California’s ZEV Regulation for 2018 and Subsequent Model Year Vehicles

2016
Need for ZEV Regulation

- California is the nation’s largest market for passenger cars and light-duty trucks
  - Over 25 million registered vehicles
  - Over 800 million miles driven every day
  - Over 29 million gallons of gasoline consumed each day
- Widespread adoption of ZEVs necessary to meet California’s GHG reduction goals
  - 40% below 1990 levels by 2030
  - 80% below 1990 levels by 2050
2012 ZEV Regulation Modifications

- In 2012 the Board passed sweeping modifications to the ZEV Regulation
  - Simplified ZEV Regulation for 2018 and subsequent model years
  - Substantially increased requirements
How does the ZEV Regulation work?

ZEV credit % requirement based on average annual sales

Generate ZEV credits through introduction of clean vehicle technology

Spending rules based on type of vehicle that earned credit
Section 177 ZEV States

- "Section 177 ZEV State": a state that is administering the California ZEV requirements pursuant to section 177 of the federal Clean Air Act (42 U.S.C. Sec. 7507)

- Current S177 ZEV States

<table>
<thead>
<tr>
<th>Connecticut</th>
<th>Massachusetts</th>
<th>Oregon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maine</td>
<td>New Jersey</td>
<td>Rhode Island</td>
</tr>
<tr>
<td>Maryland</td>
<td>New York</td>
<td>Vermont</td>
</tr>
</tbody>
</table>
Volume Status

- LEV Regulation Definitions (CCR, Title 13, section 1900)
- Average California Sales
  - Passenger Cars (PC), Light Duty Trucks (LDT) and Medium Duty Vehicles (MDV)
  - Based on three previous consecutive model years
- Small Volume Manufacturer (SVM)
  - Average CA sales ≤ 4500 per year
- Intermediate Volume Manufacturer (IVM)
  - Average CA sales > 4,500 and ≤ 20,000 per year
- Large Volume Manufacturer (LVM)
  - Average CA sales > 20,000 per year

Volume Status Definition: CCR, Title 13, section 1900
Percentage ZEV Requirements: 1962.2(b)
Volume Status

Transition in Volume Status

- Increase in Volume Status
  - SVM and IVM – average CA sales > 4,500 based on 3 consecutive 3 year averages
  - IVM and LVM –
    - **Average CA sales > 20,000** based on 5 consecutive 3 year averages
    - **Global revenue test for MY 2018 - 2020**
- Decrease 3 consecutive 3 year averages
- Increase or decrease in volume status effective in the following model year
### Volume Status

**Example: Increase in Size IVM to LVM**

<table>
<thead>
<tr>
<th>Model Year</th>
<th>Annual CA Sales (PC, LDT, and MDV)</th>
<th>Average California Sales</th>
<th>Global Revenue (Billions of $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>19,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>20,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>20,600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>20,750</td>
<td>20,033</td>
<td>39.5</td>
</tr>
<tr>
<td>2019</td>
<td>21,000</td>
<td>20,450</td>
<td>40.1</td>
</tr>
<tr>
<td>2020</td>
<td>19,000</td>
<td>20,783</td>
<td>40.5</td>
</tr>
<tr>
<td>2021</td>
<td>22,000</td>
<td>20,250</td>
<td>3rd</td>
</tr>
<tr>
<td>2022</td>
<td>21,500</td>
<td>20,667</td>
<td>4th</td>
</tr>
<tr>
<td><strong>2023</strong></td>
<td><strong>23,000</strong></td>
<td><strong>20,833</strong></td>
<td><strong>5th</strong></td>
</tr>
<tr>
<td><strong>2024</strong></td>
<td><strong>23,500</strong></td>
<td><strong>22,167</strong></td>
<td></td>
</tr>
</tbody>
</table>

Does not pass revenue test

Subject to LVM Req.

Increases in California Production Volume: 1962.2(b)(7)
Production Volume

- **Definition:** “Calculating the Number of Vehicles to Which the Percentage ZEV Requirement is Applied”
  - Simply called “Production Volume” for presentation
  - The production volume on which **your ZEV requirement** is based
  - Not the same as calculation for determining manufacturer’s Volume Status
Production Volume

- Volume of PCs and LDTs, including ZEVs
- One Method
  - Average of the previous 2\textsuperscript{nd}, 3\textsuperscript{rd}, and 4\textsuperscript{th} model year from model year in which you are complying
  - Example: 2018 MY production volume calculation based on average of 2014 – 2016 MY sales
- May apply to use same year method for two if California sales decrease by at least 30%
  - Two model years between 2018 and 2025
  - Example: 2018 MY sales < 2017 MY sales = production volume based on 2018 MY sales
ZEV Requirement

