

POLICY BRIEF

American Oil and Gas Make Coronavirus Vaccines Possible

December 21, 2020

Summary:

- The “miracle vaccines” for Covid-19 would not be possible without the huge contributions of America’s first-in-the-world supplies of oil and natural gas.
- Hydrocarbons are the basis of organic chemistry which in turn makes plastics that are used in the production of vials, screening and protective gear and thousands of other applications throughout the medical logistics chain.
- Plastics have innumerable medical uses from the casing of an open MRI machine to the housing of refrigeration units, where many vaccines and medicines are stored until use, to the smallest tubing. Plastic medical equipment has made health care simpler and less painful and they can be mass-produced at low cost.
- Hydrocarbons derived from oil and natural gas make medical supplies possible to manufacture, including IV components, syringes, tubing, polypropylene masks, gowns and goggles to protect first responders and patients.
- Hydrocarbons provide 63 percent of our electricity nationwide used in hospitals, production facilities, cooling and sterile air handling.
- 95 percent of our transportation fuels – gasoline, diesel and jet fuel – necessary to transport all the personnel, component parts and eventually the vaccines themselves, comes from oil and natural gas.
- Hydrocarbons make modern life possible in every link of the chain for sustaining life and producing medical “miracles.”
- Modern, accelerated development and deployment of life-saving vaccines are impossible without hydrocarbons, with which the United States is uniquely blessed through its vast resources.
- Plans to zero out hydrocarbons in our electrical system (in 15 years) and throughout our economy (in 30 years) would harm the medical profession both in research and administration, and could cost countless American lives in the process.

Few Americans realize that oil and natural gas are used to make plastics, glass and other materials needed in developing a vaccine. In fact, in today's world it would be impossible to produce the medical results Americans expect without oil and natural gas. From outfitting a laboratory to supplying electricity to run the equipment to transporting the vaccine to hospitals, clinics, pharmacies and doctors' offices, the oil and gas industry supported and is continuing to support front-line operations in the search for an effective immunization and its distribution to the public. What normally takes years to accomplish was accomplished in a matter of months as the necessary tools and materials were already available to researchers to develop vaccines to control the coronavirus outbreak.

Over 165 vaccines against the coronavirus are currently being developed around the globe, including 27 already in human trials, according to the New York Times Coronavirus Vaccine Tracker¹. As they move through the testing phases and become approved, governments are pre-ordering the vaccines and are contracting out the requisite syringes and vials. By some estimates, 850 million syringes² could be needed in the United States, assuming two doses for each person as many of the vaccines require a secondary booster after the first shot. One firm was contracted to create plastic prefilled syringes where the needle automatically retracts directly from the patient into the barrel of the syringe when the plunger handle is fully depressed.³



¹ New York Times, Corona Vaccine Tracker, <https://www.nytimes.com/interactive/2020/science/coronavirus-vaccine-tracker.html>

² Plastics Technology, The Race for a Coronavirus Vaccine Spurs Syringe, Vial Production, July 22, 2020, <https://www.ptonline.com/blog/post/the-race-for-a-coronavirus-vaccine-spurs-syringe-vial-production>

³ In its first quarter earnings report, the company noted that in 2019 Chinese manufacturers had produced approximately 82.6 percent of its products. That supply was interrupted when COVID struck China, but the company will have sufficient inventory to fulfill demand despite the temporary disruption in products from China. Plastics Technology, The Race for a Coronavirus Vaccine Spurs Syringe, Vial Production, July 22, 2020, <https://www.ptonline.com/blog/post/the-race-for-a-coronavirus-vaccine-spurs-syringe-vial-production>

Hydrocarbons Are Used to Make Plastics Used in Medical Equipment and Supplies

Plastics, also called polymers are derived⁴ from natural, organic materials such as cellulose, coal, natural gas, salt and crude oil. The production of plastics begins with the distillation of crude oil in an oil refinery, separating the heavy crude oil into groups of lighter components, called fractions. Each fraction is a mixture of hydrocarbon chains (chemical compounds made up of carbon and hydrogen), which differ in terms of the size and structure of their molecules. One of these fractions, naphtha, is the crucial compound for the production of plastics.

Plastics have been recognized for their critical role to the production and distribution of life-saving products:

- medical equipment, including face masks, diagnostic equipment, disposable gowns, shoe booties and hoods;
- material inputs used to make medical supplies such as test tubes, housings for test kits, goggles, surgical gloves, and surgical instruments.

