

Agenda Item D

Electricity as Transportation Fuel



Electricity that is used as a substitute for gasoline or diesel qualifies as a transportation fuel under a Low Carbon Fuel Standard. While electric vehicles were first manufactured more than a century ago, their use has been limited to very small numbers until now. That situation is expected to change substantially as many auto manufacturers are poised to launch electric vehicle lines as early as this year. The potential increased use of electric vehicles raises questions about how electricity might be treated under a LCFS. This agenda item poses several issues DEQ would like the advisory committee to consider and comment on:

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Key Definitions

Describing the options for how to treat electricity as transportation fuel requires some definition of terms, especially concepts for two different “types of power” that could serve future electricity demand. As used by DEQ in this paper, terms cited below have the following meanings:

- **“Current Power Mix”**: Is the mix of different types of electricity generation currently being used by each utility to serve customers within its service district, and includes base load power, as well as power generated by peaking plants, and short and long-term purchases of power from others. Each utility will have its own mix of “current power.” Oregon’s “current power mix” could also be reflected by a statewide average.
- **“New Resource Power”**: Is the new electrical generating capacity that will serve Oregon’s increased long-term electricity demand and/or replace existing generation capacity. Oregon would draw from both in-state and out-of-state generation sources to obtain new resource power.
- **“Transportation Fuel”**: Transportation fuel includes fuel used or intended for use as a motor vehicle fuel or for transportation purposes in a mobile non-vehicular source (for example, construction equipment, boats, and service equipment at ports or airports) but not fuel used in stationary sources such as generators.

Electricity Issue #1

Energy Economy Ratio for Electric Vehicles

Advisory Committee Objective:

Comment on how DEQ should apply an Energy Economy Ratio for electric vehicles.

Discussion

Electrically-powered vehicles can play a significant role in reducing the carbon intensity of transportation fuel. Conventional vehicles lose most of their fuel's energy to inefficiencies in the operation of internal combustion engines and elaborate drive trains. These losses include:

- Idling,
- Heat lost from combustion,
- Pumping losses, (drawing air through filters, compressing it in combustion chambers and expelling it through an exhaust system), and
- Mechanical losses (valve trains, gear boxes, water pumps, etc.)

By contrast, electric vehicles are very efficient. They operate only as needed, give off far less unused heat, and do not need to drive the complex machinery of a combustion engine. For example, in an average conventional internal combustion car only 13 percent of fuel energy reaches the tires to move car; the rest is lost to inefficiencies in the engine and drive train. In a typical electric vehicle however, 61 percent of fuel energy is available to move the vehicle. To adjust for variation in drive train efficiency, California's LCFS applies an Energy Economy Ratio to fuels used in systems that are significantly different than conventional engine-transmission configurations. California Air Resources Board (CARB) compared the distance a conventional vehicle can travel on a given unit of energy to the distance an electric vehicle can travel on the same amount of energy. CARB found that light duty electric vehicles go four times farther than their conventional counterparts that are currently on the road, resulting in an Energy Economy Ratio of four. They recognized, however, that by 2016 conventional vehicles in California will be 30 percent more efficient than the fleet of 2002 due to CARB's Low Emission Vehicle standards (LEV and Pavley), which Oregon has also adopted. Compared to the more efficient conventional vehicles of 2016 and beyond, the efficiency advantage of electric vehicles will be reduced to an EER of three. Because there will be many more electric vehicles in operation by 2016 than there are currently, CARB decided to adopt an EER of three to reflect future conditions.

California ARB also established that electric vehicles in heavy-duty or off-road applications (where electricity substitutes for diesel fuel) have an EER of 2.7. However, CARB acknowledges their electric vehicle EERs are based on a small sample of electric vehicles and intends to review and refine the EERs in the future when more data are available. (See Agenda Item B for DEQ's paper on updating the LCFS rule). In the LCFS program, the Energy Economy Ratio (EER) is used by a regulated or opt-in party when calculating their credits or deficits. If an opt-in party calculated credits for electric passenger vehicle charging they would use an EER of 3.0. If an opt-in party (such as a business or airport, etc.) replaced their diesel service vehicles with electric models, they could use an EER of 2.7 to calculate emission reduction credits. Also, see Electricity Issues # 6 in this paper for a discussion on the types of electrification activities that could potentially qualify for credits.