Total ZEV Credit Percentage Requirement 2018+

Model Year

- 2018: 4.5%
- 2019: 7.0%
- 2020: 9.5%
- 2021: 12.0%
- 2022: 14.5%
- 2023: 17.0%
- 2024: 19.5%
- 2025+: 22.0%

Percentage ZEV Requirements: 1962.2(b)(2)

advanced clean cars
ZEV Credits

- Only one type of credit: ZEV Credits
- Several types of vehicles eligible to earn credits
  - ZEV – Zero Emission Vehicle
  - TZEV – Transitional Zero Emission Vehicle
  - HICE – Hydrogen Internal Combustion Engine Vehicle
  - BEVx – Extended Range BEV
  - NEV – Neighborhood Electric Vehicle
- PZEVs and AT PZEVs no longer eligible
- Credit value simplified
ZEV Credits 2018 and Beyond

Credits from ZEVs

Credits from TZEVs

Zero Emission Range (UDDS Test Cycle)

Credits per Vehicle

2018+ MYs
ZEVs

ZEV – Zero Emission Vehicles

- Zero exhaust emissions of any criteria pollutant or greenhouse gas under any and all possible operational modes and conditions

- Types of ZEVs
  - Battery Electric Vehicles (BEV)
  - Fuel Cell Electric Vehicles (FCEV)

- Credit based on all-electric range of vehicle

2018+ MYs
ZEV Credits

Credits awarded when vehicle is delivered for sale

Fast Refueling discontinued

All-electric Range (AER)

Urban All-Electric Range Test (Test Procedures F.3.1.1)

2018+ MYs

ZEV Credit Calculations: 1962.2(d)(5)(A)

- Credits awarded when vehicle is delivered for sale
- Fast Refueling discontinued
**ZEVs**

- **2016 Nissan LEAF (30 kWh)**
  - EPA Label = 107
  - Approx. AER = 160
  - Credits for 2018 MY = 2

- **2015 Hyundai Tucson FCV**
  - EPA Label = 265
  - Approx. AER = 360
  - Credits for 2018 MY = 4

- **200 mile ZEV**
  - EPA Label = 200
  - Credits for 2018 MY = 3

**Zero Emission Range (UDDS Test Cycle)**

- **70%**
TZEVs

TZEV - Transitional Zero Emission Vehicles

- PHEV – Plug-in Hybrid Electric Vehicles
- Requirements
  - SULEV emission standards
  - Zero evaporative emissions
  - 15 year/150,000 mi extended emissions warranty
  - 10 year/150,000 mi warranty on energy storage device
- Zero Emission Vehicle Miles Traveled (VMT) TZEV Allowance
- HICE – Hydrogen Internal Combustion Engine Vehicle
TZEVs
Zero Emission VMT TZEV Allowance

All-electric Range (AER) UDDS Test Cycle

- < 10 mi: 0.00
- ≥10 miles: (0.01 x EAER) + 0.30
- > 80 miles: 1.10 (cap)

Equivalent All-Electric Range (Test Procedures G.11)

≥ 10 miles of AER on US06 test cycle add additional 0.2 credits
TZEVs

Zero Emission VMT TZEV Allowance

TZEVs w/US06 AER ≥10 miles
Max TZEV Allowance = 1.3

TZEVs w/UDDS AER ≥10 miles but ≤80 miles

>80 miles AER = 1.1 credits

Transitional Zero Emission Vehicle (TZEV): 1962.2(c)

advanced clean cars
HICE

Credits for Hydrogen Internal Combustion Engine (HICE) Vehicles

- Vehicles with a total range of at least 250 UDDS miles earn a base of 0.75 credits
- Can be combined with Zero Emission VMT TZEV Allowance
  - Total credit subject to a 1.25 credit cap when combined with VMT TZEV allowance
BEVxs

BEVx – Range Extended BEVs

- APU – Auxiliary Power Unit
  - On-board ICE generator
  - Gasoline range must not exceed AER
  - Must meet emissions requirements as TZEVs
- Credits based on AER
  - Same as ZEV calculation
  - Minimum 75 miles AER on UDDS drive cycle
NEVs

