# *Appendix 1.*
# *Organizations and Programs on City Certification/Rankings*

### City/Community Certification Programs that Set Up Standards and Conformity:

- STAR Community Rating System (USA) http://www.starcommunities.org/rating-system/
- Sustainable Jersey (New Jersey) http://www.sustainablejersey.com/
- ISO 14001 (international) http://www.iso.org/iso/catalogue_detail?csnumber=31807
- ISO 37120 (international) http://www.iso.org/iso/catalogue_detail?csnumber=62436; http://www.dataforcities.org/registry
- ANSI Network on Smart and Sustainable Cities (ANSSC) (USA) http://www.ansi.org/standards_activities/standards_boards_panels/anssc/overview.aspx?menuid=3
- LEED city/sustainability indicator by U.S. Green Building Council (international), under development. http://www.usgbc.org/LEED
- QUEST (Quality Management tool for Urban Energy Efficient Sustainable Transport) (Europe), a municipal certificate program for urban energy efficient sustainable transport in Europe.
  http://www.quest-project.eu
- Taiwan EPA has measures that assess local air and would reward local governments according to their performance (see file "Measures in Taiwan" in Basecamp)
- Taichung City certifies low-carbon communities and low-carbon schools http://unfccc.epa.gov.tw/UNFCCC/chinese/_upload/20120418/low-carbon.pdf
- AASHE Sustainability Tracking, Assessment & Rating System (STARS) (international), a transparent, self-reporting framework for colleges and universities to measure their sustainability performance https://stars.aashe.org/

### Peer-to-Peer learning Programs:

- CityLinks by ICMA (international) http://icma.org/en/cl/home
- National Resource Network (USA) http://www.nationalresourcenetwork.org/en/home
- Transportation Planning Capacity Building Peer Program (USA) https://www.planning.dot.gov/peer.asp
- California-China Urban Climate Collaborative (CCUCC) by ICLEI USA (California and China) http://icleiusa.org/programs/international-collaboration/ccucc/

### City Rankings

- The City Energy Efficiency Scorecard, ACEEE (USA) http://aceee.org/local-policy/city-scorecard

### Sustainability Indicators:

- EPA Air Quality Index http://www.airnow.gov/index.cfm?action=aqibasics.aqi
- Sustainable Community Indicator Catalog (by University of Pennsylvania's Penn Institute for Urban Research, the HUD Office)
  http://www.sustainablecommunities.gov/indicators/discover

### Voluntary Disclosure on Carbon Emissions:

- CDP (https://www.cdp.net/), cities, firms, water, forests

### City Voluntary Pledge to Reduce GHG Emissions:

- C40 (http://www.c40.org/about)
- Compact of Mayors (http://www.c40.org/compact_of_mayors)

### Green Building Tools/Programs

- Urban Green Council energy efficiency buildings/green codes http://urbangreencouncil.org

### Organizations Provide Technical Assistance and Tools for Community Sustainability

- ICLEI (International, USA, Southeast, etc.) http://www.iclei.org/; http://icleiusa.org/programs/international-collaboration/; http://icleiusa.org/programs/international-collaboration/ccucc/
- ICMA (international) http://icma.org/en/international/home; http://icma.org/en/international/news/Article/104448/Announcing_the_ASEAN_Cities_Climate_Change_Partnership
- EcoDistrict (USA), a non-profit and focuses on neighborhood sustainability http://ecodistricts.org/about/

### City Sustainability Plans and Targets

- Greenovate Boston http://www.greenovateboston.org
- PlaNYC http://www.nyc.gov/html/planyc/html/home/home.shtml

### Other Organizations to Advocate Clean Air

- Clear Air Alliance China (CAAC) - first "Bluetech Award" competition http://www.cleanairchina.org/cus/en08/index.html

# Appendix 2. Organizations Interviewed

| Name | Title | Affiliation | Email | Web link of the affiliation | Phone |
|---|---|---|---|---|---|
| **Boston** | | | | | |
| **Robert Keller** | | City of Cambridge for STAR community application | rkeller@cambridgema.gov or 617/469-4602 | | |
| **Cliff Cook** | | City of Cambridge for STAR community application | ccook@cambridgema.gov | | |
| **Van H. Du** | Special Assistant/Sustainability Adviser to the Chief of Environment, Energy & Open Space | Greenovate Boston | van.du@boston.gov | http://greenovateboston.org/ | (617)635-3850 |
| **Robert O'Keefe** | | Health Effects Institute | rokeefe@healtheffects.org | | |
| **NYC** | | | | | |
| **Kizzy Charles-Guzman** | New York City Program Policy Director | New York City Bar Association | kizzycg@gmail.com | | |
| **Michael Replogle** | | Department of Transportation, NYC | mreplogle@itdp.org | | |
| **Dallas** | | | | | |
| **Thomas Ruiz** | Special Senior Advisor to the Regional Administrator | EPA Regional Office 6 | ruiz.thomas@epa.gov | | Work: (214) 665-3153<br>Mobile: (214) 803-7927 |
| **Kevin Lefebvre** | Senior Environmental Coordinator | Green Dallas (Office of Environmental Quality, City of Dallas) | kevin.lefebvre@dallascityhall.com | | (214)671-8150 |
| **Frank Camp** | Managing Director | | GreenDallas@dallascityhall.com | | |
| **William Madison** | Senior Environmental Coordinator | | | | |
| **Kevin Overton** | Senior Environmental Coordinator | | | | |
| **Dayna Cowley** | Senior Environmental Coordinator | | | | |
| **Dolores Johnson** | | American Lung Association | DJohnson@lungs.org | | (214)974-9060 |
| **Chris Klaus** | | North Central Texas Council of Governments – AirNorthTexas (Arlington) | CKlaus@nctcog.org | | (817)695-9286 |
| **Jahnae Stout** | | | jstout@nctcog.org | | |
| **Research Triangle Park** | | | | | |
| **Dale Evarts** | | EPA Office of Air and Radiation | Evarts.Dale@epa.gov | | |
| **Denver** | | | | | |
| **Adam P. Eisele** | Environmental Engineer | EPA Regional Office 8 | | http://www2.epa.gov/aboutepa/epa-region-8-mountains-and-plains | |
| **Laura Farris** | International Coordinator | | | | |
| **Scott Jackson** | Unit Chief, Indoor Air, Toxics and Transportation Unit | | | | |
| **Chris Parr** | Portfolio Energy Manager, Denver Housing Authority | Denver Housing Authority | cparr@denverhousing.org | | |
| **Emily Freeman** | EMS Program Administrator | DEH - City & County of Denver | | http://www.denvergov.org/environmentalhealth/EnvironmentalHealth/EnvironmentalQuality/EnvironmentalManagementSystems/tabid/444655/Default.aspx | |
| **Gary Lasswell** | Environmental Public Health Manager | DEH | | | |
| **Cyndia N.** | EMS Intern | DEH | | | |
| **Elizabeth Babcock** | Manager of Air, Water, and Climate | City & County of Denver | | | |
| **Sonrisa Lucero** | Sustainability Strategist | City & County of Denver | Sonrisa.lucero@denvergov.org | | |
| **DC** | | | | | |
| **Daivd Grossman** | | ICMA - International City/County Management Association | dgrossman@icma.org | http://icma.org/en/cl/home | |
| **Andrea Fox** | Director of ICMA Center for Sustainable Communities | | | | |
| **Jessica Cho** | CityLinks Program Manager | | | | |
| **Nancy Leahy** | | USAID | nleahy@usaid.gov | | (202)712-1157 |
| **Chad Tudenggongbu** | | ICLEI | chad.tudenggongbu@iclei.org | | |
| **Hilari Varnadore** | Executive director | STAR Communities | hilari@starcommunities.org | | (855)890-7827 ext.102 |
| **Stephanie and Christopher** | | Institute for Sustainable Communities | cforinash@iscvt.org; srust@iscvt.org | | |
| **John Walker** | | NRDC - Air pollution office in DC | jwalke@nrdc.org | | |
| **Julie Rosenberg** | | EPA - Air office DC | Rosenberg.julie@epa.gov | | |
| **Kevin McCarty** | Conference of Mayors | | | | |
| **Beth Keller** | | ICMA | ekellar@slge.org | | (202)962-3611 |

