UNABLE TO KEEP FURNACES GOING

OHIO STATE UNIVERSITY FORCED TO CLOSE ON ACCOUNT OF LACK OF COAL.

By Associated Press.
Columbus, O., January 10.—Ohio State University was compelled to close to-day in all departments except one, because of the cold weather and the lack of coal to keep the furnaces going. Two thousand students are thus excused from their recitations.
Reports from Central Ohio to-day show stock that is not sheltered suffering from the cold. There was a heavy fog early to-day and this froze on the stock. The weather throughout this section is the coldest of the season with one exception, the Weather Bureau reporting three below zero to-day.
FACULTY WILL MEET TOMORROW AT 4 P. M.

Uncertainty of Heat and Light Necessitates Daylight Session.

Lack of heat and light is having a wide effect on the working of the University, and students are not the only ones to have their meetings and regular schedules changed and postponed. Coincident with the statement by the President that tomorrow would be a holiday in the University, came the announcement that the regular faculty meeting would be held in daylight for fear that there would not be heat or light for the meeting if it was held at night, as is usual.

The statement of President Thompson is as follows:

"Thursday has been announced as a University holiday. On account of the uncertainty of the coal supply, and therefore of heat and light, it has been decided to hold the faculty meeting Thursday at 4 p. m., instead of at 7:30 p. m.

"W. O. THOMPSON."
ORDER LIGHTS OUT TO CONSERVE FUEL DURING SHORTAGE

In view of the fuel supply and in view of the necessity of conserving the amount of light and heat available, it is hereby ordered that all buildings used for instruction, including the Library, be closed at 6:30 p.m. and remain closed until 7:30 a.m., provided that in case of necessary public meetings and special University service, light and heat will be furnished upon the approval of the President.

This order shall take effect at noon on Saturday, December 8, 1917, and remain in force until further announcement.  W. O. THOMPSON.

December 7, 1917.
PRESIDENT GIVES EXPLANATION FOR CAMPUS SITUATION

Explains Why University Cannot Operate as Usual and Tells How Students May Help.

CARE AND THOUGHT NECESSARY

Ohio State, as Representative of Many Interests, Must Be Conserving, He Says.

Why it is impossible to carry on work at the University in the usual way, and how students can co-operate with the University in endeavoring to meet and solve the problems that are constantly arising, were two topics discussed by President Thompson in his convocation address in the Chapel yesterday morning.

Taking up the first statement, he said, 'Things cannot be carried on a...

COAL SUPPLY IS LOW; MORE EXPECTED SOON

University Unlikely to Close Until Railroad Tieup Prevents Arrival of Cars.

WILD REPORTS ARE UNFOUN...
said: "Things cannot be carried on as they have heretofore because we do not know what is ahead of us. Taking the coal situation: the University consumes 15,000 tons of coal annually, which is an average of 50 tons daily. Already $34,000 has been spent for coal and $30,000 to $35,000 more is needed to carry the University through the winter.

Advise Care and Thought

"So," he continued, "it is up to us to be as careful and thoughtful as possible. The University closes at 6:30 p.m. in order to conserve fuel. Tuesday the University had enough coal to last until today, with the promise of more, but we are sure of nothing, although we have confidence. Many people do not know yet that we are at war, and every person will have to realize that this war is the greatest event since the birth of Christ, before we can win the war."

President Thompson also remarked that it cost the United States 14 times as much to send one soldier to the front as it does France or England, and since all energies are expended toward carrying on our end of the war, it is our duty to bear what inconveniences are thrust upon us. "It is up to us," he said, "to be as conserving and careful as possible, and the University should lead in this, as it represents the interests of the entire state, and this is the least we can do."

The University will not close unless a tieup in the railroad traffic intercepts the coal on the way. Although there was only coal enough last night to last until this morning, a few cars were on the way with a supply which will hold the situation for another day. "Though we do not expect to have a large surplus of coal on hand at one time," said Carl E. Steeb, secretary of the board of trustees, yesterday, "there will be enough coming in to keep the University running."

Reports have been circulated to the effect that different classes in various buildings will be dismissed for the remainder of the semester, due to the inability of the power plant to heat the rooms, and that the fuel situation is so acute as to be necessary to close the University until warmer weather.

All these reports are false and unfounded and have not come from official sources. The University will not close until the situation is such as to warrant the sacrificing of coal intended for the University, to the public.
Concerning the Coal Situation

The University has been very much disturbed by the uncertainty of the coal supply. The unusual severity of the weather has added to the uncertainty. Every effort has been made to secure coal in sufficient quantity and with sufficient regularity to operate the University as usual. The efforts have not met with complete success. The situation at present is fairly hopeful. There is good reason to believe that the supply will be sufficient from this time on. However, a snowstorm blockading the railroads and a low temperature would create a situation of great uncertainty. These conditions are beyond the control of University authorities.

An effort will be made to proceed as usual. If all the buildings cannot be heated and utilized, the officials will heat as many as possible with the fuel available and ask teachers and students to adjust themselves accordingly. In case some of the buildings cannot be heated and provision cannot otherwise be made, the recitations and examinations will be excused. There is no reason to believe that all classes in the future will be discontinued; nevertheless, some of them may be. If available facilities are not sufficient to meet all the needs, they will be used as far as possible.

This statement is made in order that students and teachers may know how to proceed from day to day. The situation has probably been as bad in the last week as it ever will be and the prospect is that it will improve. A few examinations may be omitted, but the great majority of them will be provided for. The Ohio Fuel Administrator is earnestly endeavoring to meet the needs of the University.

January 23, 1918.

W. O. THOMPSON.
OSU contemplates conversion to coal

by Rich Moore

With the availability of future fuel oil and natural gas supplies questionable, the University’s conversion to coal for heating purposes is a long-term possibility.

Henry Whitcomb, director of financial management for the Ohio Board of Regents, said in the long run, conversion to coal by the major universities “is the only logical way to go.”

According to Dallas Sullivan, director of the University’s energy conservation program, Ohio State is contemplating replacing a boiler, which was installed in 1931, with one which has coal-burning capabilities. The old boiler was converted from coal to fuel oil and natural gas in 1970, and went out of operation last year.

“THERE IS a budget request for the engineering of the coal boiler program, but it hasn’t been approved yet,” Sullivan said.

Thomas B. Smith, associate vice president for the Office of Physical Facilities, said the installation of the coal burning boiler would be a three-year project and would cost from $4 to $5 million.

He added that this possibility is only being investigated, and no definite proposals have been made.

Whitcomb said money for the planning of systemwide coal conversions might be available in the next two-year budget which begins July 1.

“If the money for the planning is available in the upcoming budget, then the 1979-1981 budget would probably have funds for the construction of coal facilities,” Whitcomb said.

“We have to take a further look into the coal situation and its consequences,” Whitcomb said.

A coal conversion program for the state’s largest universities would take from three to five years at an estimated cost of $50 to $100 million dollars, Whitcomb said.

COAL WAS last used in the McCracken Power Plant in 1970, Smith said. The conversion from coal to fuel oil and natural gas in 1966.

“We changed from coal because of environmental reasons,” Smith said. “Coal is extremely dirty and there was no place for the smoke to go.

We’re surrounded by residential areas.

“If we were to change to coal, a new coal-burning facility would have to be built. It wouldn’t be practical to attempt a total coal conversion in the power plant,” Smith said.

E. Glenn Hess, director of utility services for the Office of Physical Facilities, said: “It would be cheaper to build a new coal-fired heating plant and tie it to the power plant’s steam heating system.”

“Location of a new plant would be the biggest problem,” Smith said.

“We really don’t have an appropriate place close enough to campus that would make the plant practical.”

SMITH ADDED that no matter where a coal plant was built there would be the complication of storage, hauling and the added expense of handling the coal.

“Gas or fuel oil can be piped into the boilers very easily, but coal must be hauled, unloaded, transferred inside and then dumped into the boilers,” Smith said.