The Northeast States for Coordinated Air Use Management, which is also developing a LCFS, has suggested applying an EER of four for electric drive trains but that factor was based on California's early comparison of electric vehicles with conventional vehicles before the increased efficiency of the California motor vehicle greenhouse gas emission standards take effect.

Proposal for Discussion

Oregon DEQ proposes to use an EER of 3.0 for light duty electric vehicles, and an EER of 2.7 for certain types of service vehicles or equipment that substitute lower carbon transportation fuel.

Electricity Issue #2 Calculation of Carbon Intensity for Electricity Used as a Transportation Fuel

Advisory Committee Objective:

Discuss and comment on the following questions concerning the carbon intensity of electricity used as a transportation fuel in Oregon.

- What "type of power" will serve Oregon's future electricity demand, of which electric vehicles will be a small part? Different "types" of power will have different carbon intensities.
- Should an Oregon LCFS program use customized carbon intensity values for each utility, or use the average carbon intensity of all electricity used in the state?

Discussion and Overview

The carbon intensity of electrical power varies considerably depending on the mix of generation sources that serve individual utilities. Preliminary values for the carbon intensity of Oregon's 2007 electricity mix are:

PacifiCorp: 262 g CO₂e/MJ

PGE: 199 g CO₂e/MJ

Public Utilities ~10 g CO₂e/MJ

Statewide Av: 155 g CO₂e/MJ^{*}

* The statewide average carbon intensity value reflects the weighted average of Oregon's official ODOE power mix for 2007.

These figures have a wide range because the state's investor-owned utilities rely on a substantial amount of coal-fired generation, while Oregon's consumer-owned utilities serve their base load with low carbon hydro-electric power provided by the Bonneville Power Administration.

Because electric vehicles are several times more efficient than traditional vehicles in converting energy to distance traveled, California's LCFS applies an EER of three to vehicles with electric drive trains. After making this adjustment, the preliminary life-cycle carbon intensities of transportation electricity are:

PacifiCorp:	87.3 g CO ₂ e/MJ
PGE:	66.3 g CO ₂ e/MJ
<u>Public Utilities</u>	<u>~3.3 g CO₂e/MJ</u>
Statewide Av:	51.7 g CO₂e/MJ *

(For light duty vehicles, these values would be compared to the average carbon intensity of Oregon's gasoline which preliminary calculations indicate is approximately 92 g CO₂e/MJ.)

The carbon intensities above reflect each utility's "**current power mix**", which can fluctuate year-to-year based on annual and seasonal changes in rainfall, and other factors affecting the production, purchase, and sale of electricity. The statewide average carbon intensity of all Oregon utilities also changes over time but less dramatically due to the moderating effects of averaging.

One key question is whether the future charging of electric vehicles should be attributed to a particular segment of electrical generation as is done in California's LCFS. Assuming that vehicle charging will be part of Oregon's increased electrical demand, it seems reasonable to follow the California model and attribute that increase to "**new resource power**". Such new resource power is expected to be generated by natural gas and renewable sources of electricity added to comply with Oregon's RPS. The average carbon intensity of electricity generated by natural gas is approximately 178 g CO₂e/MJ, and becomes 59.3 g CO₂e/MJ when adjusted by the electric vehicle EER of 3 and used as a transportation fuel. Accounting for the addition of low carbon renewable power, this carbon intensity would be decreased further under this approach.

Options for addressing carbon intensity of electricity in Oregon

To develop our approach DEQ starts with two fundamental questions:

1. What "type of electricity" will be used to serve future electric vehicle use? Should the LCFS program use: a) Oregon's "*current power mix*" to reflect the carbon intensity of electricity that will be used by electric vehicles, or b) should the program use the carbon intensity of anticipated "*new resource power*"?

Again, as used in this paper "**current power mix**" means the mix of different types of electricity generation used by each utility to serve customers within its service district, and includes base

load power, as well as power generated by peaking plants, and short and long-term purchases of power from others. Each utility can have its own unique carbon intensity profile reflecting its “current power mix”. Oregon’s overall “current power mix” could also be represented as a statewide average. **New resource power** is the new electrical generating capacity that will serve Oregon’s increased long-term electricity demand and/or replace existing generation capacity. Oregon would draw from both in-state and out-of-state generation sources to obtain new resource power. It seems likely that the carbon intensity profile of new resource power will be substantially similar among utilities, as compared to the large variation of utility specific carbon intensities within Oregon’s “current power mix”. The use of new resource power could therefore virtually eliminate the significant disparities between individual utility carbon intensities and geographic service areas of the state.