| | | | | | |
|---|---|---|---|---|---|
| **Andrea Denny** | | EPA - State & Local Climate & Energy Program | Denny.Andrea@epa.gov | | |
| **Emma Zinsmeister** | | EPA | zinsmeister.emma@epa.gov | | (202)343-9043 |
| **Vijay Jagannathan** | | WRI | | http://www.wri.org/profile/vijay-jagannathan | |
| **Chad Tudenggongbu** | | ICLEI - Local Governments for Sustainability USA | chad.tudenggongbu@iclei.org | | (917)558-0849 |
| **Mark Ginsberg** | Former DOE RE/EE director | Green Buildng Council | mark.ginsberg35@gmail.com | | |
| **David Ribeiro** | Senior Analyst, Utilities, State, and Local Policy Program | ACEEE | DRibeiro@aceee.org | | (202)507-4750 |
| **Lauren Ross** | | | | | |
| **Jayson Antonoff** | | Institute for Market Transformation, Technical Director, City Energy Project | Jayson@imt.org | | (202)525-2883 |
| **California** | | | | | |
| **Saharnaz Mirzazad** | | ICLEI - Local Governments for Sustainability | saharnaz.mirzazad@iclei.org | http://icleiusa.org/about-us/who-we-are/<br>http://icleiusa.org/programs/international-collaboration/ccucc/ | |
| **Kimi Narita** | Director of Strategic Engagement | NRDC<br>City Energy Project | knarita@nrdc.org | | (310)434-2317 |
| **Baltimore** | | | | | |
| **Kristin Baja** | | Baltimore City Sustainability Office | Kristin.Baja@baltimorecity.gov | | |
| **Alice Kennedy** | | | alice.kennedy@baltimorecity.gov | | |
| **Toronto, Canada** | | | | | |
| **Helen Ng** | Executive Vice President | World on City Data (ISO 37120) | Helen.Ng@globalcities.ca | | (416)966-2368 |

# Appendix 3. 2016 Sustainable Jersey Master Action Tracking Spreadsheet

| KEY |
|---|
| MAIN CATEGORY |
| Sub-Category |

| Status | Code |
|---|---|
| Awarded Points | AP |
| Uploaded | U |
| Complete with Docs | CD |
| Complete - No Docs | C |
| Active | A |
| Under Consideration | UC |

| Action | Abbreviated Submission Requirements | Shelf Life (yrs) | Resubmission Requirements | Points | Status | Project Lead | Due Date |
|---|---|---|---|---|---|---|---|
| **ANIMALS IN THE COMMUNITY** | | | | | | | |
| **Animals in the Community Education** | In your certification application, upload:<br><br>1. Narrative summary of what was accomplished & steps taken to do so. Explain wildlife/domestic animal issues community identified as priority. Note impacts achieved.<br>2. Project documentation of outline for educational program from within 2.5 years of the June submission deadline, description of professional development course, curricula updated w/animal-related education. Provide dates, number of students & teachers participating. Programs can target a variety of audiences and take on a variety of forms.<br>3. Examples of educational materials - multiple documents can be combined in 1 file.<br>4. If school initiatives pursued, upload documentation of municipality's involvement in/knowledge of them. | 2.5 | In your certification application, upload:<br><br>1. Documentation that educational programs have been implemented from within 2.5 years of the June submission deadline.<br>2. Educational materials from programs implemented from within 2.5 years of the June submission deadline. | 10 | | | |
| **Companion Animal Management Pledge**<br><br>***(Pre-Requisite for Companion Animal Management Plan)*** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Official copy of Companion Animal Management Pledge adopted and distributed prior to or during the year you are applying for certification. Include core provisions of the model (treat animals humanely, respectfully, responsibly). Include a memo introducing Pledge w/municipal staff (Planning & Zoning Board, Health Department, Parks Department, Animal Control officers, Environmental Commission) expectations for implementation. List staff receiving memo & their affiliations. | Non-Expiring | NO UPDATE NEEDED | 5 | | | |
| **Companion Animal Management Plan** | **Pre-Requisite:** Companion Animal Management Pledge (refer to the action's requirements)<br><br>In your certification application, upload:<br><br>1. Narrative summary of what was accomplished & steps taken to do so.<br>2. Officially adopted copy of Companion Animal Management Pledge/Resolution w/memo introducing resolution & Companion Animal Management Plan w/municipal staff expectations for implementation. List staff receiving memo & their affiliations.<br>3. Copy of Companion Animal Management Plan from within 5.5 years of the June submission deadline.<br>4. Outreach materials. | 5.5 | In your certification application, upload:<br><br>1. Documentation that the plan has been completed or re-examined from within 5.5 years of the June submission deadline.<br>2. Updated Companion Animal Management Plan. | 10 | | | |
| **Enhanced Licensing Compliance** | In your certification application, upload:<br><br>Base 5 Points:<br><br>1. Narrative summary of what was accomplished & steps taken to do so.<br>2. Flyers, handouts, news media clippings, educaitonal materials from outreach campaign.<br>3. Statistics showing increased numbers of dogs & cats registered where there is existing ordinance.<br>4. Updated census figures.<br><br>Additional 5 Points:<br><br>1. Copies of ordinance & documentation of its distribution. | 2 | | Variable: 5,10 | | | |