He added the University would also have to contend with the requirements of the Environmental Protection Agency (EPA). “We would have to hire a consulting engineer to work out the coal requirements,” Smith said.

The EPA has restrictions on the amount of smoke a plant can emit, said Jack J. Clayton, facility operations manager for Battelle Memorial Institute. These restrictions limit the percentage of sulfur dioxide the emissions can legally contain and the amount of ash and other particles carried out of smoke stacks.

CLAYTON SAID Battelle completed a coal conversion program in 1976. Battelle now receives 75 per cent of its heating from coal and 25 per cent from fuel oil.

“The cost of coal is now about half that of fuel oil,” said Clayton.

Clayton added the University would probably have less problems converting to coal than many other universities because it once used coal.

“I’m open minded about the coal possibilities,” Sullivan said. “We may wind up with some coal capability in the future, but I doubt we ever build a totally new coal facility.”

The availability of fuel oil, natural gas and sufficient funding would determine the entire coal conversion possibility, he said.
OSU Officials Considering Changing Back To Coal Heat

Barely seven years after Ohio State University completed the conversion from coal to gas-fired heating for the campus, officials are thinking of returning to coal.

The university is encouraged in its consideration by the Ohio Board of Regents, which has ordered a staff study of the possibility of converting heating systems at all state-supported universities to forms other than natural gas.

THOMAS B. SMITH, associate vice president for physical facilities at OSU, estimated it would cost $4 million to $5 million to convert one boiler in the campus McCracken Power Plant from a gas to a coal burner.

There is room in the main power plant for only one coal unit, Smith said. That conversion would supply about one-fourth to one-third of the campus heating needs.

Thus, to supply the entire campus, new buildings would have to be constructed to house the boilers.

SPURRED BY THE developing gas shortage of recent years, the university launched its conversion study about six months ago, Smith said.

He added the study did not go into engineering details. For that, he said, the university would hire professional designers.

Meanwhile, the university’s trustees at their March 4 meeting authorized top officials to scrape together money allocated to other construction to make alterations in heating units to allow burning of either gas or fuel oil.

IN ITS 1977-79 biennial budget request to the regents, OSU asked for $150,000 to plan the gas-to-coal conversion and $4 million for construction to begin in the 1979-81 biennium.

But the regents, in forwarding higher education requests to the governor and the General Assembly, recommended the appropriation of no planning money for the budget period to begin in July.

At the same time, the regents staff recommended $5 million be appropriated to OSU for its coal conversion project, but construction would begin in the 1981-83 biennium.

SMITH SAID THE change from coal to gas began at the university in 1963, the first conversion was completed in 1965 and the total revision of heating system completed in 1970.

He said the project was undertaken primarily to allow the university to meet anti-pollution standards.

Henry Whitcomb, director of financial management on the regents’ staff, estimated the conversion to alternate fuels at all state universities and colleges at between $50 million and $100 million, a figure he hopes to refine as planning studies proceed.

WHITCOMB SAID the regents will seek inclusion in the 1977-79 appropriations of an as yet undetermined amount of money for planning and design for various campus heating plants.

He said the amount to be sought from the legislature may be determined at the board’s March 18 meeting.

“We will try to make sure the universities in future winters don’t face shortages like they did this winter,” Whitcomb said.
Despite push for coal, OSU stays with gas

By Joe Giampietro

Though state officials are pushing the use of Ohio coal in state buildings, Ohio State's energy needs will continue to be met by gas and oil.

"Coal is the logical choice but there are just too many problems with it," explained Dallas Sullivan, Ohio State's director of energy conservation. "The Environmental Protection Agency (EPA) laws are a major stumbling block."

The federal EPA enforces strict pollution control standards for the burning of coal with a high sulfur content in Ohio.

As a result about 3,000 miners are out of work and 15 to 20 mines are completely shut down in Belmont and Monroe counties, according to Neal S. Tostenson, president of the Ohio Mining and Reclamation Association. These mines, in the Southeastern Ohio area, are rich in high-sulfur coal.

Gov. James A. Rhodes and the Ohio EPA have been fighting for the repeal of the federal standards before unemployment benefits begin to run out for most of the miners.

Last December State Auditor Thomas E. Ferguson issued a statement saying Gov. Rhodes should "require all state universities and institutions to revert to coal as their major energy source" to alleviate the unemployment in Ohio's coal fields.

However, William W. Wilkins, director of the state's Department of Administrative Services, said the governor "can't order anyone to go against any law" in reference to the EPA regulations.

Wilkins said there has been some positive feedback concerning efforts to burn Ohio coal within the state.

The University of Toledo is in the process of buying a boiler in order to switch to coal-fired energy system. Miami University is using a new coal system with precipitators that will remove the pollution caused by burning high-sulfur coal.

The Capital Improvements Bill, which is awaiting ratification in the Statehouse, has a provision for converting the power plant at Central State University to a coal-fired process.

Sullivan said it would cost $50 million to build a coal-fired plant at OSU and EPA laws would probably require the use of scrubbers as a pollution control device since the university is in a densely populated area. The university switched from coal to a gas system during the 1960s.

"It would take at least six to 10 years to convert the system back to coal," Sullivan said. "And three times the manpower to maintain the facilities."

He said a conversion would be complicated because only 60 percent of Ohio State's power comes from the central plant, McCracken Power Plant. The remainder of the power comes from plants scattered around the campus. These include power plants on West Campus, in the medical complex and in some living areas.

"There would be no way to run pipes to the other buildings, these plants cover from a central plant," Sullivan said.

He said the energy situation "looks good" for this winter.
Return to coal would be costly for University

Monumental capital cost and unresolved environmental requirements would be formidable problems if Ohio State were to convert its natural gas and oil-burning power plant back to coal.

Thomas B. Smith, associate vice president for physical facilities, says that even if such a conversion were made, the central plant supplies only 60 percent of campus heat because 40 percent is produced by boilers in dispersed individual buildings not served by tunnel systems.

Smith said conversion of four of the six central plant boilers to coal would cost an estimated $50 million or more and even then might not comply with clean air standards at the time.

In an interview, Smith discussed the feasibility of coal conversion in response to State Auditor Thomas E. Ferguson's recent suggestion that all state-assisted colleges use coal as their major energy source.

"The best way to make such a conversion would be to build a new plant at a different location off the central campus. The cost of the steam distribution lines connecting to the existing distribution system would also require major capital expenditures," he explained that McCracken Power Plant is too far from a rail siding for delivery of coal and also that there is no space for adequate storage of coal or ashes at the present location.

"To depend entirely on truck deliveries would limit competitive bidding among carriers to supply the coal," he said.

When Ohio State switched to natural gas as a prime fuel over a five-year period ending in 1970 - when concern over air pollution was growing - the situation was different, he said.

"Natural gas was approximately 20 percent of its present cost and in plentiful supply with no indication of coming shortages."

Smith said the conversion from coal to gas is cheaper than gas to coal because of the simpler equipment required.

"Coal pulverizing equipment, coal and ash handling for boilers, and other accessories would require more maintenance and more personnel," he said.

In the coal-burning period the University was generating its own electricity. Now electricity is purchased because of economic considerations.

"The only electric generation now is for demand limiting," he said. "That means only enough power is generated to keep the monthly peak load below a predetermined maximum. All needs above that figure would be delivered at a higher rate by the utility."

The University burned up to 125,000 tons of coal a year during the University's coal-burning period.

"Today we would burn only about 50,000 tons because of savings from the university's six-year-old energy conservation program and the decrease in electric generation," said Smith.

"Coal costs, up from the earlier $7 a ton to $30 to $60 a ton today and rising, would result in lower fuel costs than natural gas today. However, when we switched from coal to gas we cut our power plant staff from 100 to 33."

"With coal, we could save about 40 percent on fuel costs at current prices, but the additional labor and maintenance costs would offset a big portion of that."

Smith said a partial conversion to coal - replacement of just one old boiler, for example, would probably cost about $10 million, including emission control and handling equipment.

