This product is part of the RAND Corporation technical report series. Reports may include research findings on a specific topic that is limited in scope; present discussions of the methodology employed in research; provide literature reviews, survey instruments, modeling exercises, guidelines for practitioners and research professionals, and supporting documentation; or deliver preliminary findings. All RAND reports undergo rigorous peer review to ensure that they meet high standards for research quality and objectivity.

TECHNICAL REPORT

Constraints on JP–900 Jet Fuel Production Concepts

James T. Bartis, G. Torrance Flint Jr.

Prepared for the United States Air Force

RAND PROJECT AIR FORCE

The research described in this report was sponsored by the United States Air Force under Contract FA7014-06-C-0001. Further information may be obtained from the Strategic Planning Division, Directorate of Plans, Hq USAF.

Library of Congress Cataloging-in-Publication Data

Bartis, James T., 1945-
Constraints on JP–900 jet fuel production concepts / James T. Bartis, G. Torrance Flint, Jr.
p. cm.
Includes bibliographical references.
ISBN 978-0-8330-4144-9 (pbk. : alk. paper)
1. Coal liquefaction. 2. Jet planes—Fuel. 3. Petroleum coke. I. Flint, G. Torrance. II. Title.

TP343.B327 2007
665.5'3825—dc22

2007013242

Published 2007 by the RAND Corporation
1776 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138
1200 South Hayes Street, Arlington, VA 22202-5050
4570 Fifth Avenue, Suite 600, Pittsburgh, PA 15213-2665
RAND URL: http://www.rand.org/
To order RAND documents or to obtain additional information, contact
Distribution Services: Telephone: (310) 451-7002;
Fax: (310) 451-6915; Email: order@rand.org

Summary

Researchers at the Energy Institute of Pennsylvania State University (Penn State) are conducting research on producing jet fuel by coprocessing coal or coal-derived products with low-value liquid intermediates produced during petroleum refining. To date, most of this research effort has focused on a coal-tar blending process. Penn State currently plans to build a one-barrel-per-day pilot plant and produce 100 barrels of product to be delivered to and tested by the Air Force Research Laboratory.

Recognizing the limited availability of the coal-tar derived liquids used in the coal-tar blending process, the Penn State research team has recently shifted its attention to a co-coking process, in which a mixture of solid coal and a refinery intermediate, decant oil, is used to produce a combination of liquid fuels and coke.

The findings and recommendations of the RAND Corporation review of these two processes are as follows:

Finding 1

Our review of Penn State's work on JP-900 revealed a research team with considerable expertise in coal pyrolysis. Coal pyrolysis as a means of producing liquid fuels was studied extensively during the first half of the 20th century, but few research teams today have the expertise to address how pyrolysis might be exploited and combined with other liquid-fuel production approaches, including coal and biomass liquefaction via Fischer-Tropsch synthesis, and with other biomass routes to liquid-fuel production. (See pp. 8–9.)

Recommendation

Consider supporting laboratory research and engineering analyses focusing on identifying possible opportunities by which pyrolysis can significantly improve the energy efficiency and costs of producing liquid fuels from coal and/or biomass.

Finding 2

The limited availability of coal tar seriously impedes the ultimate production potential of the Penn State coal-tar blending process. At most, successful development would produce only a

few thousand barrels per day of jet fuel. The net displacement of imported oil would be even smaller (pp. 3–4).

Recommendation

Cease all research directed toward developing this process, and cease testing fuels produced from this process. This includes terminating the planned pilot-scale operations at the Harmarville, Pennsylvania research site (p. 8).

Finding 3

For the Penn State co-coking process, the limited availability of decant oil and the limited markets and high quality specifications for premium coke will limit liquid-fuel production to less than 140,000 barrels per day, only a portion of which would likely be suitable for use as a jet fuel. Less than 8,000 barrels per day of this production would be attributed to coal. The net increase in U.S. coal production due to developing the co-coking process would be negligible, about 2 million tons per year, and this estimate assumes that process economics are favorable and that one-half of U.S. decant oil production can be diverted to co-coking (pp. 5–7).

Recommendation

Cease all research directed toward developing (including product testing) any co-coking process concept that depends on large amounts of decant oil for the production of jet fuel. If work is to continue on co-coking, it should be limited to fundamental research investigating the feasibility of co-coking concepts that use feedstocks that are at least an order of magnitude more abundant than decant oil and produce higher liquid and lower coke yields.