NEV - Neighborhood Electric Vehicles

- Vehicles earn 0.15 credits per vehicle
- Technological Requirements:
  - Acceleration: 0 – 20 mph in 6 sec or less
  - Top Speed: ≥ 20 mph
  - Constant Speed Range: ≥ 25 miles
  - Sealed, maintenance-free batteries
  - 24 month warranty on drivetrain (including battery)
Discounted AT PZEV and PZEV Credits

- Credits awarded prior to 2018 MY for PZEVs and AT PZEVs
- Banked credits may be used for 2018 through 2025 MY compliance
- Banked credits discounted at the end of 2017 MY compliance

<table>
<thead>
<tr>
<th>Volume Status</th>
<th>AT PZEV Accounts Discounted</th>
<th>PZEV Accounts Discounted</th>
</tr>
</thead>
<tbody>
<tr>
<td>IVM</td>
<td>75%</td>
<td>75%</td>
</tr>
<tr>
<td>LVM</td>
<td>93.25%</td>
<td>75%</td>
</tr>
</tbody>
</table>
Advanced Technology Demonstration Program

- IVMs and LVMs only
- Credits awarded to ZEVs placed as prototypes
  - Includes BEVxs
    - Excludes NEVs and TZEVs
- Vehicles do not need to be delivered for sale to earn credits
- Placed for at least 2 years, 50% of time in CA
- Limited to 25 vehicles per model per ZEV state per year
GHG-ZEV Over Compliance

- Credits awarded for over compliance with GHG fleet standard
- Manufacturers must apply **no later than December 31, 2016**
- Three conditions for eligibility
  - No outstanding ZEV compliance debts
  - No outstanding GHG program debts
  - Projected plans show over-compliance in 2018 - 2021 MYs by at least 2 gCO2/mile
GHG-ZEV Over Compliance

How are GHG-ZEV Over Compliance Credits earned?

- 2018 – 2021 MYs: calculate over compliance with GHG program requirements each year
- Must over comply by $\geq 2.0 \text{ gCO}_2/\text{mile}$
- Credit calculation based on previous model year over compliance
  - Example: 2018 MY Over Compliance Credits based on the amount they have over complied with 2017 MY Fleet Average GHG Compliance Target
How are GHG-ZEV Over Compliance Credits calculated?

\[ \text{US PC and LDT Sales} \times \text{gCO2/mile below Manufacturer Fleet Average GHG Standard} \]
GHG-ZEV Over Compliance

Manufacturer Fleet Average GHG Standard

\[ \sum \left[ \frac{gCO_2/mile \ Target \ Value \ for \ each \ model}{\# \ of \ vehicles \ sold \ for \ each \ model} \right] \times \text{Total production Volume (PC, LDT, and MDV)} \]

Target values based on unique model type (PC, LDT, or MDV) and vehicle footprint (CCR, Title 13, 1961.3)

- Must include ZEVs in calculation
GHG-ZEV Over Compliance

Over Compliance Calculation

\[
gCO_2/\text{mile} = (0.55 \times \text{City CO}_2) + (0.45 \times \text{Highway CO}_2)
\]

- Where:
  - City CO2 is based on FTP test Cycle
  - Highway CO2 based on Highway Fuel Economy Test

Manufacturer Fleet Average GHG Standard

Total production Volume (PC, LDT, and MDV)

\[
\sum \left[ \text{gCO}_2/\text{mile emissions values from each model} \times \text{# of vehicles per model} \right]
\]
GHG-ZEV Over Compliance

GHG Emission Values for ZEVs

- **BEVs**

  \[
  \text{City/Highway CO}_2 = (270 \text{ gCO}_2e/\text{kWh}) \times E_{EV} - 0.25 \times \text{CO}_2_{target}
  \]

  - Where: \( E_{EV} \) is measured from test cycle \((SAE\ J1634)\)

- **FCEVs**

  \[
  \text{City/Highway CO}_2 = (9132 \text{ gCO}_2e/\text{kg} \ H_2) \times H_{FCV} - G_{upstream}
  \]

  - Where: \( H_{FCV} \) = hydrogen consumption \((SAE\ J2572)\)
ZEV Requirement

Total ZEV Credit Percentage Requirement for 2018 and Subsequent MY Vehicles

- 2018: 4.5%
- 2019: 7.0%
- 2020: 9.5%
- 2021: 12.0%
- 2022: 14.5%
- 2023: 17.0%
- 2024: 19.5%
- 2025+: 22.0%

Model Year
ZEV Requirement

ZEV Percentage Requirements for LVMs

- **Minimum ZEV Floor** - Portion of ZEV requirement that must be met with ZEV credits
- **TZEV Credits** - Portion of requirement that may be met with credits from TZEVs