"The University is keeping an open mind on the question and is watching the development of other alternatives to direct coal burning," he said.

One of these is called fluidized bed combustion in which coal is burned with powdered limestone which also binds to the sulfur in the coal. Coal gasification may also become a viable option for suppliers, as this would use existing distribution systems and combustion equipment.

Only one public institution in Ohio has adopted the fluidized bed system. The Columbus State Institution is installing a fluidized bed at a cost of $5 million and expects to start operation in April or May.

Smith said the University has realized a 52 percent reduction in fuel consumption last year compared to 1972-73 as a result of an intensive management program which has been directed by Dallas Sullivan, director of the Division of Energy Conservation.
COLUMBUS, Ohio -- Ohio State University plans to install a coal-fired boiler for burning low-cost coal within environmental limits at an estimated savings by the year 2000 of some $120-150 million in fuel costs.

The plan, which would convert half the fuel consumption on the Columbus campus to Ohio coal and calls for installation of stringent safeguards to eliminate combustion products, is part of the university's Energy Master Plan for 1980-2000.

Dallas Sullivan, director of the Energy Management Division, says bidding on the coal boiler could begin as early as this summer, pending Ohio Environmental Protection Agency approval.

He says it would take 30 to 36 months to complete bidding, engineering and construction. The boiler would be built at McCracken Power Plant, 304 W. 17th Ave.

A public open house will be held at the power plant on Wednesday (3/30) from 10 a.m. to 2 p.m. Officials will be on hand to discuss details of the plan.

The plan also calls for extension of the central steam distribution system to high-load areas such as the midwest campus (colleges of Agriculture and Veterinary Medicine), Cannon Drive facilities (Lincoln and Morrill Towers, Drake Union and the

- more -
Biological Sciences Building) and the new University Hospitals' facilities. The steam line extension will eliminate operation of 42 single boilers, saving more than $50,000 annually in operating and maintenance costs.

Total construction cost of the project, including the boiler, emission control equipment and steam line extension, is estimated at $18.1 million, according to Sullivan.

Comparisons of natural gas and coal costs for the rest of the century show 1983 projections of $5.01 for gas and $1.71 for coal per million Btu's, said Sullivan. Corresponding projections are $6.52 and $7.02 in 1985; $13.77 and $3.21 in 1990, and $21.73 and $5.15 in 1995.

Annual savings based on current natural gas and coal costs would be $2.6 million, a figure rising to $3.31 million by 1990 and $8.54 million by 1998, when the project's debt is retired.

The plan would give the university a three-fuel capacity (coal, gas and fuel oil), thereby permitting it to deal with short supplies of particular fuels and to take advantage of future price differentials of any of the fuels, Sullivan said.

The project cost includes about $3.5 million for equipment to clean up the emissions from burning coal, he said.

Air quality equipment to be installed in the power plant will include a dry scrubber to remove sulfur from flue gases and a bag house to take out dust and particulate matter.

Duane Skidmore, professor of chemical engineering and a member of the engineering committee for the coal boiler plan, estimates some 90 percent of the sulfur and 99.5 to 99.9 percent
of the particulates will be removed from combustion emissions.

"The scrubber, an integral part of the bag house, sprays calcium hydroxide -- a white dust -- into the bags, where it reacts with the hot sulfur gases blown in from the furnace and ties the sulfur up chemically into a non-toxic solid," says Skidmore. The main waste product is calcium sulfate, the material in wall board, according to Skidmore.

"The six bags are like giant vacuum cleaner bags which allow air to filter through their porous fabric walls while trapping the solids inside," says Skidmore. The bags will be cleaned by turning them upside down and shaking their contents into a collector.

The boiler will replace an idle 1932 coal-fired boiler which was taken out of service several years before the university converted to natural gas.

Sullivan assures that returning to coal burning doesn't mean a return to the dirty black smoke that occasionally drifted from the McCracken Power Plant stacks before conversion to gas in the 1960s. "I don't expect there to be any more stack smoke after installation of the new boiler than there is now," he said.

The new boiler will operate during any period of demand, with the older gas-fired boilers serving to supplement the loads.

The cost of natural gas at the time the power plant was converted to gas was about one-tenth what it is today and the price of coal was about one-sixth today's cost.

The power plant project also examined other options, according to Sullivan. These included construction of a
completely new power plant at a cost of $100 million and rebuilding an existing boiler to burn coal.

"The main difference between new and rebuilt boilers would be in the sizes of fuel burned," he said. "A new boiler could be stoker-fired and adaptable to different coal sizes, whereas a rebuilt boiler could be fired with pulverized coal only.

"The flexibility of a new boiler would allow for various pelletized fuel mixtures, including a new limestone-coal pellet being developed for sulfur removal."

Sullivan said the new boiler would burn six to nine tons of coal per hour, with a four-to-six-day enclosed coal storage facility at the plant. Emergency storage could be arranged nearby in case of an extended coal strike.

Coal would be trucked to the plant from Ohio mines. Ash and dust would be trucked out in closed containers to land fills.

"Since we are a state institution, we are committed to burn Ohio coal and install all the necessary equipment to comply with the standards," Sullivan said.

In addition to heating, the new boiler could probably justify more electrical co-generation, he said. The power plant's 16,000-kilowatt generator capacity now is used only for "peak-shaving," which means when electrical consumption rises above the projected estimate for any one month -- requiring a higher rate paid to the utility. Sullivan says this higher rate, called a "demand charge," is expected to rise soon.

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(Contact: Dallas Sullivan, (614) 422-6240.)

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NOTE TO EDITORS AND NEWS DIRECTORS

Students, faculty, staff and the general public are invited to an open house at Ohio State University's McCracken Power Plant, 304 W. 17th Ave., on Wednesday (3/30) from 10 a.m. to 2 p.m. to discuss the coal-fired boiler project with representatives of Ohio State's Energy Management Division, the university's Office of Physical Facilities, the Ohio Environmental Protection Agency, the Ohio coal industry and the University District Organization.

A videotape presentation of the university's energy management program will be shown at various times during the open house.

Ohio State University
Communications Services
Ohio coal to save OSU millions by year 2000

By Michael Cover

3-29-83

Spending $18.1 million now may save OSU an estimated $120-150 million in fuel costs by the year 2000.

OSU will install a coal-fired boiler for burning low-cost Ohio coal in McCracken Power Plant on 17th Avenue which already has a 16,000 kilowatt generating capacity. The project is expected to be completed by early 1984, according to Dallas Sullivan, director of OSU's Energy Management Division.

Funding for the project will come from the sale of bonds. The bond sale plan is expected to be presented to the Board of Trustees at Friday's meeting, Sullivan said.

"The boiler would be built inside the present plant with the pollution control equipment outside, just north of the north McCracken stack," Sullivan said.

The new boiler will have to meet requirements that are "more stringent than or as stringent as Ohio law," said Bob Miles, unit supervisor for the air pollution control group of the central district office of the Ohio Environmental Protection Agency.

New coal-fired boilers in Ohio must meet strict requirements for air quality because of the high sulfuric content of Ohio coal.

Miles said the new boiler will not be allowed to emit more than about .05 parts per million Btu's of particulate matter and sulfur dioxide. An exact limit has not yet been decided upon by the federal government, he said.

Existing boilers in Ohio cannot emit more than .1 parts per million Btu's of particulate matter and sulfur dioxide, Miles said.

The plan would convert half the fuel consumption on campus to Ohio coal. OSU currently operates exclusively on natural gas with a fuel oil reserve, Sullivan said.

Natural gas cost projections made by Posidick and Hilmer, an engineering firm in Cincinnati, indicate that what the university now pays $5.01 for, could cost $21.73 in 1995. The annual savings, based on current natural gas and coal costs, would be $8.54 million by 1998, when the project will be paid for.

The plan will give the university a three-fuel capacity (natural gas, fuel oil and coal) so it may take advantage of price changes and fuel shortages.

