LOS ANGELES
AT 3:30 P.M.
ECOLOGY

Menace in the Skies

[See Cover]

On the morning of Oct. 26, 1948, at Donora, Pa., the skies delivered a deadly warning that man had poisoned them beyond endurance.

As workers trudged to their jobs, a heavy fog blanketed the bleak and grimy town. It hung suspended in the stagnant air while local businesses—steel mills, a wire factory, zinc and coke plants—continued to spew waste gases, zinc fumes, coal smoke and fly ash into the lowering darkness. The atmosphere thickened. Grime began to fall out of the smog, covering homes, sidewalks and streets with a black coating in which pedestrians and automobiles left distinct footprints and tire tracks. Within 48 hours, visibility had become so bad that residents had difficulty finding their way home.

Donora's doctors were soon besieged by coughing, wheezing patients complaining of shortness of breath, running noses, smarting eyes, sore throats and nausea. During the next four days, before a heavy rain washed away the menacing shroud, 5,910 of the town's 14,000 residents became ill. Twenty persons—and an assortment of dogs, cats and canaries—died.

Investigating the tragedy, meteorologists concluded that it had been triggered by a temperature inversion, an atmospheric phenomenon that prevents normal circulation of air. Ordinarily, warm air rises from the earth into the colder regions above, carrying much of man's pollution with it. Occasionally, a layer of warmer air forms above cooler air near the ground; the inversion acts as a lid, preventing pollutants at lower altitudes from rising and dispersing. Inversions are no novelty, but what happened at Donora shocked public-health officials into an awareness that such layers pose a dead-

Hospitals were soon filled with patients suffering from acute respiratory diseases; deaths in the city mounted. The British Committee on Air Pollution finally estimated that during the five days that the smog smothered London, there were 4,000 more deaths than would have occurred under normal circumstances. During the next two months, there were another 8,000 excess deaths—most of them apparently caused by respiratory disease—that scientists suspected were a direct result of the killer smog.

Extreme air pollution again darkened London in 1956, killing 1,000, and in 1962, claiming more than 300 lives. In 1953, a ten-day temperature inversion over New York City trapped so much air pollution that 200 excess deaths were attributed to the smog by Dr. Leonard Greenburg, then New York's commissioner of air pollution. Another New York smog in 1963 killed more than 400, and there were 80 excess deaths recorded in New York during a four-day siege over the last Thanksgiving Day weekend. Scientists suspect that thousands of deaths each year in cities all over the world can be linked to air pollution. Says U.S. Assistant Surgeon General Dr. Richard Prindle: "It's already happening. Deaths are occurring now. We already have episodes in which pollution kills people. And as we build up, we're going to have an increasing frequency of episodes."

"Take a Deep Breath." Such warnings, added to the widely publicized New York and Los Angeles air-pollution alerts and open bickering between politicians and industry over pollution controls, have made the U.S. suddenly aware that smog is a real and present danger. The belching smokestacks that long symbolized prosperity have now become a source of irritation; the foul air that had come to be accepted as an inevitable part of city living has suddenly become intolerable. "Tomorrow morning when you get up," reads a recent magazine ad placed by New York's Citizens for Clean Air, Inc., "take a deep breath. It'll make you feel rotten." Indeed, as the adjoining color pages show, the U.S. city dweller had only to look at his skyline last week to see the startling and ominous inroads that smog has made.

Air pollution has become a worldwide preoccupation. Some 230 miles southwest of Tokyo, for example, schoolyards in the port city of Yokaichi are filled with children running and playing games. But their shouts and laughter are muffled by yellow masks impregnated with chemicals to protect them against air polluted by nearby petrochemical plants. In Tokyo, where smog warnings were issued on 154 days last year, police order in ten heavily polluted districts return to the station house to breathe pure oxygen after each half-hour stint on traffic duty in order to counteract the effects of...
WASHINGTON, D.C.  Only five miles from the White House, a holocaust of smoke and grime is sent up by open-air burning at Kenilworth garbage dump, operated by the District of Columbia on land owned by the National Park Service. Stacks in back belong to a Potomac Electric Power Co. generating plant.
NEW YORK
Manhattan at sunset, seen from Riker's Island in East River, seems wraped in a fiery fog. At right are stacks of Con Edison Company's Ravenswood plant, which manufactures power for all parts of city. To left, company's Waterside plant. In the center, the U.N. Building.