| Action | Abbreviated Submission Requirements | Shelf Life (yrs) | Resubmission Requirements | Points | Status | Project Lead | Due Date |
|---|---|---|---|---|---|---|---|
| **Pledge Supporting NJ Wildlife Action Plan** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Copy of officially adopted Pledge adopted prior to or during the year you are applying for certification. Make sure to support the State Wildlife Action Plan & incorporate list of 7 principles into public lands management, ERI, master plan revisions & zoning.<br>3. Memo introducing Pledge w/municipal staff expectations for implementation. List staff (Planning, Transportation, Zoning Board, Economic Development Committee, Animal Control officers, Environmental Commission) receiving memo & their affiliations. | Non-Expiring | NO UPDATE NEEDED | 10 | | | |
| **Wildlife Interaction Plan** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Wildlife Interaction Plan w/documentation it was officially adopted or updated from within 5.5 years of the June submission deadline. It must be a species-specific plan w/components listed in step #5 of What to Do section.<br>3. Documentation of significant stakeholder involvement (meeting minutes w/attendees & affiliations)<br>4. Outreach materials (media reports, newsletter articles, etc.) | 5.5 | In your certification application, upload:<br><br>1. Documentation that the plan has been completed or re-examined from within 5.5 years of the June submission deadline.<br>2. Updated Wildlife Interaction Plan. | 10 | | | |
| **ARTS & CREATIVE CULTURE** | | | | | | | |
| **Establish a Creative Team**<br><br>***(Pre-Requisite for Arts & Creative Culture Actions)*** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. A Report that meets program submission standard (detailed in the action on our website) defining the purpose/role of the team, its structure, geographic area, and a summary of past and planned activities from within 18 months of the June submission deadline.<br>3. Communities recertifying must submit a report updating activities from within 18 months of the June submission deadline.<br>4. Resolution, ordinance, or meeting minutes substantiating how and when the team was established. | 1.5 | In your certification application, upload:<br><br>1. Documentation in a report updating activities from within 18 months of the June submission deadline. | 10 | | | |
| **Creative Assets Inventory** | **Pre-Requisite:** Establish a Creative Team (refer to the action's requirements)<br><br>In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Completed CAI in text, map or spreadsheet form from within 18 months of the June submission deadline.<br>3. Documentation indicating significant stakeholder invovlement from within 18 months of the June submission deadline.<br>4. If the CAI is older than 5 years, document public participation process utilized to update the inventory | 1.5 | In your certification application, upload:<br><br>1. Documentation in a report updating activities from within 18 months of the June submission deadline. | 10 | | | |
| **Creative Placemaking Plan** | **Pre-Requisite:** Establish a Creative Team (refer to the action's requirements)<br><br>In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished and steps taken to do so.<br>2. The Creative Placemaking Plan document. The minimum requirement for submission is a document that addresses the nine elements in the “What to do and How to Do It” section of this action.<br>3. Documentation that the Plan has been incorporated into the municipality’s Master Plan, or the municipality’s Economic Development Plan or Business Improvement District Plan, or documentation that the Plan has been adopted by a resolution of the Planning Board.<br>4.Documentation identifying the community members and organizations involved in developing your Creative Placemaking Plan. | 1.5 | In your certification application, upload:<br><br>1. Documentation in a report updating activities from within 18 months of the June submission deadline. | 10 | | | |
| **Utilizing Your Creative Assets** | **Pre-Requisite:** Establish a Creative Team (refer to the action's requirements)<br><br>In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished and steps taken to do so.<br>2. Report describing your project that meets all of the requirements outlined in the "What to submit" section of the action.<br>3. Council meeting minutes where the project was discussed. | 1.5 | | Variable: 10,20,30 | | | |
| **BROWNFIELDS** | | | | | | | |

| Action | Abbreviated Submission Requirements | Shelf Life (yrs) | Resubmission Requirements | Points | Status | Project Lead | Due Date |
|---|---|---|---|---|---|---|---|
| **Brownfields Inventory & Prioritization**<br><br>***(Pre-Requisite for ALL Brownfields Actions)*** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Inventory-related information downloaded from DEP Dataminer.<br>3. Written policy for regularly updating the Brownfields Inventory with who is responsible and how often it occurs from within 6.5 years of the June submission deadline.<br>3. Description of process used to prioritize sites with weighted factors and priority sites. | 6.5 | In your certification application, upload:<br><br>1. Documentation of an updated inventory from within 6.5 years of the June submission deadline. | 10 | | | |
| **Brownfields Marketing** | **Pre-Requisite:** Brownfields Inventory & Prioritization<br><br>In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Site Mart data sheets.<br>3. Copies of Brownfields outreach materials. | 3.5 | In your certification application, upload:<br><br>1. Documentation of any updates in the inventory & prioritization reflected in the marketing materials.<br>2. Any new marketing materials since initial approval from within 3.5 years of the June submission deadline. | 10 | | | |
| **Brownfields Reuse Planning** | **Pre-Requisite:** Brownfields Inventory & Prioritization<br><br>In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Reuse Data:<br>a. Information collected to determine reuse options for priority sites OR NJDEP Brownfield Development Area application data sheets.<br>3. Public meeting notes & conclusions.<br>4. Either one of the following options:<br>a. Resolution indicating prioritized Brownfield sites & reuse options.<br>b. Brownfields Master Plan Element & resolution approving the Element (may also submit Redevelopment Plan for Master Plan).<br>c. Resolution authorizing Redevelopment Plan. | 6.5 | In your certification application, upload:<br><br>1. Explanation why the documentation submitted previously is still valid, or new documentation from within 6.5 years of the June submission deadline. | 15 | | | |
| **CLIMATE MITIGATION & ADAPTATION** | | | | | | | |
| **Municipal Carbon Footprint (PRIORITY)**<br><br>***(Pre-Requisite for Community Carbon Footprint)*** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Documents that substantiate the numbers you inputted in the Sustainable Jersey provided worksheet that calculated the carbon footprint.<br>3. Results from the Carbon Footprint calculator, located in the action on the website. | 3.5 | In your certification application, upload:<br><br>1. Document an inventory completed from within 3.5 years of the June submission deadline. | 10 | | | |
| **Climate Action Plan** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Climate Action Plan, which includes both municipal and community carbon footprints of baseline emissions, a target for reducing emissions, and a detailed action plan for achieving the target.<br>3. Documentation that the Climate Action Plan was officially adopted or re-examined by the municipal government from within 2.5 years of the June submission deadline. | 2.5 | In your certification application, upload:<br><br>1. The plan must be completed or re-examined from within 2.5 years of the June submission deadline.<br>2. If the plan was re-examined, submit updated carbon footprints and action plan from within 2.5 years of the June submission deadline. | 10 | | | |
| **Community Carbon Footprint** | **Pre-Requisite:** Municipal Carbon Footprint (refer to the action's requirements)<br><br>In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Documents that substantiate the numbers you inputted in the Sustainable Jersey provided worksheet that calculated the carbon footprint.<br>3. Results from the Carbon Footprint calculator, located in the action on the website. | 3.5 | In your certification application, upload:<br><br>1. Updated results from the Carbon Footprint calculator, completed from within 3.5 years of the June submission deadline. | 10 | | | |
| **Wind Ordinance** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Dated small wind ordinance as approved by the local governing body.<br>3. Outreach materials explaining ordinance.<br>4. Documentation that the planning department was informed of the ordinance, its intent, and its responsibilities. | Non-Expiring | NO UPDATE NEEDED | 10 | | | |
| **COMMUNTY PARTNERSHIP & OUTREACH** | | | | | | | |