OSU is committed to burn Ohio coal because it is a state institution, Sullivan said. The boiler would burn six to nine tons of coal per hour. The coal would be trucked in from Ohio mines.

Emissions control equipment accounts for $3.5 million of the project's cost.

A dry scrubber will remove sulfur from fuel gases by spraying calcium hydroxide into bags of dust and particulate matter, chemically changing them into a non-toxic solid, said Duane Skidmore, professor of chemical engineering and a member of the engineering committee for the coal boiler plan.

"The six bags are like giant vacuum cleaner bags which allow air to filter through their porous fabric walls while trapping the solids inside," Skidmore said. The bags will be cleaned by turning them upside down and shaking their contents into a collector.

The resulting ash and dust would be trucked out in closed containers to land fills.

Sullivan said the return to burning coal will not mean an increase in dirty black smoke from the McCracken stacks. "I don't expect there to be any more stack smoke after installation of the new boiler than there is now," he said.

Officials also looked at construction of a completely new power plant and rebuilding an existing boiler, but these plans were rejected because of cost and the flexibility the new boiler will provide. With the new boiler, various sizes of coal can be burned, Sullivan said.
COLUMBUS, Ohio -- The Board of Trustees of Ohio State University on Friday (4/1) authorized the financing for replacement of a coal-fired boiler to cut energy costs on the Columbus campus.

The replacement will be financed by the sale later this year of $18.5 million in either general receipts bond anticipation notes or general receipts bonds.

The trustees authorized the vice president for business and finance, Richard D. Jackson, to decide which type of bond to issue based on the market conditions at the time of the sale.

The trustees also agreed to a negotiated sale of either type of bond to The Ohio Company, provided that the net interest rate not exceed 10.5 percent annually.

The new coal-fired boiler will replace one installed in 1932 which was taken out of service several years before the university converted to natural gas.

The new boiler would convert half the fuel consumption on the Columbus campus to Ohio coal at an estimated savings of some $120 million to $150 million over the next 20 years.

In addition to the boiler, the project includes the installation of pollution control equipment for the boiler and - more -
the extension of the central steam distribution system to high-load areas not now served by the power plant.

These areas include the midwest campus (colleges of Agriculture and Veterinary Medicine), Cannon Drive facilities (Lincoln and Morrill towers, Drake Union and the Biological Sciences Building) and new and existing University Hospitals' facilities.

Dallas Sullivan, director of Ohio State's Energy Management Division, says bidding on the coal boiler could begin as early as this summer, pending approval by the Ohio Board of Regents and the Ohio Environmental Protection Agency.

The boiler, to be built at McCracken Power Plant, 304 W. 17th Ave., would take 30-36 months to complete bidding, engineering and construction, Sullivan says.

The project would give the university a three-fuel capacity (coal, natural gas and fuel oil), thereby permitting it to deal with short supplies of particular fuels and to take advantage of future price differentials of any of the fuels, he said.

Comparisons of natural gas and coal costs show that the university paid $5.09 per million Btu's for natural gas in February, while the price of Ohio coal delivered was $1.45 per million Btu's in March. The prices are projected to grow to $10.93 for natural gas and $2.09 for coal by 1990 and $14.31 for natural gas and $2.79 for coal by 1995.

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OSU to build boiler to cut energy costs

By Graydon Hambrick
Pioneer Staff Reporter

Ohio State University officials said Friday they can save $150 million in fuel costs over 20 years by building an $18.5 million coal-fired boiler to heat the campus.

OSU trustees on Friday authorized a tax-exempt bond sale and installation of a new boiler in the existing McCracken Power Plant.

Officials predict the new boiler will be operating in 1986, said Dallas Sullivan, director of OSU's energy management program.

Including debt service, the university will pay out a total $36.54 million over 15 years for the $18.5 million boiler construction.

With conservative estimates, Sullivan said, OSU will save at least $134 million over the 20 years, with a more likely savings of $150 million.

In other action, trustees awarded a new contract for dental insurance coverage to Ohio Medical Indemnity Mutual Corp., or Blue Shield, which now holds the contract.

Under the new plan, OSU and its employees will pay a total $4.8 million in premiums over 26 months. OSU pays for employees' coverage, and workers pay their family members' premiums.

Trustees also approved the appointments of Dr. Manuel Tzagournis, OSU medical college dean, as vice president for health services as well as dean, and Thomas L. Tobin, public affairs director at the University of Illinois, as vice president for communications and development effective May 9.
OSU turns to coal

OHIO'S COAL industry received two boosts in recent days, at the time the Interstate Coal Task Force was meeting in Columbus and seeking ways to expand coal markets.

Ohio State University trustees have approved a bond sale to purchase an $18.5 million coal-fired boiler to heat campus buildings. Officials say this could save $150 million in fuel costs over 20 years. Even conservative estimates set the savings at $134 million.

Representatives of Mideastern and Midwestern coal states will make an effort to convince users of oil boilers in their states to convert to coal boilers, using the approach that U.S. industry again could become hostage to foreign oil interests.

Officials in these surrounding coal states were urged to follow the lead of Gov. Richard F. Celeste, who earmarked $4 million in his budget for coal research and development.

Perhaps the best news in recent months for the coal mining industry was the announcement that 1,400 laid-off miners would be recalled, probably by early May, to operate three mines which will be reopened in Vinton and Meigs counties. The mines are owned by the American Electric Power Co.

Richard L. Trumka, president of the United Mine Workers, said his organization is lobbying Congress, which could strap Ohio coal mines with pending legislation. The proposal would further limit the amount of sulfur dioxide emissions that power plants can release into the air. The UMW chief feels Congress should aid the industry in finding methods to clean high-sulfur coal and await final acid rain findings.

The plan revealed by OSU and the announcement by AEP contains encouragement for the depressed coal mining industry. It is obvious that more Ohio mines will be placed into operation as the economy improves.
Coal plan is watched closely

By Tom Ewing
Lantern staff writer

This is the final part of a three-part series on Ohio State's $18.5 million plan to make high-sulphur Ohio coal the primary fuel for the university's steam heating system.

Attention contractors: If you want to work on the coal-fired boiler or steam pipe projects, expect the university and the state to look over your shoulder — a lot.

Officials from various divisions of the university and state government are keeping a close watch on the progress of OSU's $18.5 million plan to burn high-sulphur Ohio coal at McCracken Power Plant, said Jack Probasco, facilities planner for the Office of Campus Planning and Space Utilization.

"We have to make sure we're getting what we want," Probasco said.

Wallace Giffen, technical director for the Division of Energy Management, said the coal-fired boiler and steam pipe projects, which will be completed in 1987, are now in the design stage. Engineers in the division have been busy reviewing specifications for the projects, he said.

Fosdick & Hilmer Inc., a Cincinnati engineering firm, is drawing up the plans for the projects.

"We follow very carefully what (Fosdick & Hilmer) is doing," Giffen said. "We practically parallel their efforts as a double check."

One reason for this close supervision is experience, Giffen said. OSU's failure to anticipate certain problems in the past has resulted in leaky roofs, poor repair service on electric motors, costly construction delays and other problems, he said.

For example, Giffen said, "certain equipment breaks down and we find that it's an 'orphan' because service comes out of San Rafael, California, and we have to pay $8,000 a day to get somebody out here to fix it."

"There are 386 buildings on this campus, and not one of them works perfectly," he said. "We've learned the hard way."

Probasco said the Grounds Maintenance and Facilities Maintenance divisions, along with the University Architect's Office, also have important supervisory roles.

"We all get together and hash things out," he said.

The State Architect's Office, which is officially in charge of the projects, takes bids on the work and awards all contracts. It also ensures that certain legal requirements, like hiring quotas for minorities, are met, Giffen said.

Victor Fisher, district engineer for the Ohio EPA's central district office, said McCracken Power Plant, like other boiler facilities, must go through a two-part permit process to build and operate a new boiler.

