UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAY -8 2015

OFFICE OF
AIR AND RADIATION

Mr. Gary Blankenship
President
ENVIA Energy, LLC
1021 Main St.
Houston, Texas 77002

Dear Mr. Blankenship:

You petitioned the Agency on behalf of ENVIA Energy, LLC (ENVIA) to approve a pathway for the generation of cellulosic biofuel renewable identification numbers (RINs) under the renewable fuel standard (RFS) program for cellulosic diesel and naphtha produced from biogas derived from a landfill located adjacent to the fuel production facility (the "ENVIA Pathways"). In the ENVIA Pathways a mixture of landfill biogas and natural gas feedstocks are used to produce diesel fuel, naphtha and wax through Fischer-Tropsch gas-to-liquids (GTL) synthesis.

Through the petition process described under 40 CFR 80.1416, ENVIA submitted data to the U.S. Environmental Protection Agency to perform a lifecycle greenhouse gas analysis of the ENVIA Pathways. This analysis involved a straightforward application of the same methodology and much of the same modeling used for previous RFS rulemakings.

The attached document "ENVIA Energy, LLC Request for Fuel Pathway Determination under the RFS Program" describes the data submitted by ENVIA, the analysis conducted by the EPA, and our determination of the lifecycle greenhouse gas emissions associated with the fuel production pathway described in ENVIA's petition. It also includes a full definition of the ENVIA Pathways evaluated by the EPA.

Based on our assessment of the information provided in the ENVIA petition, cellulosic diesel and naphtha produced through the ENVIA Pathways meet the lifecycle GHG reduction requirements to qualify for cellulosic diesel (D-code 7) RINs and cellulosic biofuel (D-code 3) RINs, respectively. To qualify for RINs, the fuel produced by the ENVIA Pathways must also meet the other definitional criteria for renewable fuel specified in the Clean Air Act and EPA's implementing regulations.

This approval applies specifically to ENVIA Energy, LLC, and to the process, materials used, fuels and co-products produced, and process energy sources as outlined and described in the petition request submitted by ENVIA. This approval is effective as of signature date. The EPA will consider extending a similar approval to other petitioners utilizing similar fuel pathways as ENVIA, but will do so on a case-

by-case basis upon verification that the pathway described in the petition meets the applicable CAA requirements. The OTAQ Reg: Fuels Programs Registration and OTAQEMTS: OTAQ EMTS Application will be modified to allow ENVIA to register and generate RINs for diesel and naphtha produced through the ENVIA Pathways.

Sincerely,

Christopher Grundler, Director
Office of Transportation and Air Quality

Enclosure

ENVIA Energy, LLC Request for Fuel Pathway Determination under the RFS Program
Office of Transportation and Air Quality

**Summary:** ENVIA Energy, LLC (ENVIA) petitioned the Agency under the Renewable Fuel Standard (RFS) program to approve the generation of cellulosic (D-codes 3 or 7) biofuel renewable identification numbers (RINs) for cellulosic diesel and naphtha produced from biogas derived from a landfill located adjacent to the fuel production facility. ENVIA plans to use a mixture of landfill biogas and natural gas as a feedstock, and seeks to generate RINs for just the portion of finished fuel that is derived from landfill biogas. The company intends to produce diesel fuel and naphtha through Fischer-Tropsch gas-to-liquids (GTL) synthesis. ENVIA plans to power the process with electricity that is partly purchased and partly generated onsite by a steam turbine generator. ENVIA will use no more than 64 kilowatt hours (kWh) of grid electricity and no more than 580,000 British thermal units (Btu) of natural gas as process energy[1] per million Btu (mmBtu) of total fuel produced (diesel plus naphtha from both natural gas and biogas feedstock)[2] and will also produce a minimum 0.7 Btu of a renewable wax co-product per Btu of total fuel produced (diesel plus naphtha from both natural gas and biogas feedstock). The landfill biogas feedstock, processes, energy used, co-product produced and finished biogas-derived fuels as described in this paragraph are referred to in this document as the ENVIA Gas-to-Liquid Pathways ("ENVIA Pathways").

In a proposed rulemaking published on June 14, 2013 (78 FR 36042) (the "Pathways II proposed rule"), EPA proposed adding cellulosic diesel and naphtha produced from landfill biogas using GTL production technology to Table 1 to 40 CFR 80.1426. EPA's proposal included an analysis that showed these pathways could produce fuel meeting the 60% greenhouse gas (GHG) emissions reduction threshold necessary to qualify as cellulosic biofuel if a fraction of the electricity demands were generated onsite. In response to this proposal, EPA received a number of comments that raised concerns about adding these pathways as generally applicable pathways in Table 1 to 40 CFR 80.1426. These comments included concerns about the ability to track and verify the amount of on-site electricity production as well as questions regarding the treatment of the wax co-product. Based on the comments received, EPA decided that more time and information was needed to evaluate the proposed pathways, and the Agency did not finalize any pathways for cellulosic diesel or naphtha from biogas in the final rule published on July 18, 2014 (79 FR 42128) (the "Pathways II final rule").