2. If the “**current power mix**” is selected as the type of power that will serve future electric vehicle demand, a second question needs to be addressed: Should the LCFS program use: a) the **average carbon intensity** of Oregon’s current power mix or, b) should it assign **individual carbon intensities** to each utility? If “new resource power” is selected, then the question of average vs. custom carbon intensities is unnecessary.

I. Current Power Mix vs. New Resource Power:

Some **key issues to consider and consequences** of using the current power mix average vs. the carbon intensity of expected new resources are discussed below.

- A. The charging of electric vehicles will add to future electricity demand, although it will likely be a very small fraction of the overall growth in electricity demand over the next decade. Many competing and potentially conflicting forces will influence how this future demand is served. Population and business growth would be expected to increase the need for power. At the same time, major initiatives in energy conservation are expected to reduce the need for power. The net result could extend the use of Oregon’s current power mix (hydro and other base load sources), and reduce the need for new resources. However, it seems reasonable to expect that some new resources will be needed to serve the growing net energy demand. That expectation seems justified given that PGE, and potentially other utilities have built and are planning to build new generating capacity in the near future.
- B. Electricity generated through new resources is expected to be generated largely by natural gas, with some small fraction of low carbon renewable power. The average carbon intensity of electricity generated by natural gas is approximately 178 g CO_{2e}/MJ, and would become 59.3 g CO_{2e}/MJ when reduced by an electric vehicle’s energy economy ratio of 3.
- C. A key assumption is that new resource power for all utilities will be very similar in terms of its carbon intensity. The carbon intensity of new resource power is likely to be more similar between all utilities than the carbon intensity for each utility’s base load power; presumably because there is less diversity in the generation sources that will be added as new resource power (e.g., very low carbon hydro-power is not expected to be added as new resource power).

DEQ’s understanding is that new resource power is most likely to be generated by natural gas, with some fraction of renewable power.

- D. Future new resources should show the effect of reduced carbon intensity due to Oregon’s Renewable Portfolio Standard. Using a carbon intensity estimate for new resources would allow DEQ to make some accounting of these benefits in the carbon intensity for transportation electricity. It would be very difficult today to estimate exactly how each individual utility will meet the RPS; however, on average, the carbon intensity of Oregon’s new resource electricity is expected to decrease. Using the estimated carbon intensity of Oregon’s likely new resource power allows DEQ to account for the benefits of the RPS without having to speculate about individual utility compliance approaches.

- E. Using an estimate of new resource power would result in a carbon intensity for transportation electricity slightly higher than a current statewide average of Oregon’s current resource mix, but there would be no significant disparities between different utilities or geographic service areas of the state. For example:

	<u>Individual CIs</u>	<u>Est. of New Resources CI</u>
PacifiCorp:	87.3 g CO ₂ e/MJ	NA
PGE:	66.3 g CO ₂ e/MJ	NA
Public Utilities	~3.3 g CO ₂ e/MJ	NA
Statewide Av:	51.7 g CO₂e/MJ	~59 g CO₂e/MJ *

* Value assumes 100% natural gas generation.

Related questions and issues to consider:

- Is DEQ’s expectation reasonable that future transportation electricity demand will likely be served by electricity generated from “new resources”? If not, why not?

- What assumptions are reasonable for the carbon intensity profile of “new resources”. Should DEQ assume that new resources will be comprised of power generation from 100% natural gas? Are there different types of natural gas generation to consider? Should we include some fraction of low-carbon renewables?

- If the current power mix is used, what time frame should that represent? In establishing the LCFS Baseline, DEQ is using Oregon’s 2007 electric generation source mix as a surrogate for the 2010 baseline (because at this time 2007 reflects the best and most complete data available). DEQ could use the same approach in establishing the carbon intensity value(s) of transportation electricity based on the “current power mix”.

II. Current Power Mix: Average vs. Individual Carbon Intensities:

If the LCFS program uses the “current power mix” to establish carbon intensities for transportation electricity, then the series of questions and issues below need to be addressed. However, if the LCFS program uses “new resource power”, the questions and issues in Section I above are relevant.