<table>
<thead>
<tr>
<th>Model Year</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025+</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0%</td>
<td>3.0%</td>
<td>3.5%</td>
<td>4.0%</td>
<td>4.5%</td>
<td>5.0%</td>
<td>5.5%</td>
<td>6.0%</td>
<td>16.0%</td>
</tr>
</tbody>
</table>

Percentage ZEV Requirements: 1962.2(b)(2)
ZEV Requirement

Example: LVM Model Year 2018 Compliance

Average Production Volume = 100,000

Total ZEV Requirement = 4.5%
- TZEV = 2.5%
- Minimum ZEV Floor = 2.0%
- 2000 ZEV credits

Up to 2500 credits from TZEVs

Vehicles Produced
- TZEV that earns 0.8 credits per vehicle
- ZEV that earns 4 credits per vehicle

Number of Vehicles Produced
- Up to 3125 TZEVs
- At least 500 ZEVs

[Diagram showing the above information]
IVMs may meet entire ZEV percentage requirements with credits from TZEVs

ZEV Requirement

Percentage ZEV Requirements: 1962.2(b)(2)
Rules on Credit Use

General Rules

- ZEV credits produced in excess of a manufacturer’s requirements may be “banked” for future use
- Credits earned from all types of vehicles may be traded or sold to any other party
  - No, we do not know how much a credit costs
  - Traded credits can be used the same way earned credits can
- Not applicable to GHG-ZEV Over Compliance Credits
GHG-ZEV Over Compliance

Use of GHG-ZEV Over Compliance Credits

- Must be used for MY earned
- Must be removed from manufacturer’s GHG compliance bank
- Cap on overall requirement as well as ZEV specific requirement

<table>
<thead>
<tr>
<th>Year</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50%</td>
<td>50%</td>
<td>40%</td>
<td>30%</td>
</tr>
</tbody>
</table>

- Cannot be traded to another manufacturer
Example: Model Year 2018 LVM Compliance

**Average Production Volume = 100,000**

**Total ZEV Requirement = 4.5%**
- 2500 TZEV Credits
- 2000 ZEV Credits

**Reduced ZEV Requirement = 2.25%**
- 1250 TZEV Credits
- 1000 ZEV Credits

**Total Credits:**
- 1250 Over Compliance Credits
- 1000 Over Compliance Credits
- 2250 Over Compliance Credits Total

**GHG-ZEV Over Compliance Credits:**
1962.2(g)(6)(C)
## Rules on Credit Use

<table>
<thead>
<tr>
<th>Credit Type</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025 +</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEVx</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>GHG-ZEV Over Compliance</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Cap of 50% ZEV Floor</td>
<td>50%</td>
<td>50%</td>
<td>40%</td>
<td>30%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZEV TSC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TZEV TSC</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Reduced AT/PZEV and NEV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IVM</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LVM</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total ZEV and Minimum ZEV Floor**

- **50% Minimum ZEV Floor**
- **10% Total ZEV and Minimum ZEV Floor**
- **10% TZEVs**
- **25% TZEVs**

**Color Key:**
- ZEV Requirement
- Portion of ZEV Req that may be met with TZEV Credits
Travel Provision

- “Counting Specified ZEVs Placed in a Section 177 State and in California”
- Credits earned in one state may also be earned in every state at a proportional value
  - Only FCEV allowed to “travel” 2018 and beyond
- Credits cannot “travel” more than once
- Credits travel at Proportional Value
  - Ratio of S177 State sales to CA sales
Travel Provision
How “Travel” Provision Works

Example 1: Credits Travel from California
x 1000 vehicles = 4000 credits

Example 2: Credits Travel from State B
x 1000 vehicles = 4000 credits

<table>
<thead>
<tr>
<th>STATE</th>
<th>CA</th>
<th>STATE A</th>
<th>STATE B</th>
<th>STATE C</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRODUCTION VOLUME</td>
<td>100,000</td>
<td>75,000</td>
<td>50,000</td>
<td>25,000</td>
</tr>
<tr>
<td>PROPORTIONAL VALUE</td>
<td>100%</td>
<td>75%</td>
<td>50%</td>
<td>25%</td>
</tr>
<tr>
<td>CREDITS AFTER TRAVEL</td>
<td>4000</td>
<td>3000</td>
<td>2000</td>
<td>1000</td>
</tr>
</tbody>
</table>

Credits from California remain
Credits from State B reduced
Optional S177 State Compliance Path

- Encourages manufactures to produce additional ZEVs in the S177 States prior to 2018