| Action | Abbreviated Submission Requirements | Shelf Life (yrs) | Resubmission Requirements | Points | Status | Project Lead | Due Date |
|---|---|---|---|---|---|---|---|
| **Create Green Team (MANDATORY)** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. A dated municipal government Resolution or Ordinance that formally established the Green Team -OR- Municipalities may also choose to adopt a Resolution or Ordinance that replaces the expired resolutions so long as it covers the period leading up to the application for certification.<br>3. A brief summary of Green Team activities taken place from within 12 months of the June submission deadline and a list of names and affiliations of members of the current Green Team.<br>4. For expired Green Teams, documentation, such as a Proclamation or a letter of intent by the mayor or municipal council, is required, indicating that the Green Team is still supported by the Municipal Government. | End of Calendar Year | In your certification application, upload:<br><br>1. Documentation of active Green Team from within 12 months of the June submission deadline.<br>2. Updated list of Green Team members and affiliations.<br>3. Proclamation or a letter of intent from the Mayor or municipal council explicitly supporting the Green Team with intent to pursue Sustainable Jersey certification from within the last 12 months, if initial term of appointment in Green Team resolution has expired. | 10 | | | |
| **Community Education & Outreach** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Outreach materials (flyers, media reports, newsletter articles, etc.) indicative of an active program with proof of at least two events being completed from within 18 months of the June submission deadline<br>3. (OPTIONAL) Qualitative Self-Assessment questionnaire, available in the action on our website. | 1.5 | In your certification application, upload:<br><br>1. Full documentation of action taking place from within 18 months of the June submission deadline. | 10 | | | |
| **Education for Sustainability Programs** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so, including identified partners, estimated project costs, and next steps.<br>2. Either one of the following:<br>a. Program outreach or educational materials used in the activity or materials prepared as part of the EfS program or activity<br>b. Information about your participation in the Eco Schools program<br>c. Certificate of completion from the NJ LEARNS training<br>d. Resolution to Educate for Sustainability.<br>3. Documentation (Town Council Agenda, news releases, etc.) of your efforts to publicize what you've been doing in school to your municipal government. | End of Calendar Year | In your certification application, upload:<br><br>1. Full Documentation of the previous or current school year's activities. | 10 | | | |
| **Energy Education & Outreach** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Documentation of events, workshops or activities that promoted the NJ Clean Energy Programs that includes dates of events, indicating active programs from within 12 months of the June submission deadline.<br>3. Examples of educational materials used, including outreach materials provided by the NJBPU Clean Energy Program. | 1 | In your certification application, upload:<br><br>1. Full documentation from within 12 months of the June submission deadline. | 10 | | | |
| **Green Challenges & Community Programs** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Documentation (pledge form, educational materials, etc.) that shows that the publicity and outreach for the Green Challenge Program have been active within the last 18 months.<br>3. Documentation that shows that at least 2.5% of the community has taken the pledge. If the challenge program is ongoing over many years, then the program must have at least 2.5% total, and new pledges from at least 1% of the population or households within the past 18 months. | 1.5 | In your certification application, upload:<br><br>1. Documentation that shows that publicity and outreach have been active within the last 18 months.<br>2. Documentation of pledges from at least 2.5% of the community, with new pledges forming at least 1% of the population within the past 18 months. | 10 | | | |
| **School-based Energy Conservation Programs** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Either one of the following:<br>a. For schools participating in the Energy Education, Inc. program, upload the report from EnergyCap<br>b. For schools participating in and using See The Light software, submit copies of your school's energy baseline and benchmarking reports<br>c. For schools participating in another energy savings/education program, upload copies of your energy baseline benchmarking reports and annual conservation milestones achieved.<br>3. Documentation of how you publicized the school's efforts to the municipal government.<br>4. (OPTIONAL) Qualitative Self-Assessment questionnaire, available in the action on our website. | End of Calendar Year | In your certification application, upload:<br><br>1. Documentation that you are currently enrolled in either Energy Education, Inc., SEE, See The Light or another energy conservation program.<br>2. Documentation of energy savings as specified in the submission requirements.<br>3. Document activity in previous or current school year in which you are applying for certification.<br>4. Document that school publicized participation to municipal govt. | 10 | | | |
| **Green Fairs** | | | | | | | |

| Action | Abbreviated Submission Requirements | Shelf Life (yrs) | Resubmission Requirements | Points | Status | Project Lead | Due Date |
|---|---|---|---|---|---|---|---|
| **Hold a Green Fair**<br><br>***(Pre-Requisite for "Green" Your Green Fair)*** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Documentation (advertisements, flyers, etc.) with the date of the event, indicating the event was held from within 18 months of the June submission deadline.<br>3. Qualitative Self-Assessment questionnaire, available in the action on our website. | 1.5 | In your certification application, upload:<br><br>1. Full documentation for the event from within 18 months of the June submission deadline. | 10 | | | |
| **"Green" Your Green Fair** | **Pre-Requisite:** Hold a Green Fair (refer to the action's requirements)<br><br>In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Qualitative Self-Assessment questionnaire, available in the action on our website, including a description of the sustainable practices implemented at the event in each of the following categories: energy efficiency; waste reduction; support for local economies; and alternative transportation initiatives and the monitoring and impact the practices on greening the event.<br>3. At least two examples of event flyers, press releases, or newspaper articles developed to publicize the “green” nature of the event. | 1.5 | In your certification application, upload:<br><br>1. Full documentation for the event from within 18 months of the June submission deadline. | 10 | | | |
| **DIVERSITY & EQUITY** | | | | | | | |
| **Diversity on Boards & Commissions (PRIORITY)** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Report including your community diversity profile, results of the boards and commissions’ assessment and final recommendations to improve diversity of evaluated municipal boards to be presented to the City or Municipal Council.<br>3. Agenda for the Municipal Council or Committee meeting in which the final recommendations were presented to the Mayor and governing body. | 2.5 | In your certification application, upload:<br><br>1. Full documentation from within 2.5 years of the June submission deadline. | 10 | | | |
| **Environmental Justice Planning & Zoning** | In your certification application, upload:<br><br>**Option 1:**<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. List of your Task Force Members.<br>3. Copy of the final Environmental Justice Recommendations and Action Plan which includes the date(s) these were presented to the municipal government, indicating occurrence from within 10 years of the June submission deadline.<br>4. Copy of the relevant portions of the Master Plan, ordinances, municipal administrative procedures, etc. which you have implemented.<br><br>**Option 2:**<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Summary, including an agenda from within 2.5 years of the June submission deadline, of the Training and Outreach Program implemented for Municipal Boards, Commissions and staff.<br>3. Documentation that demonstrates completed Training and Outreach Programs for municipal Boards, Commissions and staff. | Option1 (10)<br>Option 2 (2.5) | In your certification application, upload:<br><br>**Option 1:**<br><br>1. Documentation of the Task Force formed from within 10 years of the June submission deadline and your efforts to incorporate Environmental Justice issues into master plan, zoning ordinances, municipal administrative procedures, etc. as described in the submission requirements.<br>2. Updated list of Task Force members and affiliations.<br><br>**Option 2:**Documentation of Training and Outreach activities occurring from within 2.5 years of the June submission deadline. | 10 | | | |
| **Lead Education & Outreach Programs** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Meeting minutes of your currently active team along with an evaluation and summary of your lead education programs.<br>3. Documentation of your active program (agenda minutes, flyers, etc.). | 1.5 | In your certification application, upload:<br><br>1. Full documentation from within 18 months of the June submission deadline. | 10 | | | |
| **Lead-Safe Training Programs** | In your certification application, upload (at a minimum 2 of the 3):<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. A .pdf file with course name, date, location, and names of participants as well as a list of the materials provided in the training course that must have taken place from within 2.5 years of the June submission deadline.<br>3. Proof of current licensure after passing the state exam to document that at least one additional employee of the health department, code enforcement, of Prosecutor's Office has been trained as a lead inspector/risk assessor.<br>3. Lead Coordination Agreement. | 2.5 | In your certification application, upload:<br><br>1. Documentation of training occuring from within 2.5 years of the June submission deadline.<br>2. Documentation of cross-training of staff and/or Lead Coordination Agreement.<br>3. Demonstration of current program activity. | 10 | | | |
| **EMERGENCY MANAGEMENT AND RESILIENCY** | | | | | | | |