In this document we are addressing all of the comments received on the Pathways II proposal that are relevant to the ENVIA Pathways, including concerns about electricity tracking and the comments received on our proposed assessment of the wax co-product. Based on the process information provided in the ENVIA petition and EPA's analysis of that information as described in

[1] Process energy refers to natural gas burned to provide heat for the ENVIA process.
2 Based on EPA's evaluation, these limits represent the maximum amount of energy that the ENVIA process can use to produce a fuel that meets the 60% GHG reduction required for cellulosic biofuels. Based on the petition submitted by ENVIA, which is described in more detail in this document, we expect actual energy usage to be lower than these limits. Unless otherwise specified, in this document all references to energy content (e.g., Btu) are expressed in terms of lower heating value.

this document, cellulosic diesel and naphtha produced from biogas through the pathways described in ENVIA's petition achieve a 76-77% reduction in GHG emissions compared to the statutory petroleum baseline depending on the fuel considered. In order to address concerns about tracking of energy use, we are building in limits on purchased electricity and natural gas use for process energy, as well as a provision specifying minimum co-product wax production. These limits are calculated and designed to ensure that the finished ENVIA fuel for which RINs may be generated attains at least 60% GHG reduction as compared to baseline fuel. We conclude that diesel and naphtha produced through the ENVIA Pathways qualify under the Clean Air Act (CAA) for cellulosic biofuel (D-Code 3 or 7) RINs, depending on the fuel type.[3]

This document is organized as follows:

- *Section I. Required Information and Criteria for Petition Requests*: This section contains information on the background and purpose of the petition process, the criteria EPA uses to evaluate the petitions and the information that is required to be provided under the petition process as outlined in 40 CFR 80.1416. This section is not specific to ENVIA's request and applies to all petitions submitted pursuant to 40 CFR 80.1416.
- *Section II. Available Information*: This section contains background information on ENVIA and describes the information that ENVIA provided and how it complies with the petition requirements outlined in Section I.
- *Section III. Analysis and Discussion*: This section describes the lifecycle analysis done for today's determination and identifies how it differs from the analyses done for previous RFS rulemakings. This section also describes how we have applied the lifecycle results to determine the appropriate D-code for the ENVIA Pathways.
- *Section IV. Conditions and Associated Regulatory Provisions*: This section describes the regulatory provisions associated with this petition.
- *Section V. Public Participation*: This section describes how this petition is an extension of the analysis done as part of previous RFS rulemakings.
- *Section VI. Conclusion*: This section summarizes our conclusions regarding ENVIA's petition, including the D-code ENVIA may use in generating RINs for fuel produced using the ENVIA Pathways.

## I. Required Information and Criteria for Petition Requests

### A. Background and Purpose of Petition Process

As a result of changes to the RFS program in CAA section 211(o) required by the Energy Independence and Security Act of 2007 (EISA), EPA adopted new regulations, published at 40 CFR part 80, subpart M, which specify the types of renewable fuels eligible to participate in the RFS

3 Cellulosic diesel produced from cellulosic feedstocks may qualify for cellulosic diesel (D-code 7) RINs. Naphtha produced from cellulosic feedstocks may qualify for cellulosic biofuel (D-code 3) RINs.

program and the procedures by which renewable fuel producers and importers may generate RINs for the qualifying renewable fuels they produce through approved fuel pathways.[4]

Pursuant to 40 CFR 80.1426(f)(1) of the regulations:

> *Applicable pathways. D codes shall be used in RINs generated by producers or importers of renewable fuel according to the pathways listed in Table 1 to this section, paragraph (f)(6) of this section, or as approved by the Administrator.*

Table 1 to 40 CFR 80.1426 lists the three critical components of a fuel pathway: (1) fuel type, (2) feedstock, and (3) production process. Each specific combination of the three components, or fuel pathway, is assigned a D code. EPA may also independently approve additional fuel pathways not currently listed in Table 1 for participation in the RFS program, or a third party may petition for EPA to evaluate a new fuel pathway in accordance with 40 CFR 80.1416. In addition, producers of facilities identified in 40 CFR 80.1403(c) and (d) that are exempt from the 20% GHG emissions reduction requirement of the Act may generate RINs with a D code of 6 pursuant to 40 CFR 80.1426(f)(6) for a specified baseline volume of fuel.

The petition process under 40 CFR 80.1416 allows parties to request that EPA evaluate a new fuel pathway's lifecycle GHG reduction and provide a determination of the D code for which the new pathway may be eligible.

