Low Carbon Fuel Standard (LCFS) and EV Economics

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Overview of Presentation

• Low Carbon Fuel Standard (LCFS) Background
• Economic and Environmental Benefits
  – PEV owners (home and fleet)
  – Utilities
  – Society
Overview of the LCFS

Purpose: Transform CA transportation fuel pool
- Encourage the development of low carbon fuels to replace gasoline and diesel
- Spur innovation and investment in clean fuels
- Create durable framework for near- and long-term transition to low carbon fuels
- Establish a model for regional and national standards

How: LCFS regulates oil companies
Oil producers must reduce the carbon intensity of their fuel production portfolio rising from 1 percent today to 10 percent by 2020
- Reducing lifecycle emissions (e.g., production of lower carbon fuels such as biofuels, electricity, natural gas, biogas, hydrogen)
- Purchasing LCFS credits from low carbon fuel providers / distributors (if they opt in)
CARBON INTENSITIES OF LCFS FUELS

- LCFS limits on gasoline and diesel carbon intensity decline from 2013 through 2020
- Over 200 different low-carbon fuels can generate credits
- The carbon intensity of major low-carbon fuels are shown
- Significant market penetration of different low carbon fuels is shown in different years

Source: ICF International for CalETC
Many types of low carbon fuels are needed to sell credits and are reasonably projected to exist by ICF Int’l (in this and other scenarios).

Banked credits from early years maybe needed to help 2019 and 2020 compliance.

Court rulings limiting LCFS to 2013 levels (likely through end of 2015) have increased the amount of banked credits in market.

LCFS continues past 2020 at constant 2020 line.

Source: ICF International, June 2013
LCFS credit prices have fluctuated dramatically in past two years and forecasted ranges are significant

- LCFS credit prices rose from $17/MT to highs of roughly $85/MT in Q4 2013 before falling to current levels of roughly $30/m

- Social cost of GHG emitted is $37/MT in 2014 ($42/MT in 2020) according to 12 federal agencies

- 2014 study by ICF Int’l assumed long-term LCFS low and high prices at $60/MT and $170/MT, respectively

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Total Number of Transfers</th>
<th>Total Volume (mt)</th>
<th>Average Price per Credit ($/mt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CY 2012</td>
<td>24</td>
<td>164,000</td>
<td>$17</td>
</tr>
<tr>
<td>CY 2013</td>
<td>202</td>
<td>887,000</td>
<td>$55</td>
</tr>
<tr>
<td>Q1 2014</td>
<td>62</td>
<td>172,000</td>
<td>$51</td>
</tr>
<tr>
<td>June 2014</td>
<td>21</td>
<td>57,000</td>
<td>$33</td>
</tr>
<tr>
<td>May 2014</td>
<td>20</td>
<td>128,000</td>
<td>$32</td>
</tr>
<tr>
<td>April 2014</td>
<td>16</td>
<td>76,000</td>
<td>$53</td>
</tr>
</tbody>
</table>

Source: ARB Monthly LCFS Credit Trading Activity Report for June 2014, posted 7/8/14
## LCFS Rules for Electricity

<table>
<thead>
<tr>
<th>PEV Charging Location</th>
<th>Primary Credit Generator</th>
<th>CARB Requirements for Generating LCFS Credits</th>
<th>Expected Share of LCFS Credit Market</th>
</tr>
</thead>
</table>
| Single and Multi-Unit Residential | Electric Distribution Utility (EDU) | • Use credit proceeds to directly benefit current EV customers  
• Educate the public on benefits of EV transportation  
• Provide rates that encourage off-peak charging  
• Estimation of the kWh for EV charging allowed | 75-85% |
| Public Access | Charging station installer and maintenance provider | • Use credit proceeds to directly benefit current EV customers  
• Educate the public on benefits of EV transportation  
• Provide rate that encourage off-peak charging  
• Direct measurement of the kWh for EV charging  
• Contract with the property owner or lessee of the station location to maintain it during the 3 month reporting period  
• EDU or charging 3rd party non-utility can be the credit generator | >5% |
| Workplace (employee) | Workplace owner | • Educate employees on the benefits of EV transportation  
• Direct measurement of the kWh for EV charging | 5 - 10% |
| Fleet | Fleet owner | • Direct measurement of the kWh for EV charging | 5 - 10% |
Value of LCFS credits per EV