Some **key issues to consider and consequences** of using average vs. individual carbon intensities are discussed below. Some consequences could be seen as a negative or a positive depending on a person’s perspective.

- An average would provide a uniform carbon intensity value for all electric vehicle charging and carbon credit calculation across the state. It would create a “level playing field” for carbon intensity (and emission credits) between geographic areas (i.e. utility services districts), and therefore:
 - i. Keeps the LCFS program neutral as a driver for where electric vehicles (EVs) will be introduced. Does not make any areas of the state more or less attractive for EV investment based on the carbon intensity of local electricity.
 - ii. Keeps the LCFS program neutral on which utilities would benefit from opting into the program and the amount of emission credits that could be generated by individual utilities.
 - iii. By its nature an average would not accurately characterize the carbon intensity for any individual utility but it would equitably represent the carbon intensity of Oregon’s electricity sector as a whole.
- An average does not recognize and give credit to those utilities with lower carbon electricity. It would give the same amount of emission credit to any opt-in party for electricity regardless of the actual electric generation methods used to produce that electricity. Both the average and new resource power options do not offer the opportunity for utilities to establish individual fuel pathways for their electricity.
- Using individual carbon intensities could (if they opt-in) stimulate participation of utilities with the lowest carbon intensities and therefore increase the pool of LCFS credits available for regulated parties needing carbon reductions. It seems equally possible that using individual carbon intensities could discourage the development of electric vehicles in certain geographic areas served by higher carbon electricity, and could therefore decrease the pool of credits generated. Committee comments are welcome on this point.
- An average can reduce the complexity of the LCFS program and be easier for DEQ to administer, especially if utility carbon intensities are updated periodically. An average would provide a higher degree of “usability” for regulated and opt-in parties, and greater certainty year-to-year about the carbon intensity value assigned to this sector and the amount of credits that could be generated.

Related questions and issues to consider:

- To what extent, if at all, should the LCFS program treat transportation electricity differently than other low-carbon fuel producers? For example, the LCFS program will allow custom carbon intensities for individual bio-fuels producers, based on the specifics of their feedstocks and production processes. Could not the same be said for individual utilities?
- To what extent is the use of an average for the electricity sector consistent or inconsistent with the intent of the LCFS program? The program requires a reduction in the average carbon intensities of transportation fuels. Using an average would not link an individual utility's electricity with the specific greenhouse gas consequences of its use as a transportation fuel; however it would make this link for the Oregon electricity sector as a whole, and would help achieve the program objective of an overall 10 percent reduction in the average carbon intensity of Oregon's transportation fuel.
- Should Oregon's LCFS program be neutral, and not indirectly influence other state program initiatives (for the better or worse), such as the goal for utilities to increase their use of low carbon electricity, or state initiatives to stimulate the use of electric vehicles? Design choices for the LCFS program may have some influence on other Oregon initiatives. Is that an acceptable outcome?
- To what extent would individual carbon intensities stimulate participation of utilities with the lowest carbon intensities and increase the pool of LCFS credits. Would this be a meaningful incentive for small utilities to opt-in, or is that decision largely driven by other factors? To what extent would individual carbon intensities dampen the participation of utilities with higher carbon intensities and decrease the pool of LCFS credits? To what extent could using individual carbon intensities affect the commercialization of public charging stations across the state, given that different geographic areas could have higher or lower carbon intensities and therefore generate more or less emissions credits?
- Averaging times and updates to electricity carbon intensities: Two issues to consider are the time frame that will be reflected in carbon intensities for transportation electricity and the circumstances under which DEQ might update carbon intensities for transportation electricity.
 - Timeframe: Each utility's electric generation mix can vary year-to-year based on variables such as seasonal fluctuations in hydro-power availability or year-to-year differences in market power purchases. Each year, these normal variations could change the carbon intensity of each utility's electricity (within a certain range). In establishing the LCFS Baseline, DEQ is using Oregon's 2007 electric generation source mix as a surrogate for the 2010 baseline (because at this time 2007 reflects the best and most complete data available). Under either scenario above (i.e. state average or individual utility carbon intensities) DEQ would propose to use Oregon's 2007 source mix as the basis for establishing carbon intensities for electricity used as transportation fuel.
 - Updates to Carbon Intensity: Under the LCFS program, the carbon intensity for each fuel pathway, including electricity, will be adopted in rule by the Environmental Quality

Commission. Any changes to these carbon intensities will require DEQ rulemaking, including a public comment process. Calculating individual carbon intensities of Oregon's 39 utilities and conducting associated rulemaking updates would be very resource intensive for DEQ. DEQ proposes to not update carbon intensities for the electricity sector, with the exceptions discussed in Issue # 4 below.