### B. Required Information in Petitions

As specified in 40 CFR 80.1416(b)(1), petitions must include all of the following information, and should also include as appropriate supporting documents such as independent studies, engineering estimates, industry survey data, and reports or other documents supporting any claims:

- The information specified under 40 CFR 80.76 (Registration of refiners, importers or oxygenate blenders).
- A technical justification that includes a description of the renewable fuel, feedstock(s), and production process. The justification must include process modeling flow charts.
- A mass balance for the pathway, including feedstocks, fuels produced, co-products, and waste materials production.
- Information on co-products, including their expected use and market value.
- An energy balance for the pathway, including a list of any energy and process heat inputs and outputs used in the pathway, including such sources produced off site or by another entity.
- Any other relevant information, including information pertaining to energy saving technologies or other process improvements.

4 See EPA's website for information about the RFS regulations and associated rulemakings: http://www.epa.gov/otaq/fuels/renewablefuels/regulations.htm

- Other additional information as requested by the Administrator to complete the lifecycle greenhouse gas assessment of the new fuel pathway.

In addition to the requirements stated above, parties who use a feedstock not previously evaluated by EPA must also include the following, and should also include as appropriate supporting information such as state, county, or regional crop data, commodity reports, independent studies, industry or farm survey data, and reports or other documents supporting any claims:

- Type of feedstock and description of how it meets the definition of renewable biomass.
- Market value of the feedstock.
- List of other uses for the feedstock.
- List of chemical inputs needed to produce the renewable biomass source of the feedstock and prepare the renewable biomass for processing into feedstock.
- Energy needed to obtain the feedstock and deliver it to the facility. If applicable, identify energy needed to plant and harvest the source of the feedstock and modify the source to create the feedstock.
- Current and projected yields of the feedstock that will be used to produce the fuels.
- Other additional information as requested by the Administrator to complete the lifecycle greenhouse gas assessment of the new fuel pathway.

## II. Available Information

### A. Background on ENVIA

ENVIA petitioned the Agency under 40 CFR 80.1416 to approve the generation of cellulosic biofuel RINs for cellulosic diesel and naphtha produced from landfill biogas feedstock through a combination of methane reforming and a GTL process. ENVIA's first petition, submitted in September 2011, was for a GTL process that used only landfill biogas as both a feedstock and for process heat fuel. ENVIA subsequently revised their petition in September 2014, when they provided new data for a GTL process that also uses natural gas as a feedstock and process heat fuel. The process data provided by ENVIA were submitted under a claim of confidential business information (CBI).

A petition is required because the ENVIA pathways are not approved pathways in Table 1 to 40 CFR 80.1426. The proposed ENVIA pathways differ from those EPA has modeled previously in that they involve the use of a process (methane reforming and Fischer-Tropsch GTL) to produce cellulosic diesel and naphtha from landfill gas feedstock that has not been previously modeled.

### B. Information Available Through Existing Modeling

A fuel pathway under the RFS regulations is defined by three components: (1) fuel type, (2) feedstock, and (3) production process. The pathway addressed in ENVIA's petition would produce

cellulosic diesel and naphtha using a biogas feedstock that has already been evaluated as part of the Pathways II final rule and other RFS rulemakings (see Table 1 below). Therefore, no new feedstock modeling was required. Similarly, no new modeling of the emissions associated with the combustion of cellulosic diesel or naphtha was required because combustion of cellulosic diesel and naphtha has already been modeled as part of previous RFS rulemakings. This petition only required EPA to evaluate a modified fuel production process.

In the final rule published on March 26, 2010 (75 FR 14670) (the "March 2010 RFS rule"), EPA analyzed and approved a number of pathways for cellulosic diesel and naphtha from a number of processes and feedstocks. In that rule EPA also approved a pathway for generating advanced biofuel RINs for biogas produced with any process from landfills, sewage and wastewater treatment plants and manure digesters. In the Pathways II final rule EPA made several updates to the biogas pathway including specifying that CNG/LNG is the fuel and biogas from landfills (and other sources) is the feedstock. In that rule, EPA also determined that landfills (and other sources) could be considered sources of cellulosic biogas feedstock, and added a pathway for electricity produced from cellulosic sources of biogas. Our analysis of the ENVIA Pathways used the same analytical approach that was used in the Pathways II rule to evaluate the lifecycle GHG emissions associated with the fuel pathways using biogas feedstock, as shown in Table 1 below. The ENVIA Pathways use landfill biogas, a feedstock previously evaluated by EPA for the Pathways II final rule, with the difference being that the ENVIA Pathways use a different process and produce different fuels.

This was a straightforward analysis based on existing modeling done for previous rulemakings and substituting ENVIA's process data, which only altered the amounts of inputs (syngas) and outputs (diesel, naphtha, and wax). Additionally, we estimated a displacement credit for the wax co-product taking into consideration public comments received in response to the Pathways II proposed rule. The analysis completed for this petition utilized the same fundamental modeling approach as was used in previous rulemakings for the RFS program.