| Action | Abbreviated Submission Requirements | Shelf Life (yrs) | Resubmission Requirements | Points | Status | Project Lead | Due Date |
|---|---|---|---|---|---|---|---|
| **Climate Adaptation: Flooding Risk (PRIORITY)** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Sign-in sheet(s) from interactive meeting(s) on the GRT Tool and/or printout of online collaboration team through GRT Tool.<br>3. Description of how NJ Flood Mapper Tool was used in analysis. Must include ouput maps.<br>4. Summary results from GRT Tool. | 3.5 | In your certification application, upload:<br><br>1. Full documentation from within 3.5 years of the June submission deadline. | 20 | | | |
| **Extreme Temperature Event Plan** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Sign-in sheet(s) from meeting(s) to review discussion items and develop plan strategies.<br>3. Extreme Temperature Event Plan<br>4. Evidence of how the Extreme Temperature Event Plan has been locally adopted and approved. | 3 | In your certification application, upload:<br><br>1. Narrative of how the plan was implemented.<br>2. Evidence plan monitoring and evaluation process has been completed including the public health and emergency management officials included.<br>3. Updated plan reflecting changes from plan monitoring and evaluation process. | 10 | | | |
| **Community Wildfire Protection Plans** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Copy of approved Community Wildfire Protection Plan with signature page from mayor and NJ Forest Fire Service. | 10 | In your certification application, upload:<br><br>1. Narrative of how the plan was implemented.<br>2. Once the plan expires, documentation that it has been updated | 10 | | | |
| **Firewise Community** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so. For an additional 5 or 10 points, describe mentoring efforts and activities to expand the number of recognized Firewise neighborhoods.<br>2. Copy of welcome/annual renewal letter for each Firewise Community. | 1 | In your certification application, upload:<br><br>1. Full documentation from the previous year. | Variable: 5,10,15 | | | |
| **Ready Set Go! Fire Company** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so along with the 2 RSG outreach/presentation activities completed by each fire department.<br>2. Copy of eahc fire department's approved Ready, Set, Go! report indicating your education and outreach activities were accepted.<br><br>NOTE: An additional 5 points will be awarded for each fire company (up to 3) servicing the municipality. | 1 | In your certification application, upload:<br><br>1. Full documentation from within one year of the June submission deadline. | Variable: 5,10,15 | | | |
| **Wildfire Safety Council** | UNDER DEVELOPMENT | | | 10 | | | |
| **Emergency Communications Planning** | UNDER DEVELOPMENT | | | 15 | | | |
| **Vulnerable Populations Identification for Emergencies** | UNDER DEVELOPMENT | | | 10 | | | |
| **ENERGY EFFICIENCY** | | | | | | | |
| **Energy Tracking & Management (PRIORITY)** | In your certification application, upload:<br><br>Base 10 points:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Summary of budget portfolio<br>3. Summary of prior 12 month energy baseline for all buildings in the portfolio, OR share the ESPM profile with Sustainable Jersey.<br><br>Additional 10 points:<br><br>1. Benchmarking report, ESPM Statement of Energy Performance, or equivalent benchmarking report.<br>2. Document describing reporting process for ongoing use of ET&M. | 1 | In your certification application, upload:<br><br>1. Full documentation from within 12 months of the June submission deadline. | 10, 20 | | | |
| **Municipal Energy Audits and Upgrades** | | | | | | | |

| Action | Abbreviated Submission Requirements | Shelf Life (yrs) | Resubmission Requirements | Points | Status | Project Lead | Due Date |
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| **Implement Energy Efficiency Measures** (PRIORITY) | **Prerequisite:** Complete an Energy Audit<br><br>In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so, including completed upgrades and projects.<br>2. Audit or equivalent report summarizing all measures recommended for building.<br>3. Summary of project with list of all upgrades for each building, energy savings, when upgrades were completed, and list of NJCEP incentives used.<br>4. EUI calculations. | 1 | In your certification application, upload:<br><br>1. Full documentation from within 12 months of the June submission deadline. | Variable: 5, 10, 20, 30 | | | |
| **Inventory and Upgrade All Buildings (RETIRED)** | | | | | | | |
| **Energy Audits**<br><br>***(Prerequisite for Sustainable Energy Transition Plan)*** | In your certification application, upload:<br><br>Base 10 points:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Summary of audit results depending on audit type<br>a. Direct Install (5 points): NJEP Direct Install Energy Assessment Tool<br>b. LGEA (10 points): Energy performance report for each building where LGEA conducted.<br>c. Private Audit (5 or 10 points): Summary report from facility manager, ESCO, or energy consultant.<br><br>Additional 10 points (total of 15 or 20):<br><br>1. Summary of full building portfolio & audit results for each building. | 3.5 | In your certification application, upload:<br><br>1. Full documentation from within 3.5 years of the June submission deadline. | Variable: 5,10,15,20 | | | |
| **Energy Audits for One Building (RETIRED)** | | | | | | | |
| **Sustainable Energy Transition Plan** | **Prerequisite:** Energy Audit<br><br>In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished, steps taken to do so, and additional work done to track and reach target goal.<br>2. Sustainable Energy Transition Plan.<br>3. Spreadsheet summarizing historical energy usage for the building, upgrades for implementation, and percentage reduction.<br>4. Municipal approval of the SETP and intent to implement it. | 1.5 | In your certification application, upload:<br><br>1. ? | Variable: 10,20 | | | |
| **Direct Install** | | | | | | | |
| **Outreach Campaign to Local Business Community**<br><br>***(Pre-Requisite for Achieving Target Increase in Local BusinessParticipation)*** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. A copy of the letter on municipal letterhead and a copy of the informational flyer on Direct Install.<br>3. Documentation of other efforts in support of the Direct Install effort from within 18 months of the June submission deadline (webpage, workshop flyer, newsletter, etc.)<br>4. Additional documentation of efforts. | Outreach (3.5)<br>Other Efforts (1.5) | In your certification application, upload:<br><br>1. Full documentation from within 3.5 years of the June submission deadline, including one additional outreach effort from within 1.5 years of the June submission deadline. | 10 | | | |
| **Achieving Target Increase in Local Business Participation** | **Pre-Requisite:** Direct Install – Outreach Campaign to Local Business Community (refer to action's requirements)<br><br>In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished, steps taken to do so, and additional work done to track and reach target goal.<br>2. Statement from the local Direct Install contractor that lists local businesses that have completed the Direct Install process from within 18 months of the June submission deadline. | 1.5 | In your certification application, upload:<br><br>1. Full documentation from the county DI contractor you worked with verifying the local business participation rate for your Direct Install "Outreach Campaign to the Local Business Community" from within 18 months of the June submission deadline. | 10 | | | |
| **High Efficiency Municipal Buildings** | | | | | | | |

| Action | Abbreviated Submission Requirements | Shelf Life (yrs) | Resubmission Requirements | Points | Status | Project Lead | Due Date |
|---|---|---|---|---|---|---|---|
| **High Performance Building** | In your certification application choose one of the following options & upload:<br><br>**Option A:**<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Current ENERGY STAR Award letter from within 12 months of the June submission deadline.<br><br>**Option B:**<br><br>1. Narrative Summary of what was accomplished & steps taken to do so, including your statement of the target average source energy use intensity (EUI) that is 35% better than the national average source EUI.<br>2. Statement of Energy Performance from EPA's Portfolio Manager, validated by a Professional Engineer from within 3.5 years of the June submission deadline.<br><br>**Option C:**<br><br>1. Narrative Summary of what was accomplished & steps taken to do so, including your statement of the target average source energy use intensity (EUI) that is 15% above the benchmark EUI.<br>2. Statement of Energy Performance from EPA's Portfolio Manager, validated by a Professional Engineer.<br>3. Professional Engineer signed statement referencing that the building meets the codes of EPA's Portfolio Manager Professional Engineers' Guide for indoor air quality, thermal comfort, and lighting comfort, from within 3.5 years of the June submission deadline. | Option A (1)<br>Options B & C (3.5) | In your certification application, upload:<br><br>**Option A:**Renewed ENERGY STAR Award letter from within 12 months of the June submission deadline.<br><br>**Option B:**Full documentation from within 3.5 years of the submission deadline.<br><br>**Option C:** Full documentation from within 3.5 years of the submission deadline. | 10 | | | |
| **High Performance Building Portfolio** | In your certification application choose one of the following options & upload:<br><br>**Option A:**<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Current ENERGY STAR Award letter which you received after applying for ENERGY STAR Leaders Recognition from within 12 months of the June submission deadline.<br><br>**Option B:**<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Facility List and a Facility Summary Report from EPA's Portfolio Manager, validated by a Professional Engineer from within 3.5 years of the June submission deadline. | Option A (1)<br>Option B (3.5) | In your certification application, upload:<br><br>**Option A:**Renewed ENERGY STAR Award letter from within 12 months of the June submission deadline.<br><br>**Option B:**Full documentation from within 3.5 years of the submission deadline. | 20 | | | |
| **Home Performance with Energy Star** | | | | | | | |
| **Municipal Program** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Copy of the contract executed between the municipality and the selected single energy audit contractor that delineates the launch of a municipal-wide "Energy Audit and Upgrade Program."<br>3. Copy of the letter sent from a high ranking official in local government to residents detailing the program and its benefits.<br>4. Documentation of efforts in support of the Home Performance Program occurring within the last 3.5 years (workshops, recognition efforts, discount program for involved members, etc.). | 3.5 | In your certification application, upload:<br><br>1. Documentation of efforts in support of the Home Performance Program occurring within the last 3.5 years (workshops, recognition efforts, discount program for involved members, etc.). | 20 | | | |
| **Outreach** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Clearing house information that outlines the basic package of services to be included in any audit performed by contractors listed through the clearinghouse.<br>3. Documentation of other efforts in support of the HPwES effort from within 3.5 years of the June submission deadline (workshops, recognition efforts, discount program for involved members, etc.). | 3.5 | In your certification application, upload:<br><br>1. Documentation of other efforts in support of the HPwES effort from within 3.5 years of the June submission deadline (workshops, recognition efforts, discount program for involved members, etc.). | 10 | | | |
| **FOOD** | | | | | | | |
| **Farmland Preservation** | | | | | | | |