- Access to new fuel pathways: If either a state average of Oregon's "current power mix" or "new resource power" is used to establish carbon intensities for transportation electricity, then individual utilities will not have the option of pursuing new fuel pathways for their specific electricity mix. Significant changes in carbon intensities at one or more utilities could be cause for DEQ to reevaluate the carbon intensity of the state average or new resources carbon profile. Such significant changes could be addressed under the new fuels pathway process.

Other questions and consequences to consider:

- Would using individual carbon intensities for each utility provide some incentive for some utilities to lower the carbon intensity of their electricity? Electric utilities may or may not opt-into the LCFS program. That will be a decision each utility makes based on their evaluation of costs and benefits to their rate payers. Theoretically, having individual carbon intensities could highlight the need for utilities with higher carbon electricity to reduce their use of high carbon generation. However, it is unclear to what extent a LCFS program can be a meaningful driver in a utility's decisions about their generation mix. Those decisions will be influenced by a wide variety of factors.
- Based on DEQ's conversations with utilities and ODOE to date, the use of individual carbon intensities for each utility is not likely to significantly motivate utilities to reduce the carbon intensity of their electricity or their decision to opt-into the LCFS program. Further reductions of electricity carbon intensity are more likely to be driven by Oregon's Renewable Portfolio Standard (which requires increased use of renewable fuels), and the decision to opt-in will be based on each utility's calculation of costs and benefits. How much influence would the use of individual carbon intensities have on a utility's future power generation portfolio; and should this be a factor in selecting which approach to use for calculating carbon intensities for electricity as transportation fuel? Committee input is welcome.

Proposal for Discussion

At this point, DEQ favors using the estimated carbon intensity of "New Resource Power" as the default carbon intensity for electricity used as transportation fuel. On balance, DEQ believes this to be the best approach for the following reasons:

- New resource power would seem the most likely source of electricity generation that will serve Oregon's future net energy demand, of which new electric vehicles will be a small part. Using

carbon intensity for new resources also seems the best way to account for expected carbon reductions from the RPS over the next decade.

- The carbon intensity profile of new resource power is likely to be very similar among Oregon utilities. It seems that using the carbon intensity for “new resources” could virtually eliminate the significant disparities in carbon intensities among different utilities, and that this would help avoid any unintended consequences of favoring one geographic area of the state over another when it comes to the market penetration of electric vehicles. It also helps keep Oregon’s LCFS program neutral in regard to indirectly influencing other state initiatives.
- Using new resource power as the default carbon intensity for transportation electricity is simpler for DEQ to administer, and lessens the need for each utility to request frequent updates to their numbers in DEQ’s rule.

However, DEQ wishes to hear from the committee before deciding which approach to move forward with in our compliance scenarios and economic analysis. Immediately following our May meeting, DEQ, DOE, and the PUC will discuss the Committee’s comments on this issue and DEQ will select a carbon intensity value or values for transportation electricity to use in our compliance scenarios.

Electricity Issue #3

Calculation of Carbon Intensity for Electricity Used in Fuel Production

Advisory Committee Objective:

Discuss and give input on how DEQ should calculate the carbon intensity for electricity used to produce fuel.

Discussion of issue

The carbon intensity of electricity used in the production of fuel (such as ethanol) is a significant factor in the life-cycle carbon intensity of the fuel produced. There are two basic options for accounting for electricity use in the production of fuel. One is to apply the specific carbon intensity of the utility serving the fuel production facility. The other is to apply the average carbon intensity of all electricity in the state. California’s LCFS applies the average carbon intensity of all electricity to fuel production and Washington’s Department of Ecology is considering the same approach.