PITTSBURGH
Though it is credited with a good cleanup record, Allegheny County still has formidable problems, as shown in this morning view of U.S. Steel's Clairton Works, looking east to Monongahela River.
Baltimore

Pungent clouds of smoke climb skyward at noon from just one of hundreds of industrial plants in the area near Patapsco River.
CHICAGO

Mist and smoke, much of it blown in from the steel mills and other heavy industrial centers of nearby Gary and Hammond, Ind., shroud the Loop and most of the spectacular skyline on Sunday morning. Aerial photo shows city as seen from its southwest side, looking out across office buildings and apartments near Lake Michigan.
ST. LOUIS
While the Gateway Arch is blurred, the city’s south side is even more thickly soaped in at 3:30 p.m. by smog that comes from car exhausts and fumes from industry on Mississippi’s banks.

DETROIT
On the Detroit River, a cumulus of white and orange—containing iron oxide—rises from Great Lakes Steel plant into morning sky. In rear, other concentrations of industry add to haze.
ODESSA, TEXAS
Fat, black billows hover over plant of Sid Richardson Carbon Co., which runs seven days a week. Though factory is located ten miles west of Odessa, part of the dense smoke still drifts into city.

BIRMINGHAM
The South's biggest steel producer, Birmingham pays a price in pollution for its distinction. This picture was taken on Sunday afternoon, when plant exhausts are one-third less than usual.

HOUSTON
Its sides lined with 125 plants-paper, fertilizers, chemicals, cement-Houston Ship Channel, shown here at midmorning, is a prime source of both wealth and grime for Southwest's richest city.
LOS ANGELES

Riding along Wilshire Boulevard at 4:30 p.m., with the sun looking more like the moon, drivers need headlights in order to pick their way through the midafternoon smudge.
HAYDEN, ARIZ.

Not even the widest-open spaces of the U.S. West are left untouched. At 10:30 a.m. in the foothills of the Pinal Mountains, inversion layers of sulphur-dioxide fumes unfurl from smelters operated by Kennecott Copper. Winds will push much of this large trail of smoke across the desert to Phoenix, 80 miles to the northwest.
breathing excessive amounts of carbon monoxide.

“Sitting on the hill of Lycaebetus, overlooking the valley of Athens,” writes Greek City Planner Constantinos A. Doxiadis, “I can see early Monday morning first clouds building in the lower part of the valley, where the industries are. It grows, it covers the middle and lower parts of the city. Gradually it reaches the eastern part, and by expanding in height it covers the rock of the Acropolis and the Parthenon. By then everybody in the city of Athens has had to breathe the polluted air.”

Authorities in the German state of North Rhine-Westphalia are so concerned about the dangers of smog in 15 Ruhr districts that they have posted warning signs that will bar traffic from roads in the event that air pollution becomes extreme. And out in space last September, after other astronauts had repeatedly failed to photograph Hoenmon because of the dense brown disk of smog that usually hangs above it, Gemini 11 Command Pilot Pete Conrad finally shot a picture of the city on one of its better days. Discussing the photograph after his return to earth, Conrad pointed to the reduced but ever-present pall over the city. “Notice the air pollution drifting out there,” he said, “in case anybody thinks we don’t have it.”

Smog disintegrates nylon stockings in Chicago and Los Angeles, eats away historic stone statues and buildings in Venice and Cologne. Rapidly industrializing Denver, which for many years boasted of its crystalline air, is now often smogbound. In Whiting, Ind., a concentration of fog and pollution from an oil refinery produced a chemical mist that one night last year stripped paint from houses, turned others rusty orange, and left streets and sidewalks covered with a greenish film.

Pollution’s First Victim. Air pollution, commonly thought to be a result of the industrial revolution, actually preceded man himself. Nature has long contaminated the air with sand and dust storms, with forest fires and volcanic eruptions that spew tons of particles and gases into the atmosphere. When Krakatoa, a volcano in the East Indies, blew up in 1883, the debris and dust it hurled into the air spread around the globe, darkening daytime skies for hundreds of miles. Krakatoa dust, suspended in the atmosphere, produced spectacularly ruddy sunsets and sunrises the world over for months after the blast.