**Table 1: Excerpts of Existing Fuel Pathways from Table 1 to 40 CFR 80.1426**

| | Fuel Type | Feedstock | Production Process Requirements | D-Code |
|---|---|---|---|---|
| N | Naphtha | switchgrass, miscanthus, energy cane, *Arundo donax,* and *Pennisetum purpureum* | Gasification and upgrading processes that convert cellulosic biomass to fuel | 3 (Cellulosic) |
| L | Cellulosic diesel, jet fuel and heating oil | Crop residue, slash, pre-commercial thinnings and tree residue switchgrass, miscanthus, | Any process that converts cellulosic biomass to fuel | 3 |

| | | | | |
|---|---|---|---|---|
| | | energy cane, *Arundo donax, Pennisetum purpureum,* and separated yard waste; biogenic components of separated MSW; cellulosic components of separated food waste; and cellulosic components of annual cover crops | | |
| Q | Renewable compressed natural gas, renewable liquefied natural gas, renewable electricity | Biogas from landfills, municipal wastewater treatment facility digesters, agricultural digesters, and separated MSW digesters; and biogas from the cellulosic components of biomass processed in other waste digesters | Any | 3 |
| T | Renewable compressed natural gas, renewable liquefied natural gas, renewable electricity | Biogas from waste digesters | Any | 5 (Advanced) |

### C. Information Submitted by ENVIA

ENVIA supplied all the information as required in 40 CFR 80.1416 that EPA needed to analyze the lifecycle GHG emissions associated with the ENVIA Pathways. The information submitted includes a technical justification that has a description of the fuel, feedstock used, and ENVIA's proprietary production process with modeling flow charts, a detailed mass and energy balance of the process with information on co-products as applicable, and other additional information as needed to complete the lifecycle GHG assessment.

## III. Analysis and Discussion

### A. Lifecycle Analysis

Determining a fuel pathway's compliance with the lifecycle GHG reduction thresholds specified in CAA section 211(o) for different types of renewable fuel requires a comprehensive

evaluation of the renewable fuel, as compared to the gasoline or diesel that it replaces, on the basis of its lifecycle GHG emissions. As mandated by CAA section 211(o), the GHG emissions assessments must evaluate the aggregate quantity of GHG emissions (including direct emissions and significant indirect emissions such as significant emissions from land use changes) related to the full lifecycle, including all stages of fuel and feedstock production, distribution, and use by the ultimate consumer.

In examining the full lifecycle GHG impacts of renewable fuels for the RFS program, EPA considers the following:

- Feedstock production – based on agricultural sector models that include direct and indirect impacts of feedstock production.
- Fuel production – including process energy requirements, impacts of any raw materials used in the process, and benefits from co-products produced.
- Fuel and feedstock distribution – including impacts of transporting feedstock from production to use, and transport of the final fuel to the consumer.
- Use of the fuel – including combustion emissions from use of the fuel in a vehicle.

EPA's evaluation of the lifecycle GHG emissions related to the ENVIA Pathways for this petition request is consistent with the CAA's applicable requirements, including the definition of lifecycle GHG emissions and threshold evaluation requirements. It was based on previous lifecycle analysis modeling that EPA completed for the March 2010 and Pathways II final rules as well as information regarding the ENVIA Pathways that was submitted under a claim of CBI by ENVIA. The information provided included the mass and energy balances necessary for EPA to evaluate the lifecycle GHG emissions of the proposed ENVIA pathways. As described above, the proposed ENVIA Pathways involve a feedstock type and finished fuels that have already been evaluated as part of rulemakings for the RFS program, so no new modeling of these components was necessary for today's decision.

**Feedstock Production** – ENVIA provided, as part of the information claimed as CBI, their process yields in terms of biogas used per volume of finished naphtha, diesel, and co-product wax produced. ENVIA intends to use biogas obtained from an adjacent landfill as feedstock. Since landfill biogas as feedstock was already evaluated as part of the Pathways II final rule, no new feedstock production modeling was required. As described in the Pathways II final rule, we do not believe there will be any changes in upstream waste production associated with the approval of these biogas pathways under the RFS program. Our analysis also considers the alternative use of the biogas and accounts for changes in emissions from this alternative use in the ENVIA Pathway. For all of the biogas sources evaluated in the Pathways II rule including landfill biogas, the alternative fate was assumed to be collection and flaring. We determined what GHG emissions would be avoided by evaluating the difference in GHG emissions between the baseline scenario of collection and flaring and the alternative scenario of collecting the biogas and conversion to liquid fuels. The GHG emissions in the baseline scenario were described in the Pathways II proposed and final rules, based on an emissions factor for collection and flaring of 1,004 $gCO_2e$ per mmBtu of biogas flared. In our analysis

of the ENVIA biofuel products, these baseline emissions were subtracted from the lifecycle emissions associated with using cellulosic diesel and naphtha as transportation fuels.