Plastic materials have made modern healthcare possible. From the casing of an open MRI machine to the smallest tubing, plastics have made health care simpler and less painful. Disposable

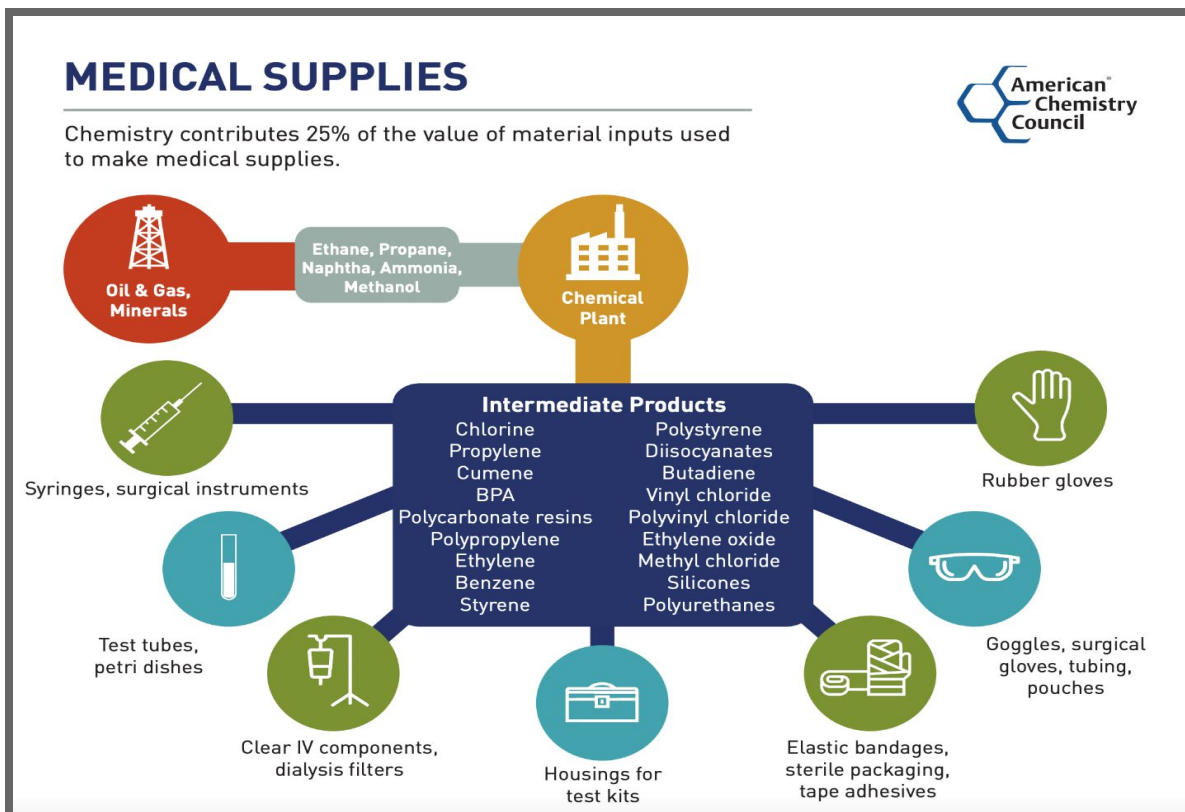
⁴ Plastics Europe, How Plastics are Made, <https://www.plasticseurope.org/en/about-plastics/what-are-plastics/how-plastics-are-made>

syringes, intravenous blood bags and heart valves are made of plastic. Plastics can be molded or formed into endless shapes and products. Tubing, syringes, IV bags, catheters, labware, films for packaging, surgical instruments, housings and connectors are just a few examples of the wide array of plastics-based medical devices. Plastic packaging⁵, which is light weight, low cost, durable, and transparent, is ideal for medical applications. Today's most innovative medical procedures are dependent on plastics⁶, which can be mass-produced at low cost and are thereby economical.

Plastics help keep medical environments and treatments sanitary, safe and effective. With the introduction of single-use, plastic-based devices at a large scale in the 1960s, the dangerous cross-contamination between patients was dramatically reduced and hospitals were made safer for workers. Later, the turn to plastics was due to an increase in infectious diseases, aging populations leading to a rise in geriatric care and a shift towards shorter hospital stays and more home health care.

