CAAF/09-IP/2
5/10/09
English only

CONFERENCE ON AVIATION AND ALTERNATIVE FUELS

Rio de Janeiro, Brazil, 16 to 18 November 2009

Agenda Item 4: Production and infrastructure

LESSONS LEARNED IN FACILITATING SUSTAINABLE ALTERNATIVE AVIATION FUELS DEPLOYMENT

(Presented by the United States)

SUMMARY

Commercial deployment of alternative aviation fuels faces several challenges including gaining the attention of energy producers, the unique requirements of aviation and tight credit markets due to the economic crisis. This information paper describes work in progress and "lessons learned" in facilitating aviation alternative fuels deployment by the Commercial Aviation Alternative Fuels Initiative's (CAAFI) Business and Economics team.

1. INTRODUCTION

1.1 The deployment of any new technology poses challenges. In the case of alternative aviation fuels, the initial steps to qualify the technology as airworthy (safe for use in aircraft) and to characterize its environmental performance as acceptable, while necessary, do not in themselves assure successful commercial deployment.

1.2 Deployment of alternative fuel in the aviation sector faces unique challenges. These include: first, that aviation represents less than 10% of overall transportation fuel demand making it to be a smaller and less attractive market than the ground transport or rail sectors. Second, airlines are viewed as poor credit risks by private sector financial institutions. In the current world economic situation aviation is not a strong candidate for private capital investment. Finally, the aviation fuel market has high barriers to entry with demanding airworthiness requirements and complex environmental issues associated with aircraft operation at multiple altitudes.

1.3 From a production perspective the current jet fuel production and distribution system is built upon a century of experience of the energy industry in which other fuels are dominant. As a middle distillate refined from crude oil, Jet fuel supply is tied to and dependent on the demand for and price of other petroleum products. This model leads to both supply and price volatility that needs to be addressed. An attraction of alternative fuels that can represent from as much as 40% of plant production for Hydrotreated Renewable Jet (HRJ) and as much as 60% for jet fuel derived from Fischer Tropsch

processes based upon current manufacturer claims. Achievement of these high levels of plant supply plays a key role in current deployment initiatives.

1.4 The timely deployment of new alternative jet fuels derived from multiple feedstocks and processes must address the challenges and opportunity described in paragraphs 1.1 to 1.3. CAAFI's Business and Economics team (ref CAAF/09-WP27), led by CAAFI's private sector airline partners has made the initiation of deployment efforts its primary focus.

1.5 In building its initial deployment efforts CAAFI seeks to build upon existing policy opportunities and public funding mechanisms. In the U.S., funding for research, development and full scale deployment via programs of the U.S. Department of Agriculture and Department of Energy could include aviation fuel as an eligible use for grant and loan provisions. Globally, agencies such as the World Bank, Inter-American Development Bank (IDB) and Asian Development Bank (ADB) have programs that seek to promote both economic development and environmental gain building upon their extensive experience with Aviation.

2. AVIATION ATTRIBUTES/PREREQUISITES FOR SUCCESSFUL ALTERNATIVE FUELS DEPLOYMENT

2.1 CAAFI's approach to deployment began with the creation of an inventory of attributes that make aviation a desirable customer for energy sector interests. This has produced interest in the energy and investor sectors as a means of motivating deployment efforts. Aviation's strengths as a customer for emerging fuel producers are:

- assured reliance of aviation on high density hydrocarbon liquid fuels for the foreseeable future;
- Concentrated Airport Distribution;
- aviation systems engineering / risk management capability embedded in FRL process*;
- concise roadmaps with multiple R&D sources developed by CAAFI teams*;
- single ICAO environmental regulatory framework to ensure global acceptance*;
- quantifiable air quality (PM 2.5) benefit to justify insertion under national air quality legislation (e.g. Clean Air Act in the United States);
- investment in aviation fuels Carbon life cycle analysis (LCA) "Rules and tools" to limit regulatory risk*;
- disciplined ASTM Qualification Framework is barrier to low quality producers*; and
- committed government/ private sector programs to qualify added fuel candidates.

2.2 Of the section 2.1 attributes, several marked by (*) are documented under other Working Papers and Information papers presented by the United States. For those not covered elsewhere a brief discussion of their relevance follows:

2.2.1 *Assured reliance of aviation on hydrocarbon liquid fuels*: certification efforts being executed by ASTM International in the near to mid-term are focused upon the use of "drop-in" fuel which require no changes in equipment for use in existing aircraft and engines. The capital barriers to non "drop-in" fuel use—the need to acquire entirely new fleets of engines and aircraft--are viewed by most observers to prohibit their adoption in the near to mid-term. Given this, prospective investors and suppliers of liquid hydrocarbon fuels are assured of a long-term aviation market for their products.

2.2.2 *Concentrated Airport Distribution*: Data available from various sources suggests that in the U.S. 80% of all jet fuel use is concentrated in 35 airports. This existing distribution system enables energy suppliers to distribute their product at the outset and on a large scale. Unlike the more complex ground transport distribution system few new distribution channels are required for a start-up production source.