For a permit to install the boiler, OSU had to show the Ohio EPA how it would burn high-sulphur coal and stay within pollution limits, Fisher said. The Ohio EPA approved OSU's plan to use a dry scrubber because the scrubber is "the state of the art" in sulphur-dioxide removal, he said.

Sulphur-dioxide emissions are a major cause of acid rain, Fisher said.

Before OSU can use the new boiler in 1987, the Ohio EPA will conduct a stack performance test to measure pollutants coming out of the smokestack, he said. If the boiler passes the test, the Ohio EPA will issue an operating permit for the boiler which must be renewed every three years, he said.
Coal fund allocated to other areas

By Robert Siegel
Lantern staff writer

An additional $2.8 million originally allocated for coal research at Ohio State will be free for use in other areas because Gov. Richard F. Celeste vetoed the educational item in the new state budget.

The money for coal research was allotted under the Research Challenge Program, an educational item in Ohio's budget. The Governor approved the two year budget July 1 but vetoed coal research with the approval of the sponsoring senator and the university.

Funding for coal research was originally placed in the Department of Development's budget but was cut in the legislature, said Sen. Robert Ney, R-Bellaire, representing Ohio's largest coal district.

The budget passed the House and the Senate with the two separate coal research programs. When the budget bill came before the Governor he and Ney agreed to veto coal research in the education budget since it was also in the development budget.

To insure the research program, Ney tucked funding into the education budget to guarantee passage. During the final committee meetings before the budget vote, most of the coal research funding originally allocated to the Department of Development was returned, Ney said.

The veto does not cut any funds from higher education. Instead it removes a requirement for its use.

"The veto means OSU is free to spend the money as needed," said Ann H. Moore, Associate to the Chancellor of the Board of Regents.

Herb Asher, Special Assistant to President Jennings for State Relations, said the university is pleased. "It's better not to earmark the money," he said.

In a letter to William B. Coulter, Chancellor of the Board of Regents, the Governor said, "Both Senator Ney and I believe coal research and development to be a top priority for the state of Ohio and we encourage you to give coal research every consideration in the administration of the Research Challenge."
COLUMBUS, Ohio -- Ohio State University's Board of Trustees Friday (7/12) approved contracts totaling $10,286,119 for the final two phases of a boiler project to burn Ohio high-sulfur coal within safe environmental limits.

Work is set to start next month on phases II and III of the coal-fired boiler installation in the university's McCracken Power Plant. Completion of the project is scheduled for 1987.

By burning coal rather than natural gas, the new boiler is expected to meet 60 percent of the Columbus campus's annual heating requirement and produce a net cost avoidance of over $100 million by the year 2000.

The total project is estimated at $18.6 million and is being funded by university general receipt bonds. The first phase was begun last year with award of contracts for boiler and scrubber fabrication and for demolition and removal of two obsolete boilers. Phase I completion is expected next month.

Phase II will extend steam lines from the power plant to Lincoln and Morrill towers, to Drake Union, to new University Hospitals facilities, and to agricultural and veterinary medicine buildings west of Olentangy River. The steam line extensions will eliminate 42 boilers in individual buildings, saving more than $50,000 in annual maintenance costs.

Phase III will cover modifications to the power plant to accommodate the new boiler system and modernization of the power plant's outdated electrical system.

Wallace C. Giffen, technical director of the Energy Management Division, said the schedule for completing the boiler

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was dependent upon coordination of the different parts of the project.

"Timing is critical because there are a limited number of hours and days in a given year in which certain research and teaching facilities can accommodate the new construction work," he said.

The new boiler will bear the power plant's main heating load, with the plant's existing gas and oil-fired boilers used as supplementary units during periods of heavy demand, Giffen said. The number of campus buildings heated by their own boilers will be reduced to approximately 20 percent.

Air quality equipment being installed in the power plant includes a dry scrubber to remove sulfur from flue gases and a bag house to take out dust and particulate matter. The new boiler will burn up to eight tons of coal per hour. An enclosed storage facility at the plant will hold a four- to six-day supply of coal. Coal will be trucked to the plant from Ohio mines. Ash and scrubber byproducts are non-toxic and will be trucked out in closed containers to land fills, Giffen said.

The new boiler will give the university a four-fuel capability, with coal, gas, and two grades of fuel oil. It also will allow the university to meet supply shortages of certain fuels and to take advantage of future price differences of fuels.

Contact: Wallace C. Giffen, (614) 422-4046.
Written by Robert M. Boyce. (1.102)
New coal boilers to lower heat cost

By Laura Januzzi
Lantern staff writer

Work is set to begin next month in McCracken Power Plant on the installation of a coal-fired boiler expected to meet 70 percent of OSU's annual heating requirement.

The OSU Board of Trustees recently approved contracts totaling $10 million for the boiler project which will burn high-sulfur coal from Ohio within environmentally safe limits.

Wallace Giffen, technical director of the Energy Management Division, explained the boiler project is the result of a 1980 study which dealt with new ways to cut energy costs.

He said the project is beneficial and different.

"It's different because we are (keeping down) the energy cost, rather than energy use," he said.

The project, estimated to eventually cost $18 million, is scheduled for completion in 1987. By burning coal instead of gas, the boiler will save the university $100 million by the year 2000, Giffen said.

According to Brian Rowley, management analyst for the Energy Management Division, all of the project will be constructed in McCracken, except for a coal filter system which will be located behind Milliken Road.

The first phase of the project, the manufacture of the boiler parts, began last month and should be completed next month, Giffen said.

"The boiler and gas scrubber are almost done being manufactured. We can't just run down to K-Mart and get the hardware. In addition, two older boilers are being removed to make room for this new system," he said.

The second phase will extend steam lines from McCracken to Lincoln and Morrill Towers, Drake Union, University Hospitals and to the agriculture and veterinary buildings.

The line will be installed because the cost of generating steam by burning coal is less than the cost of generating steam by burning gas.

"These steam lines will serve those not being served by the central plant. They will have a loop effect, which, if something happens, will reverse the power which is important because we need power reliability in the hospital area," he said.

The third phase will include the construction of a coal building, boiler installation and power plant improvement.
OSU wants $25 million for clean-coal research

'The state should earmark for basic research a substantial portion of the $100 million it spends as a result of a clean-coal ballot issue, an OSU official told an Ohio Senate subcommittee Thursday.

"The language of the legislation should specifically direct the coal office to carry out, primarily in Ohio universities, an adequate level of basic research oriented to the solution of scientific problems surrounding the utilization of Ohio coal," said Jack Hollander, OSU vice president for research and graduate studies.

Hollander said he supported plans to use most of the money authorized by last November's election for large-scale demonstration projects which could lead to short-term commercial use by the coal industry.

"(But) we badly need new knowledge about the basic scientific questions on which these processes are based so that as time goes on we can increasingly focus our resources on the most promising approaches and avoid expensive dead ends," Hollander said.

Hollander offered no specific figure to be set aside for research, but said "it might well be in (the) vicinity" of the 25 percent level which was originally in the House bill, but was dropped before final passage.

Earmarking 25 percent of the money for research drew opposition before the subcommittee from Babe Erdos, international staff coordinator for the United Mine Workers union.

"One of the concepts of promoting Issue One was that the money would be geared toward commercialization of existing technologies. I think that to earmark 25 percent is too high a percentage," Erdos said.

Hollander's recommendations came as a Senate Finance Committee subpanel headed by Sen. Robert Ney, R-Barnesville, began hearings on a House-passed bill implementing the ballot issue.

The measure authorizes the state to initially borrow $50 million to help finance research and development projects aimed at finding environmentally acceptable ways of burning Ohio's high-sulfur coal.
OSU to propose research center

By Wendy Wallace
Lantern staff writer

Coal researchers at Ohio State will submit proposals to the Ohio Coal Development Office to be considered for part of $100 million in coal research funds made available through passage of State Issue 1 in November.

Yosry Attia, associate professor of metallurgical engineering, submitted a proposal for funds for a coal research center he said would be headquartered at Ohio State.