⁵ Craftech Industries, 4 Reasons Why Flexible Materials Are Improving Product Packaging, <https://www.craftechind.com/4-reasons-why-flexible-materials-are-improving-product-packaging/>

⁶ Craftech Industries, The Many Uses of Plastic Materials in Medicine, <https://www.craftechind.com/the-many-uses-of-plastic-materials-in-medicine/>



Source: [American Chemistry Council](#)

Plastics are also more compatible with new sterilization technologies such as gamma radiation because plastics-based devices are easily sealed, sterilized and disposed of.

Major plastics used in medical supplies and equipment include:

- Syringes, surgical instruments and IV components made from polycarbonate – a plastic used for applications requiring transparency and high impact resistance.
- Polyvinyl chloride (a plastic polymer) most widely used in pre-sterilized single use medical

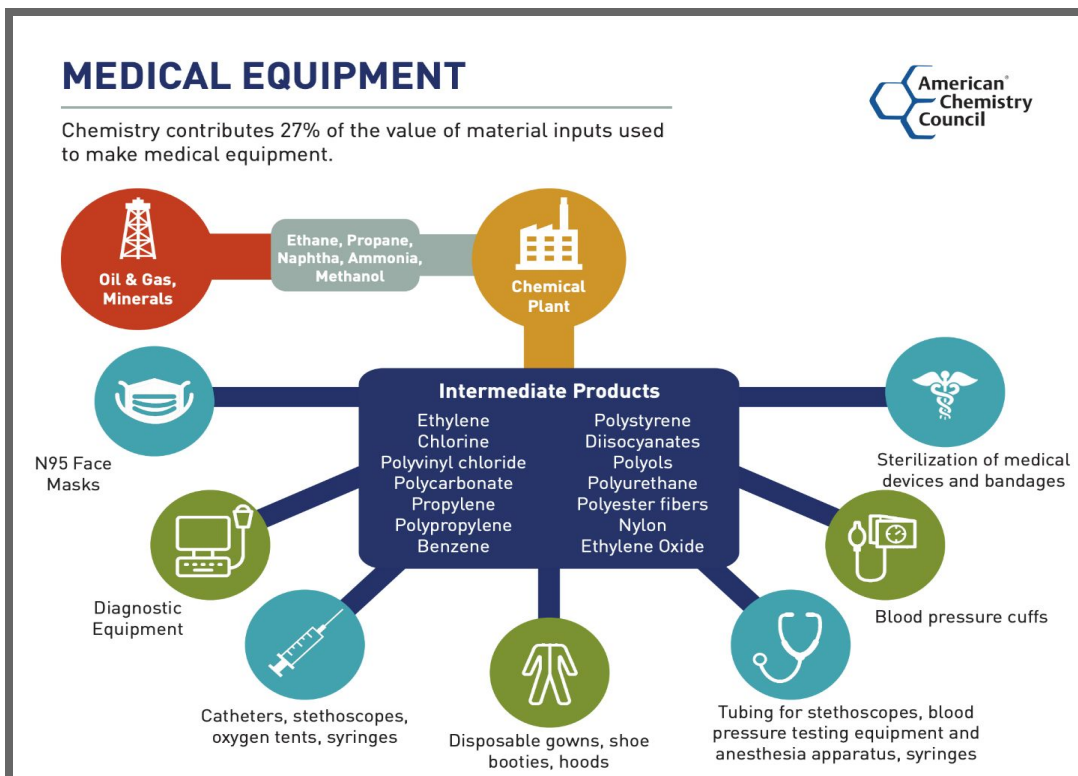
applications such as medical tubing, blood bags, and IV bags. It is a versatile plastic that has been used in medical applications for over 50 years. It is the most widely used plastic for medical devices, with a 40 percent⁷ share. Because of its transparency and anti-kinking properties, it has become a primary choice for tubing.