Using the carbon intensity of the specific utility serving a fuel production facility would seem to be desirable, but doing so may raise unintended problems regarding the equal treatment of in-state vs. out-of-state fuels. Currently, either a statewide or regional average carbon intensity is used for electricity when calculating the life-cycle carbon intensity of fuels imported from out-of-state, such as Pacific Northwest petroleum or Midwestern corn-based ethanol. In order to maintain an equal basis for comparison, DEQ should use an equivalent average for electricity when it is used in calculating the life-cycle carbon intensity of an Oregon produced fuel. Generally speaking, states are not allowed to treat out-of-state regulated parties differently than the way they treat in-state regulated parties. That is to say if Oregon used customized carbon intensities for in-state ethanol plants, we would be obligated to do the same for out-of-state ethanol. Determining custom carbon intensities for electricity used by the large number of out-of-state bio-fuels plants would create a substantial administrative burden and greatly increase the complexity of Oregon's LCFS.

To develop our approach DEQ starts with the following questions:

1. What type of electricity is serving and will serve Oregon's bio-fuels producers?
 - By 2011, Oregon should have several bio-fuels producers in operation. It seems reasonable to expect that these facilities will be served primarily by Oregon's "current power" mix. Over the coming decade, additional fuel production facilities could be served by the current power mix and/or "new resource power".
2. Are there factors that would warrant treating electricity used in fuel production differently than as a transportation fuel?
 - Yes. The issue of equity between in-state and out-of-state biofuels producers is important. If DEQ used individual utility carbon intensities as part of each fuel producer's life-cycle calculation, it is likely we would also be required to do the same for all bio-fuel producers delivering fuel to Oregon. This would mean conducting detailed life-cycle analyses of Midwestern ethanol producers and potentially other fuel producers. This would make Oregon's LCFS program more complex and resource intensive.

Some key assumptions and consequences of using average carbon intensity:

- Using an average is consistent with California's LCFS program, as well as Washington's likely approach to calculating the carbon intensity of electricity used in fuel production.
- An average offers a higher level of regulatory predictability, giving fuel producers a higher degree of certainty in knowing the life-cycle carbon intensity of their fuel under the LCFS program.
- Using the same approach that is used in calculating carbon intensities for imported fuels avoids the potential problem of treating in-state and out-of-state fuel producers differently.
- Using an average instead of the actual carbon intensity of each utility serving a fuel producer does not recognize and give credit to those fuel producers who get lower carbon electricity from their

utility. This could increase or decrease the total life-cycle carbon intensity of a fuel under the LCFS program.

Proposal for Discussion

At this point, DEQ proposes to use a statewide average carbon intensity for electricity used in the production of a regulated fuel. DEQ proposes that this average reflect the 2007 (“current power”) source mix for Oregon, which is serving as a surrogate for the LCFS 2010 baseline period. On balance, DEQ believes this to be the best approach for the following reasons:

As with Electricity Issue #2 above, using average carbon intensity for electricity when calculating a fuel producer’s life-cycle carbon intensity value:

- Provides uniformity between different geographic areas of the state, and therefore keeps the LCFS program neutral as to where a bio-fuels production facility may wish to locate. It does not make any particular utility service district more or less attractive for bio-fuels investment based on the carbon content of local electricity.
- Reduces program complexity and is easier to administer, especially if utility carbon intensities are updated periodically. An average would provide a higher degree of “usability” for regulated and opt-in parties, as well as greater certainty year-to-year about the carbon intensity value assigned to electricity.

However, DEQ wishes to hear from the committee before deciding which approach to move forward with in our compliance scenarios and economic analysis. Additional questions for the committee to consider include: Are there other pros and cons that should be considered? Are there any unintended consequences? Are there other options that should be considered?

Immediately following our May meeting, DEQ, DOE, and the PUC will discuss the Committee’s comments on this issue and DEQ will select a carbon intensity value or values for fuel production electricity to use in our compliance scenarios.

Electricity Issue #4 Updating Carbon Intensity of Electricity

Advisory Committee Objective:

Discuss and advise whether DEQ should update the carbon intensity of electricity; and if so, how often should updates occur?

Discussion

The carbon intensity of electricity used in Oregon is subject to change due to several factors. The most obvious of these is Oregon's Renewable Portfolio Standard which requires utilities to add different amounts of renewable power according to their size category. Given that renewable power typically has low carbon intensity, the RPS is expected to decrease the carbon intensity of Oregon's electricity in coming decades.