The proposed center would be open to other universities to work with Ohio State, Attia said.

Vice President of Research and Development Jack Hollander said the primary function of the center would be to coordinate coal research efforts in Ohio. Hollander is also the chairman of the Technical Advisory Committee to the Ohio Coal Development Office.

Patrick Dugan, professor of microbiology, said he will submit a proposal for funds to extend his research on microbial desulfurization of coal. The microbes developed are minuscule organisms that eat a specific type of sulfur compound contained within coal.

David Berger, director of the Office of Coal Development, said 600 letters soliciting proposals were sent out two weeks ago. The deadline for proposals is March 14.

The office will distribute $100 million over the next 10 years for three types of proposals:
• Proposals for pilot plant funds.
• Proposals for funding construction of demonstration plants.

The difference between a pilot plant and a demonstration plant, Berger said, is “lots of dollars.” A pilot plant is a small-scale model of a coal refining plant that uses technology previously tested only in the laboratory. A demonstration plant is a full-scale model, he said. OSU researchers’ proposals, however, will be for fundamental research funds.

Researchers seeking money for fundamental research can be awarded up to $150,000 or two-thirds of the total project cost, whichever is less, Berger said. Those applying for funds to build pilot plants could receive up to $10 million or one-half of the total project cost, and for demonstrations plants, $10 million or one-third of the total cost, he said.

Berger said $10 million is relatively high for a pilot plant. “More commonly we’re going to be dealing with the one-half,” he said.

The Senate Finance Committee is currently working on a bill passed by the House of Representatives, House Bill 750, that will authorize the Coal Development Office to borrow the $100 million to clean up Ohio coal.

The bill will remain in the committee for another two weeks and then will be voted out to the full senate, said Joe Olecki, legislative aid to the bill’s sponsor, Rep. Barney Quilter, D-Toledo. Olecki said he expects the bill to be passed by both houses and signed by Gov. Richard F. Celeste by the end of March.
Strip miners required to return land to original state

Mining's environmental effects concern engineer

By Margaret Newkirk
Lantern staff writer

Peter Kelley has always liked the outdoors and is concerned about the environment. That's why he got into strip mining.

Kelley, a 1982 graduate of Ohio State's Department of Mining and Engineering, is a strip mining engineer for Keffer and Rose Enterprises, a middle-sized mining company based in Canfield.

Kelley grew up watching strip mining at its deepest and ugliest. He was raised in Belmont County, on the West Virginia border. Ohio's coal seams, which run in underground plains about three feet thick through much of Eastern Ohio, tip toward the Ohio River. The coal lies at its deepest in Belmont County.

When Kelley first took his place in the coal industry, he was on the land's side. He was concerned about the devastation strip mining left behind and worked planting grass and trees on abandoned mine sites.

"But I kept thinking, there's more to it than that," he said.

Kelley was troubled by the antagonism between the coal industry and environmentalists.

"A lot of people would like to see the coal mining industry completely vanish," Kelley said. "They just don't realize what that would do to our economy."

The coal mining industry employed about 9,000 Ohioans last year and brought Ohio over $1 billion in revenue, according to Ohio Geological Survey figures. Both revenue and employment have dropped significantly in the past two years. Coal sales are down $4 million dollars compared to 1984. More than 1,000 jobs have been lost in the past year.

Most of the losses were in strip mining. Strip mine production fell three million tons in 1984, while underground production was down one million tons.

One of the industry's major problems, Kelley said, is that its technology is just beginning to catch up to new environmental regulations.

When Kelley heard of the Mining and Engineering Division at Ohio State, he saw a chance to learn how to make strip mining both profitable and clean.

Kelley graduated winter quarter 1982. He was the only winter graduate and one of a handful for that year.

Today, Kelley designs mines to meet increasingly strict environmental standards. State and federal law now requires that strip miners put back what they take out, to leave mined land as they found it.

"If you dig up a stand of trees, you put it back. If there's a hill there we have to put a hill back, and if there's a valley there we have to put a valley back," he said. "We have to put the land back to the approximate original contour."

The standards are good, Kelley said, but costly. He makes sure they don't cripple the coal industry.

"If you just go out haphazardly and try to mine without giving some consideration to where you are going to put the top soil and how you are going to put it back, then it can be very, very costly," he said.

Kelley's job begins the moment the company identifies a piece of land that might have coal under it. Both the lease with the land owner and the permit with the state spell out the land's future in meticulous detail.

Plans are specific, "right down to what kind of grass seed we use," Kelley said. Land owners can negotiate improvements too.

"If I own land with coal under it, I'd ask for a lake — a lot of people do," Kelley said.

Getting a permit for a strip mine takes about 15 months, he said, and almost always meets with public opposition. The 15-month delay can be costly for mining companies, he said, because coal prices can fluctuate drastically.

Ten years ago, jobs like Kelley's would have been few and far between, he said. Strip mining companies got their coal and moved on.

Public outcry against abandoned strip mines changed all that and paved the way for a new kind of strip miner.

Kelley sees his job as helping make Ohio coal competitive under increasingly strict environmental standards.

"The laws are already there," he said. "I just think its important to keep looking for better and cheaper ways to meet them."

THE OHIO STATE LANTERN, Thursday, February 20, 1986
Researchers find way to clean coal, lower prices

By Ken Frazier
Lantern staff writer

Two researchers at OSU hope they have discovered a way to ease Ohio's high-sulfur coal woes and make it an economically viable and environmentally safe resource.

Certain microbes eat sulfur found in the coal and the two researchers think this cleaner coal will lead to lower energy costs for Ohioans and more jobs for Ohio coal miners.

Duane Skidmore, professor of chemical engineering, said the microbe, Sulfolobus acidocaldarius, consumes sulfur in coal with no toxicity to man or plant.

"Our theory is to clean the coal while we have it in hand as a solid material. There are no time constraints," he said. "We can do it correctly by collecting the byproducts and providing the utilities with clean coal."

Skidmore said the desulfurization process he is researching consists of pulverizing the coal, heating it to about 156 degrees Fahrenheit, aerating the coal powder and adding the single-celled organism. "Just throw them into a pot of coal and there they go," he said.

Skidmore estimates his process can remove three-fourths of the sulfur in up to 400 pounds of coal in two to four days.

He said a billion and a half of the microbes would fit in a six ounce glass.

Skidmore defined high sulfur coal as coal containing four to six percent sulfur and medium sulfur coal as coal containing one to three percent sulfur.

Sulfolobus acidocaldarius was discovered in 1964 by microbiology researchers studying the distribution of microbe populations in hot springs at Yellowstone National Park. Skidmore feels since the microbe adapted to the hotter environment of a hot spring, the elevated temperature requirements of the microbe enables his process to work faster.

Microbiology Professor Patrick Dugan is researching multiple-microbe desulfurization of coal. Dugan said since deposition of a variety of organic compounds ultimately form coal deposits, his research centers on determining which blend of microorganisms will tackle the mixture of sulfur types found in coal.

Dugan is reluctant to oversimplify his processes. Rates of consumption depend on how the coal is handled, various lab control methods and the size of the experiment, he said.

Dugan's pet microbes, collectively called Thiobacillus ferroxidans, exist by eating mineral sulfur and iron. He said they operate at a temperature range from 32 to 87 degrees Fahrenheit and were discovered in coal mine drainage in 1947.
Warning signs mark a strip mining site outside of Chandlersville, near Zanesville.
Flocculation could help clean up Ohio’s coal

By Timothy Heider

An Ohio State researcher has discovered a chemical process that may resolve a dilemma that has vexed Ohio coal producers for decades — how to cheaply filter sulfur from coal.

An experimental method called selective flocculation is similar to a process sometimes used to recover heavy metallic minerals, but it has never been applied commercially to coal, according to Yosry A. Attia, adjunct associate professor of mining engineering.

Attia says his experiment was the first time flocculation has been used to remove sulfur from coal.