**Feedstock Transport** – ENVIA has indicated that its fuel production process will occur at, or adjacent to the biogas source so there are no feedstock transportation emissions included in our analysis.

**Fuel Production** – The ENVIA process includes a combination of methane reforming and the Fischer-Tropsch GTL process. For methane reforming, the biogas is first purified to remove water and contaminants and then fed to a methane reformer to create synthesis gas, known as syngas, which is composed of a mixture of carbon monoxide and hydrogen gas. The syngas is then sent to a Fischer-Tropsch (FT) system in which the carbon monoxide and hydrogen are combined in the presence of a catalyst to form a range of hydrocarbons. This reaction produces relatively short-chain (naphtha), medium-length (diesel) and long-chain (wax) hydrocarbons.

According to their petition, ENVIA seeks to generate RINs for their diesel and naphtha products derived from landfill biogas. The ENVIA process produces a wax co-product in addition to the naphtha and diesel products. The wax co-product represents a significant portion of the total process output. Wax can be further upgraded into fuel or lubricant oil or used directly in the wax market.

As described in the Pathways II proposed rule, two approaches are commonly used in lifecycle analysis to account for this type of co-product. In the first, often called allocation, the facility's total process GHG emissions are divided by the sum of the energy embodied in the wax, naphtha, and diesel products, thus reducing the overall GHG emissions per Btu of fuel output from the facility. The second approach, often called displacement, considers what products the wax co-product might displace in the wax market and subtracts the GHG emissions associated with the displaced product from the ENVIA lifecycle GHG emissions associated with the fuel and co-product production. The displacement approach is consistent with our analysis of other biofuel co-products as part of the March 2010 RFS rule. In the Pathways II proposed rule we examined both approaches and proposed to account for the co-product wax using the displacement approach. In our proposed analysis, we assumed that ENVIA's wax co-product would displace petroleum-derived wax. We sought comment on this approach as part of the Pathways II proposed rule.

We received several comments on the wax co-product accounting approach proposed in the Pathways II proposed rule. One commenter indicated that EPA's assumptions were reasonable and appropriate for the situation while also stating that new FT wax would likely substitute for a made-for-purpose wax (from other vegetable, animal or mineral sources), not petroleum wax.[5] Another commenter recommended that EPA should quantify the co-product credit using "realistic" assumptions

5 Comment submitted by Iogen Corporation, ID: EPA-HQ-OAR-2012-0401-0135. Made for purpose wax refers to wax that is not a co-product of another process.

and assess the range of uncertainty in the LCA.[6] To respond to these comments, EPA further evaluated the co-product credit associated with ENVIA's wax production, including gathering additional information on the market for wax products.

No comments indicated we should consider the allocation approach for co-product credit and some indicated our approach is appropriate therefore we continue to use the displacement approach in this analysis. Based on using the displacement approach the main areas of consideration for evaluating the co-product credit are what source of wax would be displaced by the ENVIA co-product wax and what the final use of the wax is. The following discussion goes into the further research we conducted on these two aspects of the co-product credit.

In terms of what source of wax would be displaced, industry data indicates that 85% of global wax production is derived from petroleum; the remainder includes 11% synthetic from other fossil sources including FT GTL plants and 4% from made for purpose animal and vegetable sources.[7] Petroleum based wax is primarily a co-product of petroleum refining and therefore the level of petroleum wax production is largely independent of price signals. However, refineries do have some control over wax production. Petroleum wax production is associated with production of a low quality lubricant at the refinery. Refineries can also decide to produce a higher quality lubricant that does not result in co-product wax. This decision is driven in part by regional lubricant requirements and has led to many North American refineries switching over to the higher quality lubricant production and thus reducing petroleum wax production.[8] However, the decision of existing wax producing refineries to switch over to non-wax-producing processes could also be driven in part by supply of wax from other sources such as the ENVIA process. ENVIA's wax production would increase the supply of wax, which would reduce the price of wax and make it more likely that refineries would switch processes and reduce their wax production.

The other alternative sources of wax production that could be displaced by the ENVIA wax co-product are other FT GTL sources or plant or animal-based sources (including made-for-purpose wax). Similar to the ENVIA pathways, there are existing and planned FT plants using natural gas that could also produce a wax co-product. The GHG emissions associated with natural gas-based GTL wax production is about twice that of the emissions from petroleum-based wax production.[9] Therefore, if the ENVIA co-product wax displaced wax from these other natural gas-based GTL projects, it would result in greater savings than displacement of petroleum wax production. The GHG emissions

6 Comment submitted by the American Petroleum Institute (API) and the American Fuel & Petrochemical Manufacturers (AFPM) Public Submission, ID: EPA-HQ-OAR-2012-0401-0128.
7 Kline Group (2011) Global Wax Industry 2010: Market Analysis and Opportunities. http://www.klinegroup.com/reports/brochures/y635a/brochure.pdf.
8 Wax production and market data from the American Fuel and Petrochemical Manufacturers http://www.afpm.org/wax-facts/
9 Argonne National Laboratory Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation Model (GREET), http://greet.es.anl.gov/.

associated with plant- or animal-based wax production is uncertain and depends in large part on the feedstock used. If it is a waste-based product, the emissions could be relatively low or zero.

