The purpose of this outline is to inform Panelists of staff's initial findings and analysis related to the topic below. Staff proposes to use this and similar outlines to develop the white papers/chapters of the review report due to the Board in December 2011. This outline has explicit placeholders for panel input; however, the entire document is open for input and assistance from the panel. Please review this outline and identify where data are insufficient and what data are necessary to meet the requirements of the regulation review. This outline is meant to be a high-level overview of the topic; more detail will follow in subsequent white papers/chapters.

VII. Ultralow Carbon Fuels (Topic 5)

A. Background on Topic

1. Introduction
   a. ARB is tentatively defining ultralow carbon fuels as those which reduce carbon intensity by 60 percent or greater- which parallels the U.S. EPA's requirements for advanced biofuels under the RFS2-and are derived from renewable resources.
   b. Fuels to consider include cellulosic ethanol, biodiesel from waste, renewable diesel from waste, algal biofuels, biogas, electricity, hydrogen and potentially others.
   c. Background information related to the processes through which these fuels are made can be found in the staff report Chapter III and Appendix B.
2. Importance of ultralow carbon fuels in the LCFS
   a. CI reductions are modest during the first few years of the LCFS and become more significant in later years to allow for the development of ultralow carbon fuels.
   b. Ramp-up also based on RFS2 volume mandate.
   c. These fuels will be necessary to reach our target for 2020.
   d. They will aid in continuing reductions, if necessary, through 2050.
3. The scope of each review shall include, at minimum, consideration of the following areas: **(5) the availability and use of ultralow carbon fuels to achieve the LCFS standards and advisability of establishing additional mechanisms to incentivize higher volumes of these fuels to be used.**

B. Availability of Ultralow Carbon Fuels

1. Cellulosic Ethanol
   a. Background on types of technologies can be found in Chapter III of the staff report.
   b. Cellulosic ethanol is still not commercial available in significant volumes, most plants are still in the pilot stage.
   c. U.S. EPA reduced the cellulosic biofuels portion for the RFS2 from 250 million gallons to 6 million gallons for 2011.
   d. EIA suggests that a more likely 2011 production total for cellulosic biofuels is approximately 3.94 million gallons.

e. U.S. DOE is still processing grants to help stimulate cellulosic biofuels.
f. Staff analysis of cellulosic ethanol indicates that the fuel may not be needed until 2013 or later to meet LCFS standards.
g. Method 2A/2B corn ethanol lower-CI values have helped with lower cellulosic volumes.
h. List of cellulosic ethanol plants existing and under construction: Abengoa, American Biorefining and Energy, AE Biofuels, ZeaChem Inc., Verenium, Fulcrum Bioenergy/Sierra Biofuels Plant, Verenium/BP Biofuels, Ineos New Plant BioEnergy, California Ethanol and Power, BlueFire, Coskata, Fiberight, DuPont Danisco Cellulosic Ethanol, ICM Inc., Frontier Renewable Resources, POET, Mascoma Corp., Pacific Ethanol, New Plant Energy, Qteros, Permeate Refining Inc., Range Fuels, Summit Natural Energy, Western Biomass Energy, UF Institute of food and agricultural sciences/Buckeye Technologies Inc./Myriant Technologies LLC.

2. Biodiesel from Waste
   a. Biodiesel is defined as a fatty acid methyl ester (FAME) derived from vegetable oils or other renewable feedstocks.
   b. Biodiesel is a currently commercially available fuel, supplying about 5 million gallons of fuel in California in 2010.
   c. The primary feedstocks available for biodiesel production in California are soybean, waste vegetable oil, and animal tallow.
   d. Of these feedstocks, waste vegetable oil and animal tallow are waste feedstocks and result in biodiesel of very low carbon intensity.
   e. California biodiesel production facilities have a combined nameplate capacity of about 35 million gallons according to the LCFS staff report.
3. Renewable Diesel from Waste
   a. Renewable diesel is a liquid hydrocarbon fuel with the same chemical properties as petroleum diesel.
   b. Renewable diesel is derived from the same feedstocks as biodiesel.
   c. Renewable diesel is not currently available in commercial quantities in California, but there are several demonstration and commercial scale projects currently operating throughout the United States.
   d. The most common current feedstock for renewable diesel in the U.S. is animal fat.
   e. Syntroleum and Tyson have partnered on a joint venture, Dynamic Fuels, to produce renewable diesel derived from animal fat.

f. The renewable diesel is produced in Arkansas in a recently completed facility capable of producing 75 million gallons of fuel per year.