Nature even produces its equivalent of smog. Over large fir forests, there is a continuous bluish haze produced by terpenes—volatile hydrocarbons that are emitted by the trees. Decaying animal and vegetable matter give off gases. Flowers saturate the nearby air with fragrances that may cause hay fever in man. It was natural air pollution rather than the man-made kind that claimed the man who is probably the first recorded human victim: Pliny the Elder died in 79 A.D. after breathing in an overdose of sulphur oxides emanating from erupting Vesuvius.

Once man mastered fire, however, he was superbly equipped to surpass nature’s contribution to air pollution. The burning process—combustion—powers most transportation in the U.S. plays a vital role in its manufacturing, generates electric power, heats homes and buildings, and consumes much of its refuse. But this year it will also pour 140 million tons of pollutants into the air. And as population, industrial production, number of automobiles, and other indices of U.S. prosperity increase, the upward flow of contaminants will increase correspondingly.

Colorless Contamination. The most obvious component of polluted air is the smoke that pours from millions of home chimneys, power-plant and factory smokestacks, incinerators and garbage dumps. It consists of tiny pieces of carbon, ash, oil, grease, and microscopic particles of metal and metal oxides. Some of these particles are so large that they settle rapidly to earth, but many are small enough to remain suspended in the atmosphere until they are removed by rain or wind. Though the particulates, as they are called, are highly visible and often the first target of antipollution officials, they constitute only about 10% of the pollution in the air over the U.S.

Cities such as Pittsburgh and St. Louis, which after World War II enforced vigorous and successful campaigns to clear smoke from their skies, have now discovered that their drives against pollution have only just begun. A full 90% of U.S. air pollution consists of largely invisible but potentially deadly gases. More than half of the contamination in the air over the U.S., for example, consists of colorless, odorless carbon monoxide, most of it issuing from the exhaust pipes of automobiles, trucks and buses.

The second most plentiful gas pollutant is composed of oxides of sulphur, produced by home, power-plant and factory combustion of coal and oil containing large percentages of sulphur. More than a tenth of air pollution consists of hydrocarbons, most of them emanating as unburned or only partially burned gaseous compounds from automobile fuel systems. Combustion also produces large quantities of carbon dioxide, nitrogen oxides and other gases.

As if these products of combustion were not unpleasant or dangerous enough by themselves, some also undergo complicated chemical changes in the atmosphere that make them even less attractive. In the presence of sunlight, the hydrocarbons and nitrogen oxides emitted by automobile exhausts react to produce the sort of brownish and irritating photochemical smog that blankets Los Angeles for most of the year. “Los Angeles smog” is a highly complex soup containing, among other
things, nitrogen dioxide, hydrocarbons, ozone (a highly active and poisonous form of oxygen) and peroxacyl nitrate (commonly called PAN). “London smog,” on the other hand, usually contains high quantities of sulphur oxides that react with moisture to produce a dilute but corrosive sulphuric-acid mist.

Though air conditioners can effectively filter pollutant particles out of the air, the troublesome gaseous contaminants pass through unhindered. Thus city dwellers who feel that they have found sanctuary from the smog in sealed and air conditioned offices and apartments are actually in an atmosphere that may be little better than the foul air of the streets.

$600 for Cleaning. The unwholesome mess that U.S. citizens and corporations 

spew into that great sewer in the sky costs them dearly—$11 billion a year in property damage alone, according to the Department of Health, Education and Welfare. Air pollutants abrade, corrode, tarnish, soil, erode, crack, weaken and discolor materials of all varieties. Steel corrodes from two to four times as fast in urban and industrial regions as in rural areas, where much less sulphur-bearing coal and oil are burned. The erosion of some stone statuary and buildings is also greatly speeded by high concentrations of sulphur oxides.

Heavy fallout of pollution particles in metropolitan areas deposits layers of grime on automobiles, clothing, buildings and windows; it adds about $600 per year in washing, cleaning, repairing and repainting bills to the budget of a family with two or three children in New York City, according to a study made by Irving Michelson, a consultant in environmental health and safety. Because of fly ash and soot from smokestacks, the main façade of Manhattan’s New York Hilton was so badly discolored that it had to be replaced last year, only 31 years after the hotel was completed. Ozone, a principal component of photochemical smog, discolors and disintegrates clothing and causes rubber to become brittle and crack.

Vegetation, too, suffers from polluted air—even in rural areas that until recently were believed to be out of the range of contamination. Sulphur dioxide causes leaves to dry out and bleach to a light tan or ivory color, kills the tips of grasses and of pine and fir-tree needles.