| Action | Abbreviated Submission Requirements | Shelf Life (yrs) | Resubmission Requirements | Points | Status | Project Lead | Due Date |
|---|---|---|---|---|---|---|---|
| **Farmland Preservation Plans** | In your certification application, upload:<br><br>1. Narrative Summary of activities of the municipal committee responsible for farmland preservation summarizing efforts to implement the Comprehensive Farmland Preservation Plan from within the last 12 months.<br>2. Municipal Comprehensive Farmland Preservation Plan which must contain, at a minimum, one of the following:<br>a. 8 components identified in the SADC Plan guideline.<br>b. An excerpt from the SADC approved county plan that includes the relevant preservation goals and priorities that apply to your municipality.<br>3. (OPTIONAL) Municipal Progress Report | End of Calendar Year | In your certification application, upload:<br><br>1. Documentation of the activity(ies) of the municipal committee responsible for farmland preservation summarizing efforts to implement the Comprehensive Farmland Preservation Plan from within the last 12 months. | 10 | | | |
| **Food Production** | | | | | | | |
| **Community or School Gardens** | In your certification application, upload:<br><br>1. Narrative Summary of support provided from the municipal government.<br>2. Qualitative Assessment found in the action on our website.<br>3. Samples of the community or school garden program materials, assembled in one .pdf file (lesson plans, articles, flyers, etc.). | End of Calendar Year | In your certification application, upload:<br><br>1. Samples of the community or school garden program materials from the calendar year in which you are applying for certification, assembled in one .pdf file (lesson plans, articles, flyers, etc.). | 10 | | | |
| **Support Local Food** | | | | | | | |
| **Buy Fresh By Local Programs** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. List, or link to a list, of your municipality's venues that sell NJ produce.<br>3. Buy Fresh Buy Local campaign materials, indicating an active campaign from within 12 months of the June submission deadline. | End of Calendar Year | In your certification application, upload:<br><br>1. Updated list of venues that sell NJ produce in your community.<br>2. Buy Fresh Buy Local campaign materials from within 12 months of the June submission deadline. | 10 | | | |
| **Farmers Markets**<br><br>***(Pre-Requisite for Making Farmers Markets Accessible)*** | In your certification application, upload:<br><br>1. Narrative Summary that describes your farmers' market, including number of vendors, market dates and hours of operation, and summary of costs and income. Summary should indicate that the market has operated in the June-September growing season, for the calendar year in which you are applying for certification.<br>2. Promotional and Outreach Materials (flyers, articles, etc.).<br>3. If farmer's market is run by a nongovernmental organization and/or by another community with whom you collaborate but for which you are not the host town, you must include a memo from the market manager that details the municipal support provided to the market. | End of Calendar Year | In your certification application, upload:<br><br>1. Full documentation for the calendar year in which you are applying for certification. | 10 | | | |
| **Making Farmers Markets Accessible** | **Pre-Requisite:** Farmers Markets (refer to action's requirements)<br><br>In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Either one of the following options:<br>a. Map that demonstrates the market is within a quarter mile of a transit stop with both identified<br>b. Description of para-transit utilized.<br>3. EBT information from within the June-September growing season, for the calendar year in which you are applying for certification. | End of Calendar Year | In your certification application, upload:<br><br>1. Either one of the following:<br>a. Updated map<br>b. Para-transit description.<br>2. Updated EBT information from the June - September growing season, for the calendar year in which you are applying for certification. | 5 | | | |
| **GREEN DESIGN** | | | | | | | |
| **Green Building Policy/Resolution** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Adopted and dated Policy/Resolution.<br>3. Documentation that the adopted Policy/Resolution has been distributed to all Department and Division heads, and that the policy has been published to the municipal website. | Non-Expiring | NO UPDATE NEEDED | 5 | | | |
| **Green Building Training** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. List of the training programs and names of the participants, indicating at least 2 staff or 3 municipal board members have participated in qualified training from within 2.5 years of the June submission deadline.<br>3. Official workshop agenda, flyer or course materials from the training programs.<br>4. Documentation that at least 2 staff members or 3 board members attended this training, such as a certificate of completion from the course. | 2.5 | In your certification application, upload:<br><br>1. Full documentation from within 2.5 years of the June submission deadline. | 5 | | | |
| **Green Design Commercial & Residential Buildings** | | | | | | | |

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|---|---|---|---|---|---|---|---|
| **Create Green Development Checklist** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Green Development Checklist and enabling ordinance adopted from within 3.5 years of the June submission deadline.<br>3. If recertifying, submit the Recertification Requirements Questionnaire, found in the action on our website.<br>4. List of all pre-development meetings | 3.5 | In your certification application, upload:<br><br>1. Full documentation from within 3.5 years of the June submission deadline. | 10 | | | |
| **Green Building Education** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so, including a description of how and where the green building educational information is being provided.<br>2. Copy or description of information provided in current educational materials or at the educational event, from within 18 months of the June submisison deadline. This should include the green building program information given in the Green Building Scorecard action, and information on the New Jersey Green Home Remodeling Guidelines Version (NJGHRG) 1.0 in the action on our website, and on the green home remodeling program of the U.S. Green Building Council and the American Society of Interior Designers known as REGREEN.<br>3. Any press releases, newsletters, screen shots of webpages, etc. that refer to the information provided. | Option 1 (1)<br>Option 2 (1.5) | In your certification application, upload:<br><br>1. Full documentation from within 18 months of the June submission deadline. | 5 | | | |
| **Site Plan Green Design Standards** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Municipality's standard checklist for planning/zoning board applications that illustrates green design standards, amended from within 7.5 years of the June submission deadline.<br>3. Enabling land development municipal ordinance, and a copy of a completed application that utilizes the amended site plan checklist if available. | 7.5 | In your certification application, upload:<br><br>1. Full documentation from within 7.5 years of the June submission deadline. | 20 | | | |
| **Green Design Municipal Buildings** | | | | | | | |
| **Construction Waste Recycling** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>3. Municipality's Construction and Demolition Waste Recycling Policy or Ordinance, which must be in effect at time of application submission.<br>4. Summary of the impacts of this policy/ordinance. | Non-Expiring | NO UPDATE NEEDED | 10 | | | |
| **New Construction** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Commercial (municipal) buildings: LEED silver certificate for this project and proof that the energy requirement of 20% better performance than ASHRAE 90.1-2007 has been met.<br>3. Multifamily buildings: target for development utilizing the appropriate option found in the full action description. | Non-Expiring | NO UPDATE NEEDED | 20 | | | |
| **Upgrade/Retrofit-Light Pollution** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Municipality's outdoor lighting policy or ordinance. | Non-Expiring | NO UPDATE NEEDED | 10 | | | |
| **Upgrade/Retrofit-Water Conservation** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Municipality's list of water conservation priority actions and indicate which actions have been implemented and when, indicating repair and replacement actions implemented from within18 months of the June submission deadline. | 1.5 | In your certification application, upload:<br><br>1. Document upgrades and/or replacements completed from within 18 months of the June submission deadline. | 10 | | | |
| **HEALTH & WELLNESS** | | | | | | | |

