Small Off-Road Engines (SORE)
SORE Emission Sources

Exhaust emissions: in operation

Evaporative emissions: while stored
1990: First SORE exhaust standards adopted

2003: Evaporative standards

2008: Zero-emission credits

2016: Evaporative amendments

2020: New regulatory amendments for lower emissions standards
SORE Emissions Surpass Cars

- Evaporative and exhaust emissions
- Emissions from SORE will exceed cars near 2020
- Increase in emissions due to increasing SORE population
Compliance Rates Unchanged

- Evaporative emissions testing
- 14 families (70 engines) tested to date
- Overall, ~42% of engines have failed

Model Year:
- 2015
- 2016
- 2017

24-hr Emissions / Standard:
- 0.0
- 0.5
- 1.0
- 1.5
- 2.0
- 2.5
- 3.0
- 3.5
- 4.0
- 4.5
- 5.0
- 5.5
- 6.0
- 6.5
- 7.0

Pass
Fail
What are the Health Risks?

- Operators may be subjected to elevated exhaust exposure
- Few studies on exposures and health impacts for operators
- Study to estimate exposures and health risks from air toxics, particles, CO, and noise
Devices Tested

New, used gasoline and new electric devices tested

- Chainsaw
- Leaf blower
- String trimmer
- Hedge trimmer
- Push mower
- Riding mower
A Toxic Plume for Operators
Increased Air Toxics Exposure

Elevated exposures to two carcinogens for all gasoline-powered devices

**Benzene**

- Increased by 3 – 170 µg/m³

**1,3-Butadiene**

- Increased by 1 – 22 µg/m³
Increased Potential Cancer Risks

- All gasoline devices increased potential cancer risks
- Chainsaws produced the highest risks
Moving to Zero-Emission Technology Reduces Health Risks

- Lower exposures to toxic air pollutants
- Decreased cancer risks
- Lower exposures to CO and noise
- Reduced health risks
Zero-Emission Equipment

• Zero-Emission Equipment (ZEE) is available for all landscaping applications
• More than 45 brands of ZEE on the market
• 12 ZEE brands target landscape professionals
Capitol Park—Case Study

Coordinated demos of ZEE from several manufacturers

Enough power to do job… People need to embrace the change to electric.

Plenty of power to get work done.

Useful for times of high tourist traffic, as electric is much quieter.
Demos Lead to ZEE Use

Capitol Park Grounds Crew:

- Use electric equipment about half the time
- Have purchased over 10 pieces of ZEE
Working with Local Universities

• CSU Sacramento has tested several brands of ZEE

• CSU Sac and UC Davis each have a robotic mower demo
Expanding Statewide

- Cal DOT- Northgate and Marysville
- Riverside County
- DGS Riverside

Easiest transition to ZEE for groups that:
- Work in one location
- Maintain manicured grounds
ZEE Roadshow

• Contains 5 brands of commercial grade ZEE
• Visited Green Schools Conference, Irvine EV showcase
• Will leave equipment for 1-2 weeks
Leading by Example

- Working with GovOps and DGS to update SAM language
- Required to use ZEE first for exterior maintenance and landscaping
Online ZEE Directory

- Recently launched website
- Lists of ZEE available
- Directory of zero-emission landscapers
National Sales Trends

- Electric is slowly increasing percent of sales
- Electric sales have increased nearly 40% since 2007
- Data from Sept. 2018 Freedonia Group report
## ZEE Break-Even Point

<table>
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<tr>
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<th>Mean Green CXR60</th>
<th>TORO 3000 series</th>
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<tr>
<td>Power source</td>
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<td>Break-even point</td>
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CARB
Bay Area AQMD Exchange Program

- Financed with settlement funds
- For school districts and municipal agencies
- Alameda and Contra Costa counties

Dirty In ➔ Clean Out
Residential Exchange Programs
Cities Moving to ZEE

- Ojai
  - All electric landscaping
- South Pasadena
  - “Green Zone City”
Schools Moving to ZEE

- California Green Schools Movement
Current Incentive Opportunities

- Clean Mobility in Schools Pilot Projects
- Moyer and AB 617
- Supplemental Environmental Projects
Small Business Support

• Focus on small landscaping businesses
• Can transform sector with relatively small investment
Pathway to 100% ZEE

- Significantly lower emission standards for SORE
- Category-specific ZEE requirements
- Expanded/new incentives for ZEE
Next Steps

• Return in 2020 with lower emissions standards
• Continue demonstrations through Roadshow and collaborations with manufacturers
• Implement incentive programs