- Polypropylene, another plastic, is a key component of medical-grade personal protective equipment including masks, gowns and goggles. It is

⁷ PVC Med, When Plastics Revolutionized Health Care, <https://pvcmed.org/healthcare/when-plastics-revolutionised-healthcare/>

used to produce a cleanroom suit⁸, which is a garment worn in an environment with a controlled level of contamination. One common type is an all-in-one

the pre-filled syringes noted above is injection molded from polypropylene, made from hydrocarbons.



coverall worn by people creating sterile products for the medical device⁹ industry. The suit, which may be in one piece or several separate garments worn tightly together, covers the wearer to prevent skin and hair being shed into a clean room. The suit incorporates both boots and hood designed to be breathable and lightweight while protecting the wearer. Also, the needle hub for

Source: [American Chemistry Council](https://www.americanchemistrycouncil.org/)

Hydrocarbons Are Used in Making Glass for Medical Uses

Glass is made from liquid sand¹⁰, and its manufacture is highly energy intensive. The bulk of energy consumed in glass manufacturing comes from natural gas combustion¹¹ used to heat furnaces to

⁸ Wikipedia, Cleanroom Suit, https://en.wikipedia.org/wiki/Cleanroom_suit

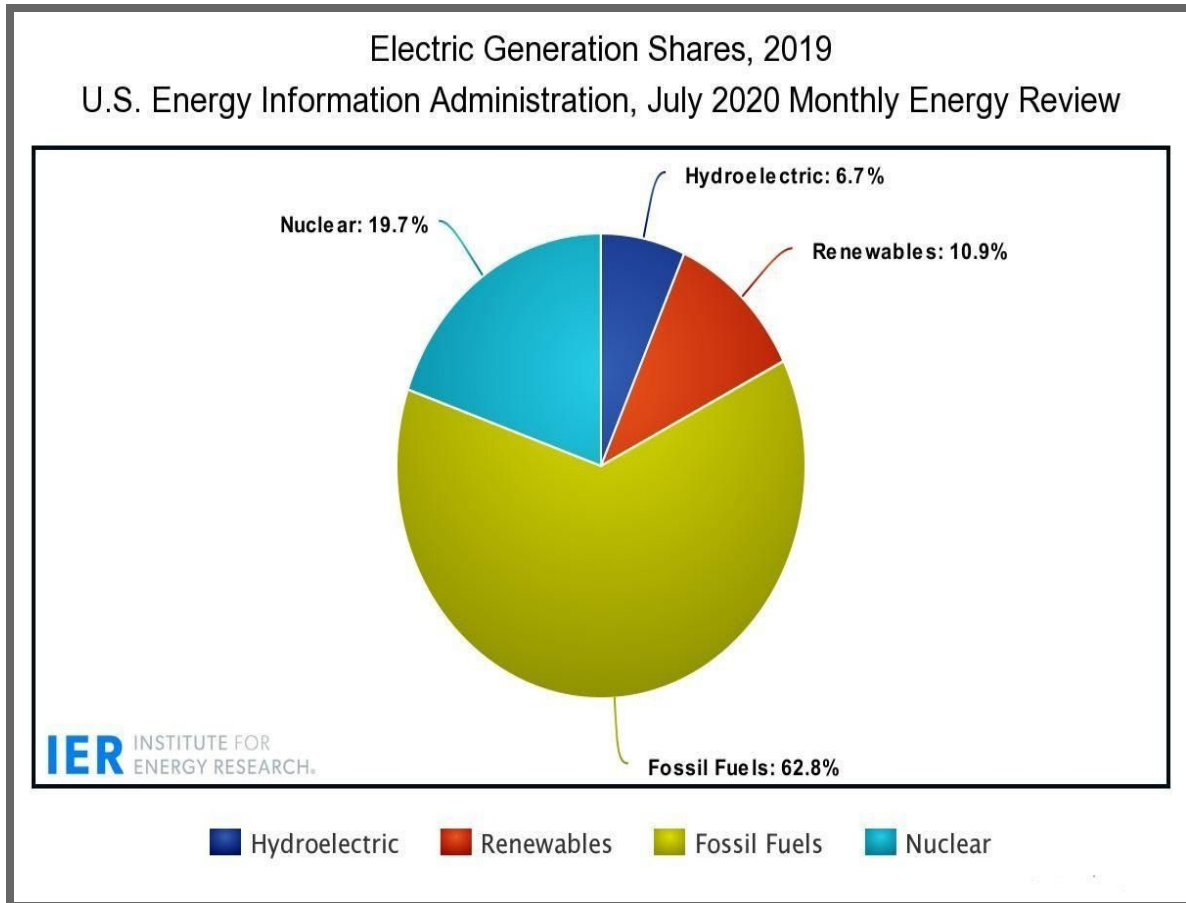
⁹ Wikipedia, Medical Device, https://en.wikipedia.org/wiki/Medical_device

¹⁰ Explain That Stuff, Glass, December 31, 2019, <https://www.explainthatstuff.com/glass.html>

¹¹ Energy Information Administration, Glass Manufacturing is an energy-intensive industry mainly fueled by natural gas, August 21, 2013, <https://www.eia.gov/todayinenergy/detail.php?id=12631>

melt raw materials to form glass. While most furnaces are natural gas-fired, there are a small number of electrically-powered furnaces and many glass furnaces use electric boosting

include slow cooling, tempering, coating and polishing, all of which require additional energy.