Therefore, the displaced GHG emissions savings associated with the ENVIA co-product wax production could range from close to zero if it displaces a waste-derived wax to twice petroleum-based wax production GHG emissions if natural gas-based GTL wax is displaced. EPA does not have sufficient information on which to determine what alternate sources of wax would be displaced by the ENVIA wax co-product and its associated GHG impact, and none was provided in the comments. Therefore, similar to EPA's approach for other biofuel co-product credits (e.g., glycerine from biodiesel), EPA believes that its proposed approach of using a value for modeling purposes in the mid-range of likely displaced wax sources is reasonable. The displacement of petroleum-based wax is a simplifying assumption determined by EPA to reflect the mid-range of possible GHG credits, and EPA believes it is appropriately representative of the average GHG impacts of ENVIA's wax production.

In terms of wax end use there are two main categories of end uses for wax: combustion end uses (e.g., candles) and non-combustion end uses (e.g., packaging). In both cases, the use of ENVIA co-product wax offsets the production emissions of the alternative wax product as discussed above. In addition, the end use emissions of the ENVIA co-product wax also displaces the end use emissions of the alternative wax product being displaced. In the Pathways II proposed rule we indicated that if combustion was the end use of the co-product wax, the co-product credit would be larger due to the displaced combustion emissions. However, we did not propose to include those savings since we did not have enough information on whether the wax would be combusted or not. However, based on comments received and further evaluation of the end uses, we have determined that both combustion and non-combustion end uses for the ENVIA co-product wax result in the same co-product displacement credit and should be included in the LCA.

In the case of combustion end use, the net $CO_2$ emissions associated with the combustion of the biogas-derived carbon in the ENVIA co-product wax would effectively be zero. This is because the carbon in the biogas is of biogenic origin and would have been released anyway in the flaring baseline. Since the combustion of displaced wax from fossil fuels would have resulted in a net increase in $CO_2$ in the atmosphere, the co-product credit is the difference between zero net $CO_2$ emissions from combusting the ENVIA co-product wax and the avoided emission from combusting the displaced fossil fuel-derived wax.

In the case of non-combustion end use, the carbon in wax is sequestered, and not released to the atmosphere. Production of the ENVIA co-product wax would result in a net decrease in $CO_2$ emissions, since the atmosphere-derived biogenic $CO_2$ is not being recycled to the atmosphere. Although the displaced fossil fuel-derived wax could have resulted in zero net $CO_2$ emissions (essentially only changing the form of $CO_2$ sequestration from crude oil to wax), the appropriate emission credit would be the difference between zero end use emissions for petroleum wax and the negative $CO_2$ emissions associated with sequestration of biogenic carbon in the ENVIA co-product

wax. The magnitude of this co-product credit is equivalent to the credit associated with combustion end uses, as described above.

Since the size of the credit for the carbon in the ENVIA co-product wax is independent of the end use of the wax, we included both the displaced petroleum wax production emissions and the end use emissions credit in the overall co-product displacement credit for ENVIA wax. Based on this analysis, the wax co-product produced by the ENVIA process results in a displacement credit of 2,880 $gCO_2e$ per kg wax.

The Pathways II proposed rule requested comment on fugitive methane emissions from FT facilities. As discussed in the proposed rule, data regarding fugitive emissions from FT facilities using methane as a feedstock are limited, but based on the available studies and information provided in the ENVIA petition EPA assumed no fugitive methane emissions from FT facilities. We did not receive any comments or data supporting a higher value; therefore, for this analysis we assume no fugitive methane emissions at the ENVIA facility.

ENVIA provided information on the total amount of electricity used in the process. ENVIA intends to satisfy this electricity demand through grid supplied electricity and electricity produced onsite. For electricity purchased from the grid we used the emissions factor for U.S. average grid electricity used in the March 2010 RFS final rule. Heat generated by the reaction can be used to preheat gases in the system and to generate electricity for use in the system. Unconverted syngas from the FT process can also be combusted to generate electricity. Our analysis included on site combustion emissions used to generate electricity and was based on the electrical demand data provided in the ENVIA petition.

**Fuel Distribution** – The assessment of the ENVIA Pathways assumed emissions associated with fuel transport and distribution of cellulosic diesel and naphtha. Emissions factors from the GREET model for Fischer-Tropsch diesel and naphtha were used to model these emissions.

