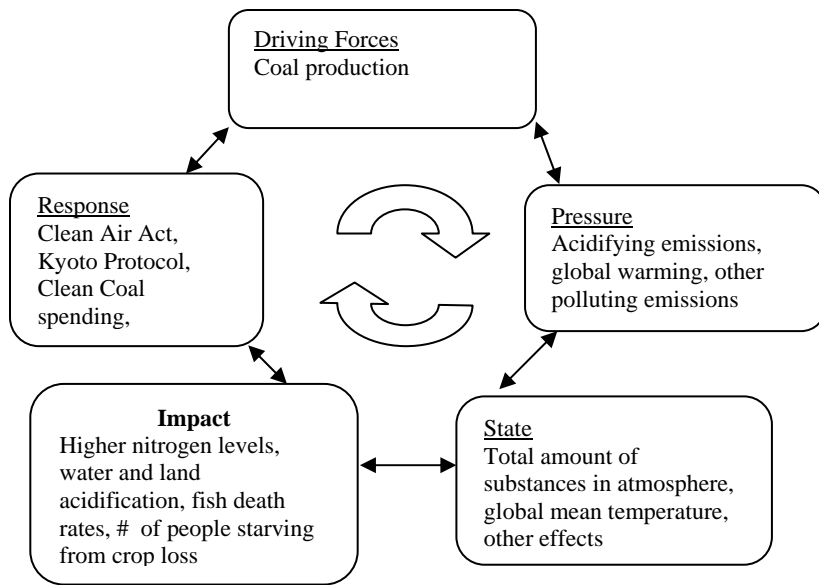


Figure 10. Driving Force-Pressure-State-Impact-Response model on emissions from coal production.¹⁷

Using Good Indicators of Contributions and Progress in Addressing Perceived Problems

Characteristics necessary for effective indicators include the following:²²

- Policy relevant:
 - Monitors the key outcomes of policy and legislation and measures progress towards policy goals.
 - Measures the issue's quality and relates to national/regional importance.
 - Provides information to a level appropriate for policy decision making.
- Measurable and analytically valid:
 - Representative of the system being assessed and shows reliability over time.
 - Developed within a consistent analytical framework.
 - Measures changes on an appropriate geographic and/or temporal scale.
 - Data is clearly defined, verifiable and scientifically acceptable (credible and robust).
 - Data collection uses standard methodologies with known accuracy and precision (statistical integrity).
 - Able to distinguish human-induced change from natural variations.
 - Helpful in relating causes, effects, and responses.
 - Responsive to environmental change and allows trend analysis or provides a baseline for future trends.
 - Possesses predictive capabilities.
- Cost effective:
 - Requires limited numbers of parameters to be established.
 - Uses existing data and information wherever possible.
 - Simple to monitor.
- Simple and easily understood:
 - Simple to interpret, accessible and publicly appealing.
 - Clearly displays the extent of the issues it represents.

Proactive Efforts and Positive Impacts

Looking at Nancy Bingham's article¹ once again, all is not lost, according to the public. She notes "The good news is that the most common beliefs about mining are not strongly held and are quite susceptible to change." It was clear from her study that "the information people do have comes mostly from movies and entertainment television, rather than textbooks or documentaries." This situation opens the door for good, integrated communication about our industry, which will lead to a change in public attitude about mining.

Conclusions

Although mines cannot be sustainable unto themselves, mining will long play a major role in sustaining society in many ways. Pursuing the principles of sustainable development has already begun to focus a new integrated message for industry that the public and government will understand, and they will often buy-in. The historical stigma attached to the coal industry is now being reversed, as the industry expands in the 21st century. Through a concerted effort using an integrated message we can make the change a permanent one. Those who work at mines or supporting operations are sustaining the massive U.S. economy, nurturing communities and workers, and are strong stewards of the environment. One day the industry will be self-enforcing as well, we hope, and the need more and more regulation will diminish because of prevailing good-faith efforts. In the meantime, we must be diligent in pursuing the principles of sustainable development and place strong peer pressure on all operators to do so.

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