2.2.3 The U.S. Environmental Protection Agency (EPA) first issued standards for particulate matter in 1971; and revised the standards in 1987, 1997 and 2006. The revised 2006 standards address two categories of particle pollution: *fine particles* ($PM_{2.5}$), which are 2.5 micrometers in diameter and smaller; and *inhalable coarse particles* (PM_{10}) which are smaller than 10 micrometers and larger than 2.5 Particulate matter (PM) pollutants have health consequences when inhaled. About 25 percent of U.S. commercial service airports are in areas that do not meet the national primary or secondary ambient air quality standard established by the EPA for designated pollutants, such as PM and ozone—including 40 of the top 50 airports. Fuels that reduce PM2.5 after combustion may be critical to aviation expansion at those airports. In direct measurements from a variety of engines all alternative fuels tested have shown marked reductions in PM2.5.

2.2.4 *Committed government/private sector programs to qualify additional fuel candidates*: The new synthetic jet fuel standard, ASTM D7566, allows for additional fuels to be certified for aviation use. Passing the certification benefits fuel producers and feedstock producers because they are assured that their product meets aviation standards. Ongoing commitment by U.S. government and private sector programs in support of testing and certification of additional fuels creates opportunity for new aviation fuel investors.

3. CREATION OF SUCCESS MOFELS AS A PATH TO EXECUTE DEPOLYMENT

3.1 CAAFI's Business and Economics team strategy envisions the creation of several successful model projects that address the industry challenges identified in paragraph 1 and that leverage the attributes identified in paragraph 2. Using lessons learned in other industries (e.g. renewable electric power) projects with start-up energy companies may attract investors. If successful, such an approach may attract larger, more risk sensitive companies to pursue investment in the sector.

3.2 As an initial objective the CAAFI business and economic team has set a target of achieving the deployment of up to ten 6,500 barrel per day fuel production facilities in the next 5 years. While such facilities will meet only 1% to 2% of U.S. industry fuel needs it aligns with the anticipated certification timing for 50/50 blends of HRJ targeted by the CAAFI certification team for approval in 2010 or early 2011. The projected facility size is consistent with recommendations of CAAFI energy supplier stakeholders.

3.3 As a means of selecting sites for such deployment the CAAFI Business and Economics team has supported four important complementary initiatives that are being pursued in both the public and private sectors by CAAFI sponsors and stakeholders.

3.3.1 *Disciplined candidate site selection for maximum success:* The CAAFI business team initiated an informal investigation in the U.S. of sites that could qualify for alternative fuels insertion using a number of criteria identified by users and suppliers. Specifically:

- potential of siting fuel facility on airport property;
- proximity to airport of multiple feedstocks;
- fuel certification for fuel process expected;

- energy manufacturers with interest in location;
- fixed Base Operator strength at airport;
- universities available to execute needed initial siting efforts under projects sponsored by the Department of Agriculture;
- aviation and energy finance consultants see high potential;
- local environmental conditions (e.g. air quality concerns with PM2.5) can drive airport interest; and
- strong local and state incentives programs.

3.3.2 *Airport Cooperative Research Program project:* The Transportation Research Board Airport Cooperative Research program is undertaking a project to explore the process described in 3.3.1.

3.3.3 *Cooperative Identification of Opportunities with Agriculture Department Regional Interests:* On September 1-2, 2009 the U.S. Air Force executed a "biofuels summit" drawing local and regional agricultural experts from each of four identified U.S. regions. CAAFI sponsors paired with State University and agriculture extension service leaders and to identify deployment priorities. Ongoing follow- up with those regions will further explore opportunities identified by these regional entities.

3.3.4 *Outreach and support services for Candidate energy companies* -- A proposed structure of support services to aviation alternative fuel producers was discussed at the CAAFI Business and Economics team meeting on October 1, 2009 with producers and investors interested in supporting these programs. The proposal initiates efforts with publicly supported initiatives using Fuel Readiness Level (FRL) categorization of candidate fuels, Life Cycle Analyses (LCA) framework assessments and introductions to both buyers and potential investment sources. The outreach and support effort is presently under review by CAAFI Public and private sources and will also be optimised based upon feedback from attendees at CAAFI's Business and Economics team.

4. CONCLUSIONS AND EXPECTED OUTCOMES

4.1 The CAAFI alternative fuels deployment approach attempts to address the unique challenges that aviation faces in order to position the industry as an early adopter of alternative fuels.

4.2 Success to date in attracting the attention of the energy sector is evidenced by the engagement of over 40 fuels companies in the most recent CAAFI meeting held on 30 September and 1 October 2009. Future success will be measured by the attainment of deployment goals and the continued refinement of measures identified in Paragraph 3.

4.3 Global producers and investment entities are invited to join, contribute to the above efforts and to propose means of enhancing developments at this very early stage of execution.

— END —