Although his results are preliminary, his purification theory that divides coal and sulfur components by grinding raw coal and injecting chemicals to purge the sulfur were convincing enough to win a two-year project to develop the process.

Work began in December. Two-thirds of the project will be underwritten by the state. The remainder will come from University funds.

Coal desulfurization has proven a difficult problem for coal producers to overcome because most of the state’s freshly-mined coal is unfit for burning under current federal environmental standards.

For coal producers and state officials alike, this has created an alarming economic paradox. Although Ohio last year was a net exporter of coal, more than half of the state’s supply was furnished by surrounding states, according to David Burger of the OHIO’s Coal Development Office.

As a result the state has chosen a few pilot studies it hopes will provide a solution “within the foreseeable future”, says Burger. Attia’s project is among them.

Most midwest coal is laced with sulfur, an acidic element and pollutant that has been linked to acid rain. Scientists have been unable to explain why coal found in this section of the country is more sulfur-laden than elsewhere, but the amount found in Ohio coal far surpasses federal anti-pollution guidelines.

This leaves coal producers in a quandary.

They can either spend exorbitant sums for post-combustion filtering, which slightly reduces the sulfur emissions, or they can try to develop new technologies to scale back the sulfur content.

“The sulfur that comes from the smokestacks in the Midwest is believed to be the cause of acid rain in other parts of the country. It’s a very serious problem since it (adversely) affects the marketability of Ohio coal,” says Attia who has worked on the flocculation technique for more than a decade.

Under his proposal, a three-step process would be used to remove sulfur from raw coal. Initially, most of the inorganic sulfur — pyrite inside the coal — can be removed by standard cleaning techniques such as liquid submersion.

“This removes some of the larger particles, but is not very effective on the type of coal that is mined in Ohio,” says Attia. So he has added a second step to grind the coal and pyrite into a fine powder and inject a chemical polymer to coat the ultrafine particles and disperse them.

During flocculation the clean coal particles which are larger in size are filtered from the slurry, leaving the pyrite behind.

“I hope to remove almost 90 percent of the inorganic sulfur from the coal, a very difficult thing to do,” says Attia.

But the trickier problem of removing organic sulfur wedged in the coal matrix will be achieved by a chemical process that basically washes the coal with warm water and bleach to split off the sulfur from the coal.

“With this process, I want to remove half of the organic sulfur from the coal. Then the combined physical and chemical makeup should bring the combustible coal into compliance with federal standards,” Attia says.

“This process is at the early stage in development. More experimentation is needed to demonstrate its feasibility on Ohio coal and that is why I am conducting the study.

I hope by the end of the two years to have something (the state) would be interested in.”

Richard B. Muter, a mineralogist at the University of West Virginia and an expert on coal desulfurization, says very little research has been done on the removal of organic sulfur.

“There are many research projects across the country that deal with sulfur removal, which have met with varying results. But most of them are fruitless,” he says.

Burger is hopeful that this study will provide some answers.

“A lot will depend on how successful and how cost-effective the method is. Everyone is pursuing options. The trick is not to break the budget,” he adds.
Measuring Air Pollution
Current Standards Yield Misleading Data

By Jeff Gabriele

A study by an Ohio State University researcher indicates that the amount of air pollution in an area may be too high, government standards are one year and far below standards the next.

But the fault does not lie with industry, according to Jean-Michel Goldmann, a professor of city and regional planning at Ohio State. The problem arises because pollution standards are often based on faulty assumptions about the weather.

Weather conditions, such as wind speed and direction, temperature, cloud height, and other factors, are important because they can affect the concentration of pollution in a given area.

To set the standard for a city, a government agency will commonly examine the meteorological data for that city during a single year, Goldmann said. The agency will find out how often the wind blows from a given direction, how often it blows at a given speed, how often a certain temperature is recorded, and so on.

Given those conditions, industry officials will calculate how much factories in the region can pollute while still staying within a certain standard, he said.

Officials base pollution standards on a single year of meteorological data because they assume that the frequency of a given weather condition will generally be the same from year to year, Goldmann said.

If, however, this occurs, for example, that the wind will blow from the east to a city at one to two miles per hour about 4 percent of the time during the calculated year, they assume that the wind will blow from that direction and at that speed about 4 percent of the time every year.

And that assumption is where officials go wrong, Goldmann said. He decided that this was the case by examining 17 years of weather data recorded by the National Weather Service in Columbus from 1948 to 1964.

"The pattern of weather conditions varied quite a bit from year to year, and it was essentially random," Goldmann said.

For example, he examined how often the weather service recorded winds from the east, east-northeast, east-southeast or southeast at one to three miles per hour. He found that this condition occurred anywhere from about 0.6 percent to 8.5 percent of the time during a given year.

Because the frequency of weather conditions changes so much from year to year, the concentration of pollution could also change dramatically each year, Goldmann argued.

To prove this, he used computer simulation to create a hypothetical region with four identical coal-burning factories.

Using the actual weather data from Columbus, Goldmann determined how much these factories could pollute during each of the 17 years, given that year's weather conditions, and still stay within a given pollution standard for sulfur dioxide.

Goldmann found that the amount the factories could pollute and stay within the standard varied by as much as 50 percent from year to year.

That means that under the current system of setting standards, officials could base pollution standards on a year where weather conditions would allow factories to emit a relatively low level of pollution.

But the next year, if weather conditions were different, the factories may put out the same amount of pollution but still cause a significant decrease in air quality.

The changes in weather from one year to the next cause the changes in air quality.

"When you base a pollution control model on a single year of weather conditions, you don't know what you're getting," Goldmann said.

He may have picked a year that's not representative."

Goldmann's solution was to create a new pollution control model that bases standards on the average weather conditions over a long period of time.

"In this new model, by selecting a sample of several years, you can have much better reliability," he said.

Goldmann emphasized that his model does not say what pollution standards should be. That's up to the public to decide. But whatever standard is chosen, it should be based on a couple of years of weather conditions, he said.

Goldmann's study was reported in the journal Geographical Analysis published by the Ohio State University Press.

Jeff Gabriele is an associate editor in the Office of University Communications.

Cleaning Ohio's Coal

An Ohio State researcher has discovered a chemical process that may resolve a dilemma that has vexed Ohio's coal producers for decades—how to cheaply filter sulfur from coal.

This has proven a difficult problem for coal producers because most of the state's newly mined coal is sent for burning under current federal air pollution control standards.

For coal producers and state officials alike, this has created an alarming economic paradox. Although Ohio last year was a net exporter of coal, more than half of the state's supply was burned by surrounding states.

An experimental method called selective flocculation is similar to a process sometimes used to recover heavy metallic minerals, but it has never been applied commercially to coal, according to Virgil A. Attia, a newly appointed professor of mining engineering. He said his experiment was the first time flocculation has been used to remove sulfur from coal.

His process divides coal and sulfur compounds by grinding raw coal and injecting chemicals into it to purify the sulfur content. Although his results are preliminary, they were convincing enough to win a two-year project to improve the process.

Most Midwest coal is laden with sulfur, an acidic element and pollutant that has been linked to acid rain. Scientists have been unable to explain why coal found in this section of the country is more sulfur-rich than elsewhere, but the amount found in Ohio coal far surpasses federal anti-pollution guidelines.

This leaves coal producers in a quandary. They can either spend exorbitant sums for postcombustion filtering, which slightly reduces the sulfur emissions, or they can try to develop new technologies to scale back the sulfur content.

"The sulfur that comes from the smokestacks in the Midwest is believed to be the cause of acid rain in other parts of the country, it's a very serious problem since it [indirectly] affects the manufacturability of Ohio coal," said Attia, who has worked on the flocculation technique for more than a decade.

"I hope to remove almost 90 percent of the inorganic sulfur from the coal, a very difficult thing to do," said Attia. —Timothy Helms
New sulfur removal process produced by OSU professor

By Peipei Chang
Lantern staff writer

A new chemical process explored by an OSU researcher will yield solutions to the long-term problem of Ohio's coal industry — how to economically remove sulfur from coal.