Scientists are certain that the ozone and PAN in Los Angeles smogs have caused the serious decline in the citrus and salad crops in the area. In one of the many smog experiments they are conducting, they have planted lemon trees in small greenhouses in a grove near Upland. Pure, filtered air is pumped into some of the greenhouses, air containing measured amounts of pollutants into others. When the fruit is finally picked, the scientists will compare the quality and yield of lemons from trees in different greenhouses, hoping to learn more about how each component of smog affects the crop. Some effects of the smog are indisputable. Such diverse plants as orchids and spinach can no longer be grown in metropolitan Los Angeles.

In semi-rural Florida, east of Tampa, large amounts of fluorides emitted from phosphate plants have rained down on nearby citrus groves, ranches and gladiolus farms. Orange and lemon trees that absorbed the fluorides produced smaller yields, and gladioli turned brown and died. A national air-pollution symposium reported that cattle grazing on grass that was contaminated with the fluorides developed uneven teeth that hindered chewing and joints so swollen that many of the animals could not stand. Fluorides have also etched windowpanes, giving them the frosted appearance of a light bulb.

Damage to People. Pollutants that injure plants and erode stone are likely to have a damaging effect on humans too. Motorists who would never contemplate committing suicide by running a hose from their exhaust pipe into the car often unknowingly endanger their lives by exposing themselves to large amounts of carbon monoxide in expressways and in tunnels and garages.

Though an hour’s exposure to 1,500 parts of monoxide per million parts of air can endanger a man’s life, only 120 parts per million for an hour can affect his driving enough to cause an accident. And concentrations of about 100 parts per million have been found in tunnels and garages and on the streets of Chicago, Detroit, New York and London.

Assistant Surgeon General Prindle points out that a heavy cigarette smoker carries a 3% to 4% concentration of carbon monoxide in his bloodstream. Thus it is not surprising, he says, that habitual smokers are the first to turn up at hospitals during periods of extreme air pollution; carbon monoxide concentrations in their bloodstream reach a toxic 25%-30% level before those of non-smokers.

Chief culprits in the Donora, London and New York smog disasters were probably sulphur dioxide and sulphur trioxide, which, either in gaseous form or converted into sulphuric-acid mist, can irritate the skin, eyes and upper respiratory tract. Extreme exposure, such as might occur in an industrial accident, can do irreparable damage to the lungs—and even attack the enamel on teeth.

Arsenic & Heart Disease. Ozone and PAN produce the eye irritation, coughing and chest soreness experienced by many Los Angeles residents on smoggy days. In laboratory experiments, continuous exposure to ozone shortened the lives of guinea pigs. Scientists have also calculated that a child born in New York City after World War II has now inhaled the pollution equivalent of smoking nine cigarettes per day every day of his life. Like those in cigarettes, some of the hydrocarbons identified in automobile exhausts have produced cancer in laboratory animals.

The particles in pollution are injurious to human tissues and articles that blocken the lungs of residents of London and New York carry gases adsorbed onto their surface. They enable sulphur dioxide, for example, to penetrate deeper into the lungs than it could on its own; without particles to carry it, the gas can be exhaled relatively easily from the upper respiratory tract. Other particulates act as catalysts in the atmosphere, speeding the conversion of sulphur dioxide into more harmful sulphuric acid. Particles of arsenic, beryllium, cadmium, lead, chromium and possibly manganese, discharged into the atmosphere by a variety of man-made processes, may contribute to cancer and heart disease.

Though researchers have not been able to prove a direct cause-and-effect
relationship between air pollution and disease, they have found that the incidence of chronic bronchitis among British mailmen who deliver mail in areas with heavy air pollution is three times as high as among mailmen who work in cleaner regions. Researchers so know that there are more deaths from chronic pulmonary disease in high-pollution areas of Buffalo than in other neighborhoods. Boston policemen working around high concentrations of carbon monoxide seem more susceptible to the common cold.

**Evolution of Control.** Alarmed by ever-murkier skies, increasing property damage, unpleasant odors and more frequent dust alerts, communities, states and the Federal Government have finally begun to mount a systematic attack on air pollution. They have been able to use as a model the pioneering antipollution program of Los Angeles, which evolved out of sheer necessity. Though the city has frequent temperature inversions and lies in a mountain-rimmed bowl that traps the pollutants, Los Angeles had practically no pollution problem until the 1940s, when it began its explosive growth in population and industry.