Other factors may also affect how future electricity is generated. These include ratepayer participation in voluntary Green Power programs, changing energy costs, and the potential for a national carbon reduction program. In light of these variables the carbon intensity of Oregon's utilities could change significantly in the next ten years. It therefore may be advisable to review and potentially update the carbon intensity of electricity at some point before 2022, or when major changes occur that significantly affect the carbon content Oregon's electricity.

Proposal for Discussion

DEQ is looking for a balanced approach that can respond to any significant and sustained changes in the carbon intensity of Oregon's electricity, while not constantly changing the electricity values used by LCFS regulated or opt-in parties. The framework for updating utility carbon intensities may be somewhat different depending on which option is selected under Discussion Issues #2 and #3 above.

If the carbon intensity of transportation electricity is based on "Current Power" (i.e. a blend of baseload and other power), then significant changes in a utility's general source mix could result in a meaningful change in carbon intensity. This would be particularly so if the LCFS program assigned custom carbon intensities to individual utilities, but significant changes in the generation mix of one or more utilities could also affect a meaningful change in a statewide average carbon intensity for transportation electricity.

If the carbon intensity of transportation electricity is based on "New Resource Power" (i.e. new electrical generating capacity or purchases added to meet increased long-term electricity demand), then the risk of significant changes in carbon intensity over the next decade would seem much less, and therefore the need to evaluate changes and potentially update the carbon intensity of transportation electricity would be less frequent.

As described in issues #2 and #3 above, DEQ favors using the estimated carbon intensity of "New Resource Power" as the default carbon intensity for electricity used as transportation fuel. DEQ also favors using the 2007 Oregon "current power mix" to establish carbon intensities for electricity used in fuel manufacturing. DEQ proposes to review and possibly update these carbon intensities as part of the overall LCFS program review, proposed for the mid-point of the program in 2016.

As a contingency plan, DEQ also proposes that the program be prepared to respond at any time to significant changes in the carbon intensity of transportation electricity used in the LCFS program. One possible test of significance could be if changes within one or more utility's generation portfolio caused the Oregon average carbon intensity or the carbon intensity of new resource power to change by more than the significance threshold used to trigger a new fuel pathway (i.e. the lesser of 5.0 g CO₂e/MJ or ten percent change in carbon intensity). For reference, see DEQ's discussion paper on establishing new fuel pathways (Agenda Item C.)

Issue #5 Electricity Opt-in Parties

Advisory Committee Objective:

Discuss and give input on which entity or entities should be the opt-in party for electricity.

Discussion of issue

A basic issue for electricity users and providers under a LCFS is which entity or entities can opt-in to sell low carbon fuel credits produced by electric vehicles and equipment. If Oregon follows the California model, utilities would be able to opt-in to the program voluntarily. If a utility agreed, other entities such as homeowners or owners of electric charging equipment would be able to opt-in and sell credits. Potential opt-in parties for electricity in the California LCFS are:

- Utilities or Electricity Service Suppliers,
- Bundled Service Providers, such as Coulomb or Better Place.
- Charging equipment owners (commercial charging and residential vehicle owners)

DEQ will need to determine if the California model best serves Oregon's needs or whether a different system is appropriate. In California's LCFS program, agreement from the utility (or electric service provider) is required for opting-in EV charging equipment owners (commercial and residential). Utility agreement is not required for bundled services providers. Should Oregon use the same approach?

The main purpose of allowing and encouraging producers of low carbon fuels (electric utilities, CNG-fuel producers) to opt-in to the program is to produce carbon reduction credits that will likely be needed by regulated parties to help meet compliance obligations. The transfer of credits between a biofuels producer and a regulated party seems fairly straightforward, in that a petroleum producer or supplier could acquire credits directly from a bio-fuels producer without the need for any intermediary. The issues become more complex for credits created from electricity used as transportation fuel. The farther down the supply chain one goes (from utility, to the supplier of charging equipment, to the end user), the more complex it becomes to quantify, track, and transfer credits to a regulated party.

In the long term, electric vehicles have potential to lower the overall carbon intensity of Oregon's transportation fuel and generate emission reduction credits. The LCFS rule should provide as much flexibility as possible for the generation and easy use of credits without undermining the integrity of the program. One way of potentially increasing the amount of emission credits generated would be to allow owners of large electric vehicle fleets or owners of a large number of electric charging stations to be an opt-in party and generate emission credits.