4. Biogas
   [under review]
5. Electricity and Hydrogen
   a. Currently, hydrogen stations are funded through ARB Hydrogen Highway (seven locations, 60-140 kg/day) and CEC AB 118 funding (eight locations, 100-240 kg/day).
   b. Hydrogen infrastructure challenges: Fuel Cell Vehicle (FCV) roll-out projections are based on infrastructure in-place ahead of vehicles; good station coverage is needed to boost consumer confidence in FCVs; early stations are costly; government funding needed to offset capitol and O&M when demand is low.
   c. The largest deployment of electric vehicle infrastructure in history is currently underway through the DOE's Electric Vehicle (EV) Project. The Project includes the installation of approximately 7,000 residential chargers and 1,600 public chargers in California. The Project provides the opportunity to evaluate EV use and the effectiveness of charging infrastructure.
   d. The Clean Fuels Outlet (CFO) is an existing regulation mandating alternate fuels' infrastructure. Proposed modifications would include hydrogen stations and monitoring electric vehicle growth to better understand infrastructure challenges and needs.
6. Algal Biofuels
   a. Algae are generally considered a very attractive potential feedstock for fuel because of the possibility of relatively high yields compared to conventional crops.
   b. Some estimates estimate that algae's potential yield is as high as 6,500 gallons of biofuel per acre, compared to about 600 gallons per acre for the most productive conventional crops.
   c. Additionally co-placement with high CO_2 emitting facilities holds promise due to the potential of algae to sequester the CO2 emissions during growth.
   d. However, there are no commercial-scale facilities producing algae, and the process of extracting oil from algae or processing the algae itself into fuel is still in its infancy.
7. Others
   [placeholder for panelist work if it doesn't fit under above categories]

C. Funding for Ultralow Carbon Fuels
   1. DOE Grants

a. Projects funded: Algenol Biofuels Inc., Renewable Energy Institute, American Process Inc., Solazyme Inc., Amyris Biotechnologies Inc., UOP LLC, Archer Daniels Midland, ZeaChem Inc., Clearfuels Technology Inc., BioEnergy International LLC, Elevance Renewable Sciences, Enerkem Corp., Gas Technology Institute , INEOS New Plant Bioenergy LLC, Haldor Topsoe , Sapphire Energy Inc., ICM Inc., Bluefire LLC, Logos Technologies.
b. Funds distributed in 2009-2010
c. Funds distributed in 2010-2011
d. Projected funds

2. AB 118
   a. Background on AB118 funding
   b. Projects funded 2009-2010
   c. Projects funded 2010-2011
   d. Funds distributed in 2009-2010
   e. Funds distributed in 2010-2011
3. Others
   [placeholder for panelist input]

D. Investment
1. Current investments
   [placeholder for panelist input]
2. Possible strategies to encourage investment
   [placeholder for panelist input]

E. Incentives
1. Current incentives built into the LCFS
   [under review]
2. Credit multiplier
   a. Pros
      i. Could provide revenue to cover some station costs
      ii. Provision to bridge the gap to long-term sustainable stations
      iii. Stability for planning
      iv. Could provide adequate station coverage to incent new fuel
   b. Cons
      i. Could decrease LCFS benefits depending on structure of credit multiplier program
      ii. The more fuels that qualify for a multiplier, the less valuable the multiplier becomes
      iii. Could conflict with AB118 funding
      iv. Could provide multiplied credits for unsold fuel (depending on structure)
      v. Moves away from a market-driven LCFS program

vi. Variability in credit value could affect credit revenue and may not be adequate to cover significant station costs

3. Volume mandate
   [under review]
4. Others
   [placeholder for panelist input]