Almost overnight, the clear air that had played so important a role in drawing moviemakers to Hollywood was replaced by palls of smoke, a brownish haze and offensive odors that made city life irritating and unpleasant. Concerned Angelenos began to come forward with California-size plans to solve the problem. One suggestion was to bore mammoth tunnels through the surrounding mountains, install huge fans in them and literally suck the smog from the Los Angeles basin into the desert to the east. There was one drawback: operating the fans for a day would require the total annual power output of eight Hoover Dams. A proposal to install giant mirrors to focus the sun's rays, heat the air, and thereby cause it to carry pollution up through the inversion also turned out to be impractical; even if the entire basin were a giant mirror, scientists calculated, not enough heat would be generated to do the job.

Then, backed by aroused citizens, Los Angeles County established a control board and vested it with the authority to control any pollution released into the atmosphere from Los Angeles County, an area of 4,000 sq. mi. Running roughshod over objections from many business leaders, the board established regulations to limit the amount of pollutants released into the air by industry, banned the use of high-pollution fuels and the burning of junked cars and garbage. To further limit pollution, the board even ordered that paint containing volatile, smog-forming chemicals not be sold in containers larger than quart size. It reasoned that such a regulation would discourage large users from purchasing high-pollutant paints.

To prove that it meant business, the board brought to court and won conviction of thousands of pollution violators. It was backed to the hilt by Angelenos. In protest against an oil company that was convicted of a pollution offense, 1,500 residents refused to pay their credit cards issued by the firm. On a single day in 1958, the board closed down $58 million worth of incinerators; instead of burning garbage, the county began hauling it as far as 40 miles away to use as land fill. Aided and guided by the board, Los Angeles oil refineries developed new techniques to reduce sulphur and to trap and recycle malodorous wastes; the refineries became the cleanest and least offensive in the world. Power companies were ordered to use low-sulphur natural gas whenever available, and required to use with a "blow-by" connection to feed unburned gasoline in the crankcase back into the engine manifold. Another law made it mandatory for all 1966 cars sold in the state to have devices that would reduce carbon monoxide emitted from the tail pipe by 50%, hydrocarbons by 65%. A further reduction in tail-pipe emissions will be required in 1970. Taking its cue from experts, the Federal Government has ordered Detroit to make similar improvements on all of its 1968 cars. But California— and the U.S.—are fighting a losing battle against the autos.

Inspections of California cars that have been driven more than 20,000 miles and are equipped with antipollution devices have shown that as many as 87% fail to meet state requirements for the suppression of hydrocarbons and carbon monoxide; the devices generally become less efficient with age and are improperly maintained. Even if the devices work perfectly, however, they cannot keep pace with the rapid growth of Los Angeles' auto population—which is expected to increase by another 2,000,000 vehicles by 1980. "Even if by then the average motor vehicle is producing only one-half of the pollution of today's average car," says County Air Pollution Control Officer Louis Fuller, "motor-vehicle pollution will be greater than it is now."

**Electric Car Research.** To solve the dilemma, Fuller believes, legal limitations may have to be placed on the movement of autos into heavily contaminated urban areas. Frank Stead, a top official in the state's public health department, has a more drastic solution. "It is clearly evident," he says, "that between now and 1980 the gasoline-powered engine must be phased out and replaced with an electric-power package." The only realistic way of bringing about such a change, Stead feels, is to "serve legal notice that after
1980 no gasoline-powered motor vehicles will be permitted to operate in California.

Californians have not overstated the auto-pollution case. In a speech that had ominous implications for Detroit's automakers, new Secretary John Gardiner suggested that "we need to look into the electric car, the turbine car, and any other means of propulsion that is pollution-free. Perhaps we also need to find other ways of moving people around. None of us would wish to sacrifice the convenience of private passenger automobiles, but the day may come when we may have to trade convenience for survival."

Detroit has responded by talking up its electric-car research, demonstrating new batteries and fuel cells, and driving newsroom around in battery-powered compact cars. And Ford President Arjay Miller insists that a crash program is on to build an electric car. But most auto officials believe that between five and ten years will pass before moderately priced cars can be produced in volume. In Washington last week, to emphasize the need for electric cars, New York Democratic Representative Richard Ottinger drove an electric Dauphine, powered by silver-zinc batteries (developed by New York's Yardney Electric Corp.), about 70 miles on trips around the city.