- Requirements
  - Additional ZEV Requirement in each S177 state
  - Must be met with “Fresh” (untraveled) ZEV credits
  - Must be met by June 30, 2018

<table>
<thead>
<tr>
<th>Model Years</th>
<th>Additional S177 State ZEV Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>0.75%</td>
</tr>
<tr>
<td>2017</td>
<td>1.50%</td>
</tr>
</tbody>
</table>
Optional S177 State Compliance Path

Advantage of Optional S177 Compliance Path

- Reduction in portion of requirement that may be met with TZEVs in 2015 – 2018 MYs
- Reduced ZEV requirement in 2018 – 2020 MYs
- Allowed to “pool” 2012 and subsequent MY ZEV and TZEV credits
  - ZEV Credits 2016 – 2021 compliance years
  - TZEV Credits 2015 – 2021 compliance years
- Allows manufacturers to place vehicles in areas of high demand within a geographic region
Optional S177 State Compliance Path

Regional Pools

West Region Pool
Oregon

East Region Pool
Connecticut
Vermont
Rhode Island
New York
New Jersey
Massachusetts
Maine
Maryland

Additional 30% Premium

In order to meet a requirement of 100 credits in OR, 130 credits would need to be transferred from East Region.

No penalty for credit transfer within pool.

Optional S177 State Compliance Path

S177 State ZEV % Requirements for LVMs

- Additional “fresh” credit percentages
- 0.75%
- 1.5%

Model Year:
- 2015
- 2016
- 2017
- 2018
- 2019
- 2020

- Minimum ZEV Floor
- Minimum ZEV Floor – Optional S177 State Compliance
- TZEV Credits
- TZEV Credits – Optional S177 State Compliance

Optional S177 State Compliance Path

S177 State ZEV % Requirements for IVM

- Prior to 2018 MY - IVMs could meet entire ZEV % Requirement with credits from PZEVs

<table>
<thead>
<tr>
<th>Year</th>
<th>PZEV Credits</th>
<th>PZEV Credits–Optional S177 State Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>0.75%</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>0.60%</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>0.45%</td>
<td></td>
</tr>
</tbody>
</table>

Additional “fresh” credit percentages

- Prior to 2018 MY - IVMs could meet entire ZEV % Requirement with credits from PZEVs.
Optional S177 State Compliance Path

Additional Flexibility for IVMs 2018 and beyond

- Must choose the Optional S177 State Compliance Path by September 1, 2016
- IVMs can start “pooling” 2012 and subsequent MY ZEV and TZEV credits in MY 2018
- Additional “Fresh” ZEV Requirement 2 years prior to

<table>
<thead>
<tr>
<th>Model Years</th>
<th>Additional Section 177 State ZEV Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 model years prior to LVM transition</td>
<td>0.75%</td>
</tr>
<tr>
<td>1 model year prior to LVM transition</td>
<td>1.50%</td>
</tr>
</tbody>
</table>

- Not eligible for reduced credit percentages
Demonstration of Compliance

- Manufacturers must submit **all ZEV production data by May 1** of the calendar year following the compliance model year
  - Oregon – Data due September 1
- Supplemental data may be submitted through September 1
  - Vehicles delivered/placed April 1 and June 30
  - CT, ME, and RI do not have supplemental reporting period, all data due May 1
- Compliance data submitted via the online reporting tool (ZEV-CRDT System)
Demonstration of Compliance

- Production data, credit balances, and credit transfer information published annually
- Released early October following the end of each compliance year
  - CT, ME and RI publish data in early June
- Data available on the ZEV Program Page
  - [arb.ca.gov/msprog/zevprog/zevprog.htm](arb.ca.gov/msprog/zevprog/zevprog.htm)
Penalties

Requirement to make up ZEV Deficit

- Must make up a deficit by the next model year
  - IVMs may request up to three consecutive model years to make up a deficit
    - Subject to ARB Executive Officer approval
  - LVMs may only use ZEV credits
  - IVMs may use ZEV and TZEV credits
- If the manufacturer still fails to comply, the manufacturer is subject to financial penalties outlined in HSC 43211
Penalties

Health and Safety Code 43211

- $5,000 penalty per vehicle not produced
- 1 ZEV credit = lowest amount of credit that can be earned by a pure ZEV
- 1 ZEV credit = 1 vehicle
- Therefore, $5,000 penalty per each ZEV credit not produced
  - Penalty is additional to credits owed
Thank You

- Thank you for participating in the 2016 ZEV Tutorial