The committee will be discussing the structure of the LCFS emission credit program at a future meeting. However, DEQ is seeking input on the pros and cons of allowing utilities and other electric service providers, bundled service providers, electric vehicle fleet owners, and owners of charging stations to be eligible as opt-in parties. DEQ would also like to hear any committee comments about the treatment of residential electric vehicle owners as potential opt-in parties. A related question would be whether or not electric vehicle fleet or electric charging stations owners would need agreement from their utility to be an opt-in party and claim credits.

Proposed for Discussion

DEQ proposes for discussion that Oregon follow the precedent set by California in allowing the four groups cited above (utilities and other electric service providers, bundled service providers, fleet owners and charging station owners) to voluntarily opt in to an Oregon LCFS.

Electricity Issue #6 Qualifying Electrification Activities

Advisory Committee Objective:

Provide initial thoughts on the option to allow certain electrification activities to generate emission credits. DEQ does not have a proposal at this time, but would appreciate any committee feedback on this concept. DEQ may be proposing this option as a part of the draft LCFS package to be reviewed by the committee. A decision on this concept is not needed in the short-term.

Discussion

There are circumstances in which electricity can substitute for transportation fuel in ways that do not involve the charging of battery-electric or plug-in hybrid electric vehicles. It is possible that these applications could be allowed to voluntarily earn low carbon fuel credits under an Oregon LCFS program. As used here, transportation fuel includes fuel used or intended for use as a motor vehicle fuel or for transportation purposes in a mobile non-vehicular source (for example, construction equipment, boats,

and service vehicles), but not fuel used in stationary sources such as generators. Some examples of potentially qualifying electrification activities include:

- **Truckstop electrification:** In recent years many truckstops around the nation have introduced equipment that allows heavy-duty trucks to avoid idling their engines while parked for long periods. For many truckers it is common practice to keep their large diesel engines running while parked overnight to provide heat, air conditioning or power for auxiliary equipment such as televisions, microwave ovens, computers and communication devices. At electrified truckstops, electricity and communications connections are provided that allow truckers to shut off their engines and power needed services with electricity. These installations were originally motivated by the need to reduce toxic diesel exhaust emissions but they can also reduce operating expenses and provide for the use of lower carbon transportation fuel.
- **Transport refrigeration units:** Transport refrigeration units are truck trailers or shipping containers with refrigeration units that cool perishable goods while in transit. These units are typically powered by diesel engines that can be operated for extended periods at warehouses, truckstops or distribution centers. If these refrigeration units were powered with electricity instead, that substitution for diesel fuel could be considered an appropriate displacement of transportation fuel that could qualify for low carbon fuel credit.
- **Electric service equipment:** Ground service equipment at Oregon airports is normally powered by internal combustion engines and is operated intermittently to load, unload and service airplanes parked at a departure gate. These vehicles are considered to be good candidates for conversion to battery-electric drive trains as they typically do not travel far from their starting point and have multiple opportunities throughout a day for recharging. Similarly, many industrial forklifts are powered by internal combustion engines and are operated within a relatively limited area. Electric forklifts exist and are normally used in food storage or movement applications to avoid emitting any noxious gases around products intended for human consumption. Either ground service equipment or forklift applications that substitute a low carbon fuel for gasoline or diesel fuel (as well as similar equipment conversions) would seem to be legitimate opportunities for reducing the carbon intensity of transportation fuels and generating low carbon fuel credits.

Discussion

DEQ is evaluating this concept and would welcome committee input. Some initial questions include:

1. In general, what type of electrification activities should qualify for LCFS credits?
2. What criteria could be used to define in rule qualifying electrification activities? Criteria could potentially include:
 - a. That only activities that displace transportation fuel would be eligible.
 - b. That activities using fuel that is exempt from the LCFS would not be eligible.
 - c. Those activities for which emission reductions are already required for a different air pollutant (such as air toxics or fine particulate) not be allowed. Or conversely, businesses

converting qualified vehicles/equipment could be allowed to generate greenhouse gas reduction credits. This could help them pay for the required reduction in other air pollutants.

Again, DEQ welcomes the committee's initial thoughts on this topic.