Fines & Prison Terms. While Los Angeles endeavors new strategies in its fight against pollution, other cities—aided by increasing federal technical and financial aid made possible by the Clean Air Act of 1963—have begun to take tentative and sometimes faltering steps in the same direction. To reduce New York City's dirty smog, some 50% of which comes from chimneys, smokestacks, and open fires (compared with only 10% of Los Angeles' smog), a regulation has recently been passed to limit the sulphur content of fuel burned within the city. It came none too soon: the U.S. Public Health Service describes the sulphur-dioxide concentrations in the New York—New Jersey metropolitan area as "the worst, the most critical" in the U.S.

In heavily polluted New Jersey, which shares high sulphur-dioxide concentrations with New York, a state assemblyman introduced a bill that would empower the Governor to shut down plants and incinerators and prohibit the movement of vehicles and the burning of any fuel during smog emergencies. Private citizens or corporate officers refusing to comply could be fined as much as $10,000 and imprisoned for as long as ten years.

To clear the air in Chicago, the city has launched a campaign to force local steel plants to adopt costly antipollution techniques, and transportation officials are investigating combination diesel-electric buses that would reduce exhaust fumes. An Illinois legislator has gone so far as to introduce a bill that would limit the use of Illinois coal—

which has a high sulphur content—in public buildings.

Gradual Suffocation. But with these few exceptions, most communities in the U.S. have still to come to grips with the problems. There is still time to do so, but it is dwindling. U.C.L.A. Meteorologist Morris Neiburger notes that the air that now streams across the Pacific from Asia is clean when it reaches the west coast of the U.S. It picks up pollution over the coastal states, loses some over the Rockies, and becomes dirty again as it moves toward the Eastern Seaboard. "Imagine the smog that would accumulate," he says, "if every one of the 800 million Chinese drove a gasoline-powered automobile—as every Angeleno does."

The Chinese autos and the new factories that produce them will quickly pollute the Asian skies, Neiburger fears, dirtying the air currents even before they reach the U.S. Eventually, if air pollution increases beyond the capacity of the atmosphere to cleanse itself, smog could blanket the earth, he says, "and all of civilization would go up in smoke from a sudden cataclysm, but from gradual suffocation by its own effluents."

Other scientists are concerned about the tremendous quantities of carbon dioxide released into the air by the burning of "fossil fuels" like coal and oil. Because it is being produced faster than it can be absorbed by the ocean or converted back into carbon and oxygen by plants, some scientists think that the carbon dioxide in the atmosphere has increased by about 10% since the turn of the century. The gas produces a "greenhouse" effect in the atmosphere; it allows sunlight to penetrate it, but effectively blocks the heat generated on earth by the sun's rays from escaping into space.

No Apocalypse. There has already been a noticeable effect on earth—a gradual warming trend. As the carbon-dioxide buildup continues and even accelerates, scientists fear that average temperatures may, in the course of decades, rise enough to melt the polar ice caps. Since this would raise ocean levels more than 100 feet, it would effectively drown the smog problems of the world's coastal cities.

The waters, however, need never rise. Within his grasp, man has the means to prevent any such apocalyptic end. Over the short run, fuels can be used that produce far less pollutant as they burn. The short run, fuels can be used that produce far less pollutant as they burn. The short run, fuels can be used that produce far less pollutant as they burn. The short run, fuels can be used that produce far less pollutant as they burn. The short run, fuels can be used that produce far less pollutant as they burn. The short run, fuels can be used that produce far less pollutant as they burn. The short run, fuels can be used that produce far less pollutant as they burn. The short run, fuels can be used that produce far less pollutant as they burn. The short run, fuels can be used that produce far less pollutant as they burn. The short run, fuels can be used that produce far less pollutant as they burn. The short run, fuels can be used that produce far less pollutant as they burn. The short run, fuels can be used that produce far less pollutant as they burn. The short run, fuels can be used that produce far less pollutant as they burn. The short run, fuels can be used that produce far less pollutant as they burn. The short run, fuels can be used that produce far less pollutant as they burn. The short run, fuels can be used that produce far less pollutant as they burn. The short run, fuels can be used that produce far less pollutant as they burn.