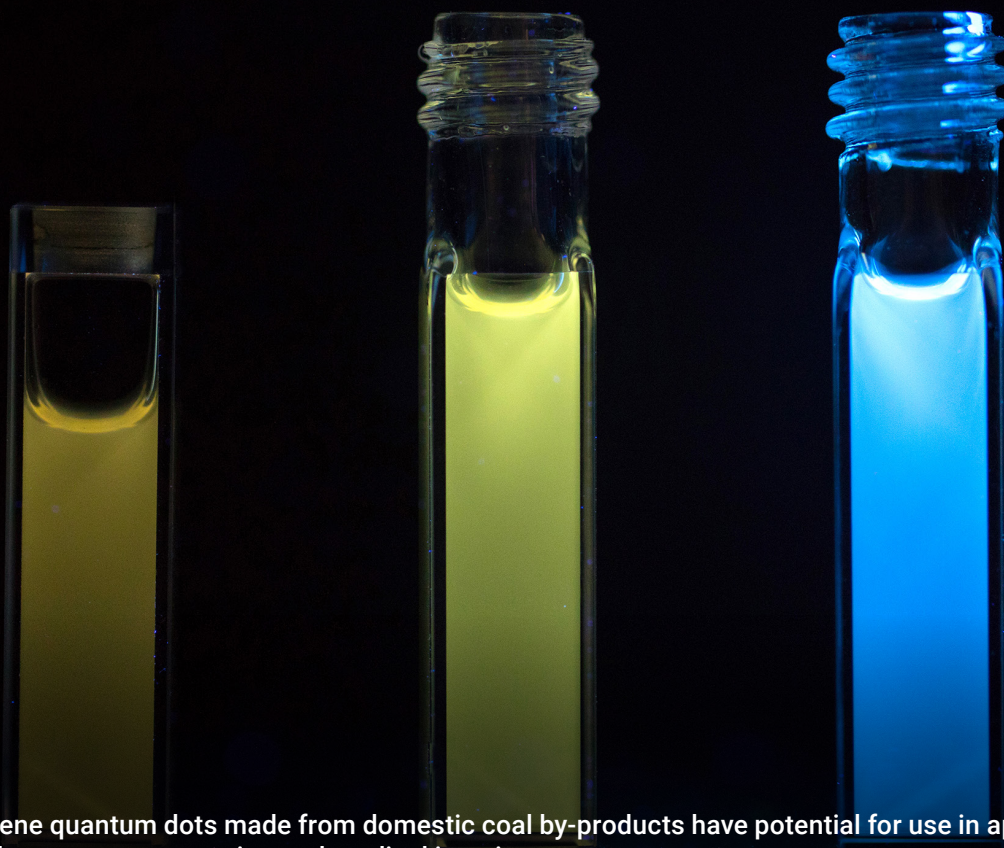


# CARBON ORE PROCESSING



Coal-based graphene quantum dots made from domestic coal by-products have potential for use in applications such as LEDs, solar cells, quantum computing and medical imaging.

Program 151, November 2022



## PROGRAM OVERVIEW

The United States has more than 4.4 billion tons of coal waste scattered across many sites throughout the nation. The Carbon Ore Processing Program aims to develop value-added products from abundant supplies of domestic coal and coal waste from power plants and industry, such as fly ash and slag. The program's goals include the following: cleaning up coal waste impoundments; driving down the cost of carbon product manufacturing; ensuring minimal environmental and workplace health and safety impacts; and securing domestic supplies of graphite, which is used for pencils, lubricants, polishes, batteries and other everyday items. In addition, some other value-added products that can be made from waste coal include nanocarbons, carbon fiber, building materials, carborundum (silicon carbide), diamond films and activated carbons.



**COAL TO CARBON PRODUCTS** — The Carbon Ore Processing Program supports R&D to transform coal and coal-wastes into value-added carbon products. Supported R&D covers an entire value-spectrum of products ranging from high-volume to high-value. Supported R&D includes projects that are developing building products, cement additives, silicon carbide, graphite for electrochemical applications, activated carbons, carbon fibers and foams, conductive inks, and nano-materials such as graphene and quantum dots. Support for these technologies includes laboratory and pilot-scale R&D as appropriate for the technology readiness level of the product. Cumulatively, these projects will support the deployment of technologies in markets with high compound annual growth rates that are outside of the traditional thermal and metallurgical markets.

**FEEDSTOCK UPGRADING** — The Carbon Ore Processing Program includes support of R&D for coal/coal-waste feedstock upgrading technologies. There are many hundreds of millions of tons of coal-cleaning wastes that were processed with pre-1970's technology, and these wastes can contain up to 50% carbon. Developing deep cleaning technologies could allow for legacy waste pile remediation while simultaneously producing a high-purity source of carbon without new resource extraction.

## CARBON ORE PROCESSING TECHNOLOGIES

- Supporting R&D of coal and coal-waste derived products in market segments with high compound annual growth rates.
- Developing feedstock upgrading technologies that can simultaneously allow for the remediation of legacy coal-cleaning wastes and the production of high-purity carbon in the absence of new resource extraction.
- Creating and maintaining a coal properties database that allows producers and consumers of coal and coal-wastes to understand the availability and movement of these resources.

## GOALS AND MILESTONES

- Initiate testing of laboratory- and pilot-scale technologies that use coal and coal-waste to produce value added carbon products to determine: (1) how the technologies can improve the value chain for carbon products in the United States, (2) the technology gaps that must be overcome, and (3) the major products that could be produced from the technologies with an estimate of the technical and economic performance targets required for commercialization of the technology.
- Complete market studies for upgraded coal and coal-waste derived products to determine how these resources can add value to sectors of the economy with high compound annual growth rates.
- Develop a readily accessible, machine-readable, and easy to use database of U.S. coal information so that coal and coal-waste producers and consumers can estimate the impact of resource availability. This will satisfy the data needs of researchers, producers, and consumers of coal and coal-waste derived carbon products.

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NETL is a DOE national laboratory dedicated to advancing the nation's energy future by creating innovative solutions that strengthen the security, affordability and reliability of energy systems and natural resources. With laboratories and computational capabilities at research facilities in Albany, Oregon; Morgantown, West Virginia; and Pittsburgh, Pennsylvania, NETL addresses energy challenges through implementing DOE programs across the nation and advancing energy technologies related to fossil fuels. By fostering collaborations and conducting world-class research, NETL strives to strengthen national energy security through energy technology development.

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