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| **Anti-Idling Education & Enforcement Program** | In your certification application, upload:<br><br>1. Narrative Summary describing the anti-idling program, the project team involved, outreach, educational and/or enforcement efforts undertaken, and the municipality's support.<br>2. Map of prioritized anti-idling locations throughout the community.<br>3. Submit 3 of the following in combined .pdf files:<br>a. Certified copy of the adopted anti-idling resolution<br>b. Photographs of any no idling signs<br>c. Detailed enforcement plan for priority anti-idling locations<br>d. Any educational materials distributed along with a description of how you worked with others to educate residents<br>e. Detailed report on the results / findings of your monitoring and evaluation efforts for your Anti-Idling Program. | 1.5 | In your certification application, upload:<br><br>1. Full documentation from within 18 months of the June submission deadline. | 10 | | | |
| **Building Healthier Communities** | In your certification application, choose one of the following options & upload:<br><br>**Option 1: Mayor's Wellness Campaign (MWC)**<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Statement of Support in form of MWC Pledge or the Council Resolution or Proclamation supporting the MWC.<br>3. Documentation of active programs regarding Youth in Motion, Seniors in Motion, Employees in Motion, and Communities in Motion from within 18 months of the June submission deadline.<br>4. (Optional) Documentation of evaluated impact of programs.<br><br>**Option 2: MWC "NJ Healthy Town"**<br><br>1. Either one of the following:<br>a. Official "Healthy Town" letter from MWC<br>b. Press release about designation as a "Healthy Town."<br>2. Annual update template available in the action on our website.<br><br>**Option 3: Y-USAs Healthier Communities Initiatives**<br><br>1. Adopted Resolution of Support.<br>2. Documentation of work with the YMCA to conduct at least 3 baseline measurements with the Community Healthy Living Index.<br>3. Documentation of implementation of programs and initiatives and their impact. | 1.5 | In your certification application, upload:<br><br>1. Full documentation from within 18 months of the June submission deadline. | 20 | | | |
| **HIA Professional Development** | UNDER DEVELOPMENT | | | 10 | | | |
| **Health in All Policies Professional Development** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Documentation at least 3 people have completed a minimum of 2 hours of HiAP and/or HIA professional training.<br>3. Copy of meeting minutes where HiAP training attendees reported out on their lessons learned and future oportunities.<br>4. OPTIONAL: Copy of presentation/summary lessons learned document provided to governing body | 2 | In your certification application, upload:<br><br>1. Full documentation from within 2 years of the June submission deadline. | 10 | | | |
| **Safe Routes to School** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. NJ SRTS Silver Level recognition if obtained. If you have this, there is no need to upload further documentation for this action. If you don't have Silver Level recognition, upload a list of current SRTS Team names and affiliations.<br>3. Official copy of Resolution of Support, endorsement letter, or MOU supporting SRTS program and documentation of at least 2 walk and/or bike to school events from within 2.5 years of the June submission deadline.<br>4. Either one of the following options:<br>a. Copy of School Travel Plans.<br>b. Description of at least 4 walk and/or bike to school events .<br>c. Copies of findings from Student Arrival and Departure Tally and/or take-home NJ SRTS Parent/Caregiver Survey. | Silver Level Recognition (1.5)<br>Resolution/MOU (2.5)<br>School Travel Plans (5.5)<br>Descriptions of bike/walk events & Tally or Survey (2.5) | In your certification application, upload:<br><br>1. Full documentation that meets each items requirements/shelf life from submission deadline. | 10 | | | |

| Action | Abbreviated Submission Requirements | Shelf Life (yrs) | Resubmission Requirements | Points | Status | Project Lead | Due Date |
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| **Smoke-Free and Tobacco-Free Public Places** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Signed and dated ordinance.<br>3. Evidence the ordinance was implemented (signs/notices) & documentation departments responsible for enforcement have been notified.<br>4. Education & outreach materials. | Non-Expiring | NO UPDATE NEEDED | 10 | | | |
| **INNOVATION & DEMONSTRATION PROJECTS** | | | | | | | |
| **Buy Electricity from a Renewable Source** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Statement of certification documenting the purchase of at least 20% renewable energy. | 1 | In your certification application, upload:<br><br>1. Documentation that RE Purchase contracts are still in force. | 10 | | | |
| **Geothermal Energy** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Documentation of project scopes and paid contracts.<br>3. Documentation of outreach initiatives. | Non-Expiring | In your certification application, upload:<br><br>1. Documentation that installation is still in use. | 10 | | | |
| **Green Roofs** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Documentation of project scopes and paid contracts.<br>3. Documentation of outreach initiatives. | Non-Expiring | In your certification application, upload:<br><br>1. Documentation that installation is still in use. | 10 | | | |
| **Raingardens** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Documentation of project scopes and paid contracts.<br>3. Documentation of outreach initiatives. | Non-Expiring | NO UPDATE NEEDED | 10 | | | |
| **Solar** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Documentation of project scopes and paid contracts.<br>3. Documentation of outreach initiatives. | Non-Expiring | NO UPDATE NEEDED | 10 | | | |
| **Wind** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Documentation of project scopes and paid contracts.<br>3. Documentation of outreach initiatives. | Non-Expiring | NO UPDATE NEEDED | 10 | | | |
| **Innovative Community Project 1** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so, including dates and how practice advances sustainability.<br>2. Documentation that may include project scopes, core principles, adopted policies, etc.<br>3. Documentation of outreach initiatives, indicating project was completed, launched or passed from within 5.5 years of the June submission deadline. | 5.5 | In your certification application, upload:<br><br>1. Documentation that the project is still providing benefits to the community.<br>2. Verify that the project was completed from within 5.5 years of the June submission deadline. | 10 | | | |
| **Innovative Community Project 2** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so, including dates and how practice advances sustainability.<br>2. Documentation that may include project scopes, core principles, adopted policies, etc.<br>3. Documentation of outreach initiatives, indicating project was completed, launched or passed from within 5.5 years of the June submission deadline. | 5.5 | In your certification application, upload:<br><br>1. Documentation that the project is still providing benefits to the community.<br>2. Verify that the project was completed from within 5.5 years of the June submission deadline. | 10 | | | |
| **Innovative Community Project 3** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so, including dates and how practice advances sustainability.<br>2. Documentation that may include project scopes, core principles, adopted policies, etc.<br>3. Documentation of outreach initiatives, indicating project was completed, launched or passed from within 5.5 years of the June submission deadline. | 5.5 | In your certification application, upload:<br><br>1. Documentation that the project is still providing benefits to the community.<br>2. Verify that the project was completed from within 5.5 years of the June submission deadline. | 10 | | | |
| **Renewable Government Energy Aggregation (R-GEA)** | | | | | | | |