(supplementary electric heating systems) to increase throughput and quality. Over 60 percent of the electricity in the United States is generated from hydrocarbons, primarily natural gas and coal. After the melting and refining process is complete, glass is formed and finished to create the final product. The manufacturing processes depend on the final glass product, and can

Source: [Energy Information Administration](https://www.eia.gov)

Medical applications of glass include¹²:

- Microscope slides, which are thin, flat pieces of glass used in medical laboratories to hold specimens such as blood samples, excretions or tissues under the microscope.

¹² Glass Buzz, 10 Amazing Uses of Glass in Medicine, November 14, 2016, <https://www.glassbuzz.ca/10-amazing-uses-of-glass-in-medicine/>

- Borosilicate Glass – a type of glass with boron trioxide and silica known for its endurance to thermal shock. Glassware within a laboratory is mainly made of Borosilicate Glass. The pre-filled syringes mentioned above uses borosilicate glass for storage and transportation. Because the amount required for packaging the pre-filled syringes is stressing the market, manufacturers¹³ are looking to develop plastic alternatives.
- Laboratory flasks, which come in different sizes and shapes, used in laboratories to prepare medication.
- Laboratory beakers – used in chemical and biomedical laboratories to hold chemical elements and aid in the preparation of new drugs. They are designed to help in stirring, mixing and heating liquid substances in laboratories. While there are plastic and metallic beakers, glass beakers are preferred for their pellucidity.

Hydrocarbons Used for Refrigeration

The coronavirus vaccines being developed are required to be refrigerated at various temperatures depending on the vaccine. Pfizer's vaccine, for example, needs to be kept

¹³ Plastic Technology, Honeywell Debuts Aclar Edge Barrier Bottles for Pharmaceuticals, July 9, 2020, <https://www.ptonline.com/news/honeywell-debuts-aclar-edge-barrier-bottles-for-pharmaceuticals>

extremely cold: minus 70 degrees¹⁴ Celsius, while Moderna's vaccine needs to be kept at minus 20 Celsius¹⁵, similar to a regular freezer. That requires that the vaccines are transported and stored in refrigerators.

A typical refrigerator is likely made out of several different types of plastic¹⁶. These include ABS, or acrylonitrile butadiene styrene, polypropylene, high impact polystyrene, polycarbonate and foamed polyurethane. Each plastic has its own strength, flexibility and insulation properties. For example, manufacturers use polycarbonate, which is strong and rigid, to form molded exterior doors, handles and body panels. ABS, polypropylene and polystyrene are used to form the fridge's interior, including the interior door and wall panels as well as the shelves and drawers. Polyurethane is primarily found in refrigerator insulation, forming thin strips that trap air between layers of harder plastics.

¹⁴ NPR, Why Does Pfizer's COVID-19 Vaccine Need to be Kept Colder than Antarctica?, November 17, 2020, <https://www.npr.org/sections/health-shots/2020/11/17/935563377/why-does-pfizers-covid-19-vaccine-need-to-be-kept-colder-than-antarctica#:~:text=Neal%2FGetty%20Images-,The%20Pfizer%20COVID%2D19%20vaccine%20needs%20to%20be%20stored%20at,stints%20or%20in%20specialized%20freezers.>

¹⁵ Moderna, Moderna Announces Longer Shelf Life for its COVID-19 Vaccine Candidate at Refrigerated Temperatures, November 16, 2020, <https://investors.modernatx.com/news-releases/news-release-details/moderna-announces-longer-shelf-life-its-covid-19-vaccine>

¹⁶ Hunker, The Type of Plastic Used in a Refrigerator, October 19, 2018, <https://www.hunker.com/12614976/the-type-of-plastic-used-in-a-refrigerator>

Hydrocarbons are also used as refrigerants. Some of the most commonly used hydrocarbon refrigerants are propane, isobutene and propylene¹⁷. A number of other hydrocarbons, such as blends containing ethane, propane or butane, are also used as refrigerants. Propane has been discussed since the late 1980s as a replacement for Chlorofluorocarbons (CFCs).