**Fuel Use** –The GHG emissions associated with using cellulosic diesel and naphtha fuels were evaluated as part of the March 2010 RFS rule. The fuel use emissions calculated as part of these previous rules were applied in our analysis of the ENVIA pathways.

**Lifecycle GHG Results** – Based on the analysis described above, we estimated the lifecycle GHG emissions associated with cellulosic diesel and naphtha produced with the ENVIA process using biogas feedstock and being powered by natural gas, purchased electricity and electricity generated onsite as described in the ENVIA petition. Table 3 shows the lifecycle GHG emissions for these fuels using data described in ENVIA's petition. To evaluate the pathways described in ENVIA's petition we compared the lifecycle GHG emissions from ENVIA's cellulosic diesel product to the 2005 diesel fuel baseline and the naphtha product to the 2005 gasoline baseline because renewable naphtha is a gasoline blendstock replacement. As shown in the table, the results are not significantly different between cellulosic diesel and naphtha produced through the ENVIA pathways.

**Table 2: Lifecycle GHG Emissions for Fuel Produced through the Pathways Described in ENVIA's Petition (kgCO2e/mmBtu)**[10]

| | GHG Emissions (kg $CO_2e$/mmBtu) | | | |
|---|---|---|---|---|
| | Fuel Produced through the Pathways Described in ENVIA's Petition | | Petroleum Baselines | |
| Lifecycle Stage | Cellulosic Diesel | Naphtha | 2005 Diesel Baseline | 2005 Gasoline Baseline |
| Fuel Production | 20 | 20 | 18 | 19 |
| Fuel Transport | 1 | 2 | * | * |
| Tailpipe Emissions | 1 | 2 | 79 | 79 |
| **Total Emissions** | **22** | **23** | **97** | **98** |
| **% Change from Petroleum Baseline** | **-77%** | **-76%** | | |

*Emissions included in the fuel production stage

The analysis in Table 2 assumes process fuel use and coproduct production as described in ENVIA's petition.[11]

### B. Application of the Criteria for Petition Approval

The proposed ENVIA pathways differ from those EPA has modeled previously in that they involve the use of a process (methane reforming and Fischer-Tropsch GTL) to produce cellulosic diesel and naphtha that has not been previously modeled. ENVIA provided all necessary information that was required for this type of petition request.

Based on the data submitted and information already available through analyses conducted for previous RFS rulemakings, EPA conducted a lifecycle assessment and determined that cellulosic diesel and naphtha produced pursuant to the ENVIA Pathways meet the lifecycle GHG threshold requirements specified in the CAA for cellulosic (D-codes 3 and 7) biofuel RINs, depending on the type of fuel produced.

Compared to the statutory petroleum baseline, cellulosic diesel and naphtha produced as described in ENVIA's petition results in a 77% and a 76% reduction in lifecycle GHG emissions respectively. These results justify authorizing the generation of cellulosic biofuel RINs for cellulosic diesel and naphtha produced by ENVIA. We have defined the "ENVIA Pathways" that we are approving for cellulosic biofuel RIN generation through this decision document to include enforceable conditions related to process energy use and minimum co-product production, so as to provide

10 Lifecycle GHG emissions are normalized per mmBtu of RIN-generating fuel produced. The wax co-product credit is included in the "Fuel Production" row of the ENVIA pathways. Totals may not sum due to rounding.

11 For purposes of our decision we have defined "ENVIA Pathways" to allow different energy use and coproduct production than specified in the petition; with these alternate values, we have determined that the fuels will attain at least a 60% lifecycle GHG reduction.

continuing assurance that fuel produced through the ENVIA Pathways attains a minimum 60% lifecycle GHG reduction.

To qualify for cellulosic biofuel RINs, the ENVIA fuel must also meet the other definitional criteria for renewable fuel (e.g., produced from renewable biomass, and used to reduce or replace petroleum-based transportation fuel, heating oil, or jet fuel) specified in the CAA and EPA implementing regulations.

## IV. Conditions and Associated Regulatory Provisions

The authority for ENVIA to generate RINs pursuant to the ENVIA Pathways is expressly conditioned on ENVIA satisfying all of the applicable requirements for renewable fuel producers set forth in the RFS regulations and all of the conditions set forth in this document. The conditions specified herein are enforceable under the CAA. They are established pursuant to the informal adjudication reflected in this decision document, and also pursuant to regulations cited below and 40 CFR 80.1416(b)(1)(vii), 80.1450(i), and 80.1451(b)(1)(ii)(W). In addition or in the alternative to bringing an enforcement action under the CAA for any violations, EPA may revoke this pathway approval if it determines that ENVIA has failed to comply with any of the conditions specified herein.