Yosry Attia, adjunct associate professor of mining engineering, uses a process called selective flocculation, in combination with traditional sulfur-removing techniques, to effectively take out the sulfur particles inside raw coal.

Attia is the first one to apply the flocculation process in removing the sulfur in coal.

He said the coal found in Ohio is highly laden with sulfur. The amount of sulfur far surpasses Environmental Protection Agency guidelines.

Scientists believe the sulfur emissions produced when coal is burned increase acidity of rain and consequently hurt the growth of plants and animals.

An effective process to free coal of sulfur will not only solve the pollution problems, but will also increase the energy production from a higher, more pure coal, Attia said.

"In most of Ohio's coal, the sulfur exists in a form of pyrite sulfur. The best way to catch the sulfur in Ohio's coal is to clean it before burning," Attia said.

Attia uses three methods to remove the sulfur from coal, depending on the size of the sulfur particles.

For large-sized particles, a physical separation process will split the sulfur from the coal because the difference of gravity between the two. In addition, traditional flotation processes can separate finer sulfur particles in coal. But most of Ohio's coal, which contains mostly ultrafine sulfur particles, needs the selective flocculation advocated by Attia.

"Flocculation means the aggregation of fine particles." The flocculation process uses a chemical to absorb the coal, but not the sulfur. This separates the two substances, Attia said.

"The selective flocculation process can recover almost up to 90 percent of the coal as a clean coal, whereas the traditional technique can only recover about 50 percent," he said.

David Berger, director of the Ohio's Coal Development Office, said coal mining is one of Ohio's important industries. But 46 percent of coal used in Ohio depends on importation from surrounding states.

Attia's project is expected to increase the amount of pure coal production in Ohio and enable utility companies to offer cheaper rates.

The funding of this project comes from the state and the university. The total budget is $225,000.
Researchers use bacteria to clean Ohio's coal

By David Sour

OSU researchers are cleaning high-sulfur Ohio coal with bacteria normally found in the hot springs of Yellowstone National Park to help aid this state's aging coal industry, said a professor of chemical engineering.

Duane Skidmore said Ohio coal is not as marketable as coal from other regions of the country because it usually contains medium to high amounts of sulfur.

These amounts are not within Environmental Protection Agency standards, because the sulfur causes acid rain, he said.

The Ohio Coal Office, an organization located in Columbus created to promote the use of Ohio coal, awarded Skidmore a $150,000 grant to fund his work less quarter.

Ohio Coal Office Director David Berger said the purpose of the grant is to find out how effective sulfur removal with microbiological agents can be and to determine how much effort is needed to apply these methods to industry.

Berger said Skidmore got the grant because of previous success with his coal desulfurization methods.

Part of the reason for the grant is to help deal with the acid rain problem, he said.

Skidmore said sulfur removal is important because sulfur dioxide is released into the atmosphere when coal that contains sulfur is burned. Sulfur dioxide reacts with other chemicals in the atmosphere and falls as acid rain, killing forests in New York, Ontario and Quebec, Skidmore said.

Researchers in the Department of Chemical Engineering received the first bacteria, or "bugs," from the Mexico Institute of Technology, which received them from Yellowstone National Park.

Researchers there had not been successful in removing sulfur from coal with the bacteria.

Bruce Beck, an OSU master's candidate from Springfield, got the bacteria to oxidize sulfur in coal after months of work, Skidmore said.

To remove the sulfur and part of the nitrogen from the coal, the coal first must be powdered to particles the size of 75 microns or less. This is finer than table salt, yet coarser than baby powder, Skidmore said.

The coal is normally powdered before it is burned in most large coal-burning boilers, he said.

The pulverized coal is then placed into a "fermentation reactor" or swimming pool-sized vat, Skidmore said. There the microbes, Sulfolobus acidocaldarius, and water are added.

The bacteria eat the sulfur, he said.

"The sulfur oxidation is very important to the bug, and it's important to us if it happens to be sulfur in coal," Skidmore said.

Next, air is pumped into the coal slurry, and the mixture is agitated to keep the mixture homogeneous. The agitation is necessary, Skidmore said, because more pollutants can be removed from the coal when the greatest surface area of each coal particle is exposed to the bacteria.

The water is then released from the vat, taking with it the sulfur, some of the nitrogen and the bacteria in solution. Workmen then rinse the coal with water to remove more impurities.

Removing the sulfur takes from two to four days, depending on the mixture characteristics, he said.

The coal gases released by the bacteria are collected at the top of the fermentation reactor and condensed to remove water vapor and most of the acid so they do not harm the local environment, Skidmore said.

All the Sulfolobus acidocaldarius now used in coal research around the world comes from Beck's supply, Skidmore said.

Skidmore said the process removes all the sulfate sulfur and the pyritic sulfur, along with 60 percent of the organic sulfur.
OSU gets coal research grant

Coal combustion research at Ohio State University will benefit from a $195,500 federal grant for the installation of a sophisticated particle analyzer.

The grant, to OSU engineer Robert H. Essenhigh, will permit researchers to determine coal-burning characteristics by measuring changes in particle size as burning takes place and the speed with which particles move about in the furnace.

The money came from a Department of Energy fund to provide better tools for campus-based energy studies.
Acid rain reduced by washing coal

By David Hickman
Staff writer

Washing Ohio's high-sulfur coal before it burns is the best way to reduce the acid rain it produces, said a professor of mining and mineral resources engineering.

Yosry A. Attia said he is searching for companies to mass-produce equipment which uses a coal cleaning technique he received a patent for one month ago.

The technique uses bacteria to free sulfur and other impurities, like ash, from the coal.

Sulfur oxides produced by burning coal are commonly believed to be one of the causes of acid rain, Attia said. Ash also needs to be removed from coal because it clogs coal combusters, making coal less efficient as an energy source.

Steps of Attia's Froth Flotation cleaning method are:
- Coal is added to water then mixed with bacteria.
- This mixture goes through a machine which adds air bubbles.
- Coal floats to the top of the mixture with the air bubbles.
- Most of the sulfur and ash fall to the bottom of the mixture.
- Coal is skimmed off the top of the mixture then dried out for use.

Attia was awarded a coal research grant of $150,000 from the Ohio Coal Development Office for Coal Research, said David Berger, director of the Coal Development Office.

"We believe this method offers substantially better cleaning performance than other washing methods," he said.

As Ohio's high-sulfur coal meets guidelines designed by the federal government to reduce acid rain, people of Ohio benefit in three ways, Berger said.

- People and industry of Ohio will be less dependent on foreign fuels and will be able to use Ohio's own resources for energy.
- A rise in people working in southeastern Ohio mining industries will occur.
- A rise in people working in new industries created to manufacture the equipment needed to process clean coal will occur.

Although Attia was the primary inventor of the process, Ohio State was also named on the patent from the U.S. patent office in Washington, D.C.

Processing time for Attia's invention was about two years, said Jim Wilkens, OSU patent and copyright administrator. This is not an unusual amount of time to wait for a patent, Wilkens said.

Ohio State will ask for a royalty from any company who wishes to manufacture and market Attia's invention, he said. Attia would receive 50 percent of the first $45,000 of gross revenues and about 25 percent of the gross revenues exceeding $45,000.
Researchers at Battelle Columbus Laboratories and The Ohio State University are developing a genetically enhanced bacteria to remove organic sulfur from coal.

The research is being funded by a $690,000, three-year contract with the U.S. Department of Energy's Pittsburgh Energy Technology Center.

The research is concentrating on thiobacillus, a species which can convert inorganic sulfur to sulfate, a chemical that can be washed from coal. However, up to half of all sulfur in coal can be organic.

The aim of the research is to alter the bacteria genetically so that it can remove organic sulfur as well, said Battelle program manager John Litchfield.

Battelle holds the contract and will subcontract some of the research to OSU.