Hydrocarbons are used for refrigeration in vending machines, supermarket refrigerators/freezers, commercial refrigeration, food processing, cold storage, industrial refrigeration, refrigerated transport, chillers, air

conditioning systems and heat pumps. They are highly adaptable to various applications. Other refrigerant classifications, such as CFCs, contain chlorine, which was found to damage the ozone layer¹⁸.

Hydrocarbons Needed for Transporting the Vaccine

Once the vaccines are produced, they need to be distributed to hospitals, clinics, pharmacies and doctors' offices. Whether they are shipped by plane, truck or other vehicle, petroleum products will be used to distribute the vaccines across America.



Source: [United Airlines](#)

¹⁷ Danfoss, Hydrocarbons, <https://www.danfoss.com/en/about-danfoss/our-businesses/cooling/refrigerants-and-energy-efficiency/refrigerants-for-lowering-the-gwp/hydrocarbons/#:~:text=The%20following%20types%20of%20hydrocarbons,R1270%20Propylene>

¹⁸Hydrocarbon Refrigerants, <https://refrigeranthq.com/refrigerant-2/hydrocarbons/>

In 2019, U.S. petroleum consumption averaged 20.54 million barrels per day¹⁹, including biofuels. Gasoline²⁰ is the most consumed petroleum product in the United States. In 2019, consumption of finished motor gasoline averaged about 9.31 million barrels per day (391 million gallons per day), which was equal to about 45 percent of total U.S. petroleum consumption.

and electricity generators. Also used as a heating oil, called fuel oil, total distillate fuel oil consumption in 2019 averaged about 4.10 million barrels per day (172 million gallons per day), which was equal to 20 percent of total U.S. petroleum consumption.



Distillate fuel oil is the second most-consumed petroleum product in the United States. Distillate fuel oil includes diesel fuel²¹ used in the diesel engines of trucks, some automobiles,

Source: [Mid-Hudson News](#)

Hydrocarbon gas liquids (HGLs)²², the third most-used category of petroleum in the United States, include propane, ethane, butane, and other HGLs that are produced at natural gas processing plants and oil refineries and are used for refrigeration as described above. Total consumption of HGLs in 2019 averaged about 3.14 million barrels per day.

¹⁹ Energy Information Administration, Oil and Petroleum Products Explained, <https://www.eia.gov/energyexplained/oil-and-petroleum-products/use-of-oil.php#:~:text=We%20use%20petroleum%20products%20to,intermediate%20and%20end%20user%20goods>