<table>
<thead>
<tr>
<th>kWh used in 150,000 mile life</th>
<th>Total lifetime LCFS credits</th>
<th>Lifetime credit value at $25/MT</th>
<th>Lifetime credit value at $100/MT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric sedan</td>
<td>~ 50,000 kWh</td>
<td>~ 40 mt CO₂e</td>
<td>~ $1,000</td>
</tr>
</tbody>
</table>

Assumes nominal $$ (not NPV) and 100% charging at residence or fleet; Would be less if charging away-from-home base and less for plug-in hybrid EVs. LCFS credits (and CO₂e reduced are directly linked to kWh)

- Lifetime value of LCFS credits varies significantly by vehicle type, vehicle efficiency, miles per year, and LCFS credit price
- LCFS value is equivalent to 2 - 8 cents per kWh
- Even at moderate prices, LCFS value can be significant for vehicle owners and could be used as an incentive mechanism (one-time or on-going)
$1.2 billion in LCFS credit value estimated through 2030

(Residential charging only, $300 million NPV)\(^1\)

Assumes a flat $50/credit nominal price through 2030 and SCE’s medium PEV forecast

\(^1\) Would be 2.7 larger for all of the CA utilities
LCFS Status with the CPUC

• Pre 2014 – LCFS has overcame several court challenges

• Q1 2014 - Investor Owned Utilities (IOUs) required to file proposals on how to sell their LCFS credits and distribute them back to PEV customers

• May 2014 - CPUC ruled on the general framework of how utilities can sell LCFS credits

• June 2014 - US Supreme Court declines to review California LCFS case

• August 2014 - CPUC is expected to rule on the framework for how utilities can distribute LCFS credits back to residential PEV customers.

• Q4 2014 – IOUs to submit detailed plans for compliance with new CPUC framework (details for SCE plans on next slides)
The LCFS credit distribution proposal to the CPUC must:

1. Reward EV owners (of both new and used EVs) for using clean fuel
2. Provide a compelling value proposition to address barriers to or facilitate EV adoption
3. Increase utility identification of the names, addresses, and EV type in service territory
4. Retain flexibility to adapt to future EV and LCFS market developments
5. Minimize financial risk
6. Achieve operational simplicity
7. Achieve consistency with other guiding principles identified in the proceeding
SCE’s proposed method of distributing LCFS proceeds to residential customers

<table>
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<tr>
<th>EV owners/lessors</th>
<th>EV Dealers</th>
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<tr>
<td>• Voucher distributed to EV buyers/lessors through dealerships (vouchers have unique identifier)</td>
<td>• Administrative incentive paid to EV dealers worth up to $50 for each voucher redeemed with SCE</td>
</tr>
<tr>
<td>• Potential value of $350 for new or existing (current) EVs</td>
<td></td>
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<tr>
<td>• $150 for purchase of a used EV (based on $50 per ton assumption)</td>
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<tr>
<td>• SCE also checks the residential utility distribution system and offers EV rate</td>
<td></td>
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</tbody>
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- CFR distributed through checks, pre-paid credit cards or on-bill credits (TBD)
- Customers may receive additional CFRs going forward based on available funds
- No forward funding: CFR distribution based on banked LCFS credits (potential start date is 2015 depending on LCFS credit prices)
- Voucher distribution will include TOU rate information specially designed for EV adopters
A 2014 ICF Int’l study found that the monetized environmental and energy security benefits of the California LCFS (as a whole) are significant and valued them at $1.4 – $4.8 billion through 2020

Specifically:

• The GHG reductions attributable to LCFS compliance, when monetized using the social cost of carbon, are valued at $500 million to $3.2 billion (NPV)

• The criteria pollutant reductions attributable to LCFS compliance, when monetized using avoided damage costs, are valued at about $60 – $360 million (NPV)

• The energy security benefits of displacing petroleum consumption – particularly petroleum imports – are valued at $800 million to $1.2 billion (NPV)

Source: ICF International, April 2014
Conclusion

LCFS credits from fuel switching to electricity (residential charging)

- Contain significant value to utilities
- Can be a meaningful incentive to increase PEV ownership
- Can be used to benefit PEV dealers
- Can help utilities address issues (e.g., locating the transformers to check, getting customers on time-of-use rates)

The LCFS program, as a whole,

- Has substantial benefits to society
- Contains several feasible compliance pathways for regulated entities
- Has overcome its initial issues (e.g. court challenges) and is being “re-adopted” in Fall 2014 with a new timeline and other improvements.