### A. Registration

ENVIA must comply with all general registration provisions, found in 40 CFR 80.1450(b) of subpart M, that apply to renewable fuel producers.[12] The description of the ENVIA process that is submitted pursuant to 40 CFR 80.1450(b)(1)(ii) shall contain a plant-specific plan detailing how ENVIA intends to demonstrate on an ongoing basis, and document through records to be maintained for a minimum of five years from the date of RIN generation, that its material inputs, process operations, energy demands, and fuel and co-product outputs conform to the definition of the "ENVIA Pathways" in this decision document, including the requirements that ENVIA shall purchase no more than 64 kWh of grid electricity per mmBtu of fuel produced (diesel plus naphtha), use no more than 580,000 Btu of natural gas as process energy[13] per mmBtu of fuel produced, and produce at a minimum 0.7 Btu of a renewable wax co-product per Btu of fuel produced.[14]

### B. Recordkeeping

ENVIA must adhere to the general recordkeeping requirements in 40 CFR subpart M that apply to renewable fuel producers. EPA is interpreting the requirements related to the type and quantity of fuel used for process heat pursuant to 40 CFR 80.1454(b)(3)(vii) to refer to the amount of purchased

[12] Domestic fuel producers are also required to register under 40 CRF Part 79 – Fuels and Fuel Additives Registration.
[13] Process energy refers to natural gas burned to provide heat for the ENVIA process.
14 Based on EPA's lifecycle GHG assessment described in this document, these are the maximum energy use values at which the fuels produced through the ENVIA Pathways achieve a 60% GHG reduction as compared to the petroleum fuels they replace, as required for these fuels to qualify for cellulosic biofuel RINs.

electricity and natural gas for process energy used to produce biofuel pursuant to the ENVIA Pathways. Use by ENVIA of any other type of process heat fuel (with the exception of biogas, unconverted syngas from the FT process, and electricity generated on-site) would be inconsistent with this pathway approval. In addition, ENVIA must adhere to the recordkeeping elements of the plant-specific plan developed and accepted at registration, and referenced in Paragraph IV.A. This includes ENVIA's calculations to demonstrate on an ongoing basis that the ENVIA facility purchased no more than 64 kWh of grid electricity and use no more than 580,000 Btu of natural gas per mmBtu of fuel produced (diesel plus naphtha), and produced at a minimum 0.7 Btu of renewable wax co-product per Btu of fuel produced.

### C. Reporting

ENVIA must adhere to the general reporting requirements in 40 CFR subpart M that apply to renewable fuel producers. As part of the quarterly RIN generation reports required under 40 CFR 80.1451(b), ENVIA shall submit to EPA the information identified in section IV.B of this document that was prepared during the relevant quarter.[15]

### D. RIN Generation

ENVIA must adhere to the general RIN generation requirements specified in 40 CFR 80.1426. In addition, ENVIA may only generate RINs pursuant to the ENVIA Pathways approved in this document if the fuel is produced in accordance with the ENVIA Pathways as defined in this document, including the requirements that ENVIA shall purchase no more than 64 kWh of grid electricity and use no more than 580,000 Btu of natural gas per mmBtu of fuel produced (diesel plus naphtha). RIN generation cannot take place until appropriate registration requirements are met and the ENVIA Pathways are activated in the EPA's electronic registration system.

## VI. Conclusion

Based on our assessment of the information provided in the ENVIA petition, cellulosic diesel produced through the ENVIA Pathways meets the lifecycle GHG reduction requirements to qualify for cellulosic diesel (D-code 7) RINs, and naphtha produced through the ENVIA Pathways meets the lifecycle GHG reduction requirements to qualify for cellulosic biofuel (D-code 3) RINs. To qualify for RINs, the fuel produced by the ENVIA Pathways must also meet the other definitional criteria for renewable fuel (e.g., used to reduce or replace petroleum-based transportation fuel, heating oil, or jet fuel) specified in the CAA and EPA's implementing regulations.

15 Since the information prepared pursuant to Section IV.B. must be included in the ENVIA quarterly RIN generation reports to EPA, it follows that this information is subject to attest engagement requirements pursuant to 40 CFR 80.1464(b).

This approval applies specifically to ENVIA, Inc. and to the process, materials used, fuels produced, and process energy sources as outlined and described in the petition request submitted by ENVIA.[16] This approval is effective as of signature date. EPA will consider extending a similar approval to other petitioners utilizing similar fuel pathways as ENVIA, but will do so on a case-by-case basis upon verification that the pathway described in the petition meets the applicable CAA requirements. The OTAQ Reg: Fuels Programs Registration and OTAQEMTS: OTAQ EMTS Application will be modified once all applicable registration requirements, including those described above, have been met. This will allow ENVIA to register and generate RINs for cellulosic diesel and naphtha produced from landfill biogas feedstock through the ENVIA Pathways using a production process of "ENVIA Process." RINs may only be generated under this pathway for fuel that is produced after the date of activation of ENVIA's registration for this pathway.

16 As with all pathway determinations, this approval does not convey any property right of any sort, or any exclusive privilege.