²⁰ Energy Information Administration, Gasoline Explained,

<https://www.eia.gov/energyexplained/gasoline/>

²¹ Energy Information Administration, Diesel fuel explained,

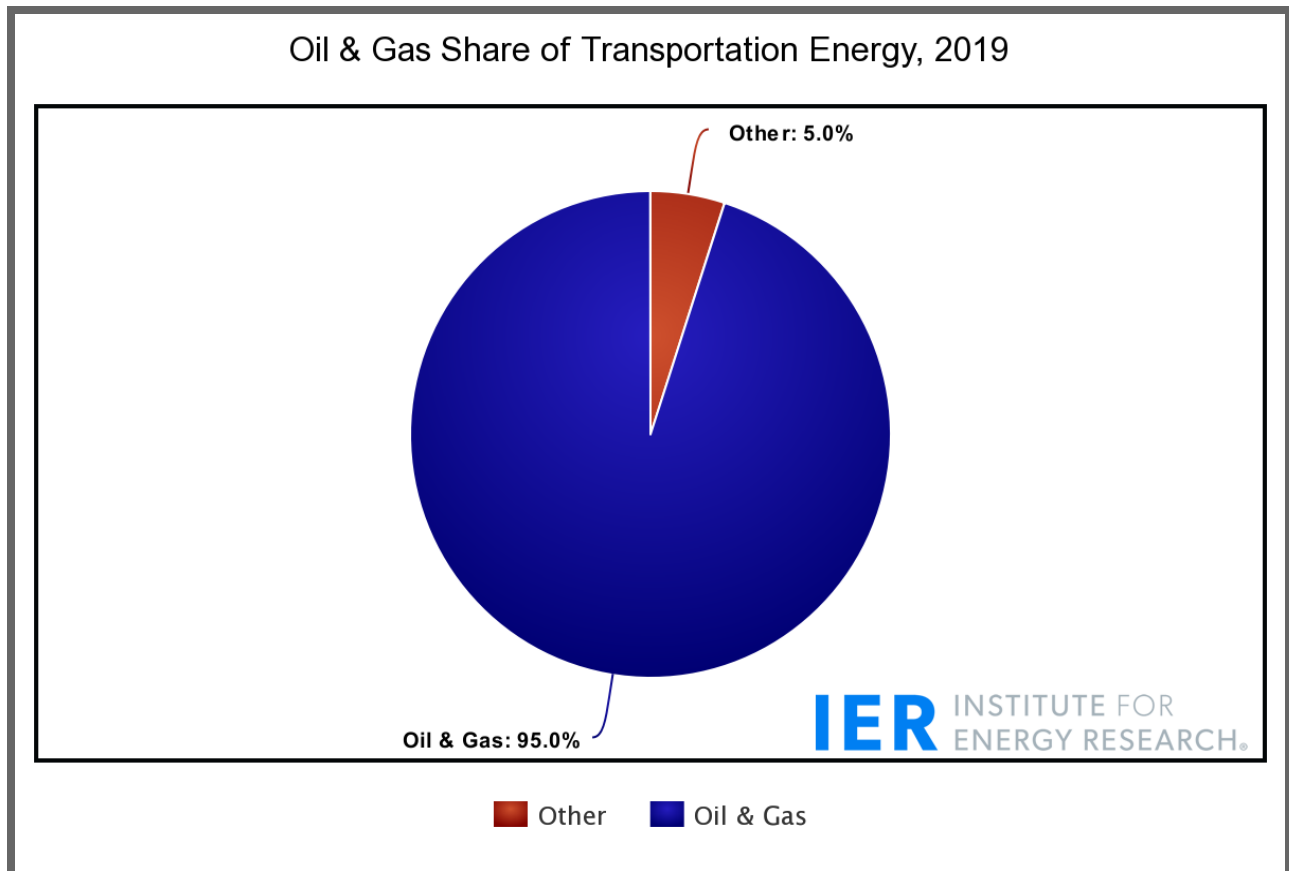
<https://www.eia.gov/energyexplained/diesel-fuel/>

²² Energy Information Administration, Hydrocarbon gas liquids explained, <https://www.eia.gov/energyexplained/hydrocarbon-gas-liquids/>

Jet fuel is the fourth most-used petroleum product in the United States. Jet fuel consumption averaged about 1.74 million barrels per day (73 million gallons per day) in 2019.

Ninety-five percent of the U.S. transportation system is fueled by oil and natural gas as the chart below depicts.

being used in the construction of medical buildings. Plastics, particularly polyvinyl chloride (PVC), are increasingly used in hospitals²³ and other medical offices for purposes other than medical supplies and equipment that are noted above. Due to its technical properties, PVC makes for hygienic and chemically resistant wall



Source: [Energy Information Administration](#)

Hospitals, Pharmacies, Clinics and Doctor Offices Rely on Plastics

Once the vaccine arrives at facilities that immunize patients, hydrocarbons are again abundant in the wide variety of plastics visible. In fact, they are even

covering and shock-absorbent, durable and safe flooring that is noise reductive and comfortable to walk on. It also allows for integration of signage of various kinds for easy navigation. And in combination with stretch ceilings made

²³PVC Med, PVC Used in Hospital Interiors, <https://pvcmed.org/healthcare/pvc-hospital-interiors/>

out of PVC, PVC flooring can improve acoustics.

Conclusion

The coronavirus vaccines would have been impossible to produce, transport, store and administer without the use of oil and gas. Hydrocarbons are the basis of the plastics used in medical facilities, supplies and equipment, of the refrigerants needed to keep the vaccines active and of the fuels needed to transport vaccines, personnel and equipment. It is crucial that Americans recognize the immense and varied benefits that the oil and gas industry confers – and has conferred specifically during the coronavirus pandemic. Calls from certain environmentalists and politicians to eliminate oil and gas, if heeded, would make the vaccine mobilization impossible.