| Action | Abbreviated Submission Requirements | Shelf Life (yrs) | Resubmission Requirements | Points | Status | Project Lead | Due Date |
|---|---|---|---|---|---|---|---|
| **R-GEA Consultant Engagement and Implementation** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Copy of R-GEA passed ordinance.<br>3. Letter(s) of certification signed by Mayor or Town Council member and selected energy agent. | End of Calendar Year | In your certification application, upload:<br><br>1. Documentation that the consultant is engaged to implement an R-GEA program either for the first time, or for R-GEA program renewal. | Variable: 5,15,35,50 | | | |
| **Electric Vehicles** | | | | | | | |
| **Make Your Town Electric Vehicle Friendly** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so, with the two tasks selected by the town.<br>2. Ordinance accessory use with updated & approved zoning & parking policies in effect for the year in which you are applying for certification.<br>3. Either one of the following options:<br>a. Pre-wire: provide updated & approved ordinance.Documentation of outreach initiatives.<br>b. Documentation that training course has been completed, by whom, and on what date.<br>c. Letters from 3 partners certifying date workplace chargers installation was completed, when feuling began, type of charging station installed.<br>d. Letters from 3 partners certifying date multi-family home chargers installation was completed, when feuling began, type of charging station installed.<br>e. Submit policy from Ride & Drive event with marketing material.<br>f. Submit signage plan and photos for public charger promotion. | Non-Expiring | NO UPDATE NEEDED | 15 | | | |
| **Public Electric Vehicle Charging Infrastructure** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Letter signed by municipality with all relevant information. | Non-Expiring | NO UPDATE NEEDED | 15 | | | |
| **LAND USE & TRANSPORTATION** | | | | | | | |
| **Sustainable Land Use Pledge (PRIORITY)** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so, and how the pledge was distributed to relevant boards and commissions, and if the pledge was publicized after adoption.<br>2. Certified copy of the resolution adopting the Sustainable Land Use Pledge. If it is NOT from within 3.5 years of the June submission deadline, documentation must be submitted that it has been redistributed to relevant boards and comissions.<br>3. Documentation of Pledge's redistribution to relevant boards and comissions if NOT from within 3.5 years at time of the June submission deadline.<br>4. (OPTIONAL) Press coverage of discussion/Sustainable Land Use Pledge | 3.5 | In your certification application, upload:<br><br>1. Documentation of Pledge's redistribution if NOT from within 3.5 years of the June submission deadline. | 10 | | | |
| **Build-Out Analysis** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Final build-out analysis report with link to report on municipal website.<br>3. Minutes from public presentation to governing body/planning board.<br>4. Additional maps, charts, figures, data & graphs.<br>5. Written assessment of build-out analysis. | 7 | | 10 | | | |
| **Green Building & Environmental Sustainability Element** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Adopted Green Building and Environmental Sustainability Element, from within 10 years of the June submission deadline.<br>3. Certified copy of the Planning Board Resolution, adopting Green Building and Environmental Sustainability Element | 10 | In your certification application, upload:<br><br>1. Documentation that the Audit has been updated from within 10 years of the June submission deadline. | 10 | | | |
| **Historic Preservation Element** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Adopted Historic Preservation Element.<br>3. Certified copy of planning board resolution adopting the HPE. | 10 | In your certification application, upload:<br><br>1. If the HPE is older than 10 years from the June submission deadline, the HPE must have been re-examined and adopted as an amendment to the Master Plan. | 10 | | | |
| **Bicycle and/or Pedestrian Audit** | In your certification application, upload:<br><br>1. A copy of the Bicycle and/or Pedestrian Audit, which includes the following components:<br>a. Survey of existing infrastructure conditions – (the Audit)<br>b. Description of opportunities and constraints (gaps and barriers) | 5.5 | In your certification application, upload:<br><br>1. Documentation that the Audit has been updated from within 5.5 years of the June submission deadline. | 5 | | | |

| Action | Abbreviated Submission Requirements | Shelf Life (yrs) | Resubmission Requirements | Points | Status | Project Lead | Due Date |
|---|---|---|---|---|---|---|---|
| **Bicycle and/or Pedestrian Plan** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Copy of the adopted Bycicle and Pedestrian Plan with all the necessary components.<br>3. Resolution incorporating Bicycle and Pedestrian Plan into Master Plan.<br>4. Documentation that the Planning Board has passed a resolution supporting the adoption of the Bicycle and/or Pedestrian plan as part of the Master Plan. | 10 | In your certification application, upload:<br><br>1. Documentation that the Plan has been updated within 10 years of the June submission deadline. | 10 | | | |
| **Complete Streets Program** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Adopted Complete the Streets Policy Resolution or Ordinance from within 3. 5 years of the June submission deadline, and meet all minimum requirements in the action description.<br>3. Either one of the following options:<br>a. Narrative description of program about how policy will be institutaionalized and impacts monitored using template provided in action.<br>b. If policy is older than 3. 5 years, submit documentation for work toward implementation. | 3.5 | In your certification application, upload:<br><br>1. Documentation on how the the policy has been institutionalized OR will be implemented using the template provided in the action from within 3.5 years of the June submission deadline. | 20 | | | |
| **Institute Complete Streets** | UNDER DEVELOPMENT | | | Variable: 10, 15 | | | |
| **Effective Parking Management** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Adopted parking policy/code provisions.<br>3. Narrative description about why the specific parking management techniques were chosen. | 5.5 | | 10 | | | |
| **Smart Workplaces** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Documentation showing recognition at the Gold level.<br>3. Documentation showing recognition at the Platinum level. | 1.5 | In your certification application, upload:<br><br>1. Documentation that the municipality has maintained NJSW recognition at the Gold or Platinum level from within 18 months of the June submission deadline. | Variable: 5,10 | | | |
| **Transit-Oriented Development Supportive Zoning** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Adopted TOD-supportive zoning ordinance or redevelopment plan with all core elements from within 10 years of the June submission deadline.<br>a. If older than 10 years from the June submission deadline, provide a narrative description of what the municipality has done to support the TOD district during the previous 10 years & description of projects built during that time. | 10 | | 20 | | | |
| **LOCAL ECONOMIES** | | | | | | | |
| **Green Business Recognition Program (PRIORITY)** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Description of the recognition action and marketing plan.<br>3. PDF of sample materials from within 12 months of the June submission deadline. | End of Calendar Year | In your certification application, upload:<br><br>1. Full documentation from within 12 months of the June submission deadline. | 10 | | | |
| **Green Jobs/Economic Development** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Qualitative Assessment, available in the action on our website.<br>3. Supporting Materials from within 12 months of the June submission deadline. | End of Calendar Year | In your certification application, upload:<br><br>1. Full documentation from within 12 months of the June submission deadline. | 10 | | | |
| **Buy Local Programs** | | | | | | | |
| **Buy Local Campaign** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so, identifying that the program was implemented from within at least 4 months of the June submission deadline.<br>2. Examples of materials developed for the “Buy Local” Campaign.<br>3. Press releases or newspaper articles about the kick-off event. | End of Calendar Year | In your certification application, upload:<br><br>1. Full documentation from within 12 months of the June submission deadline. | 10 | | | |
| **Support Local Businesses** | In your certification application, upload:<br><br>1. Narrative Summary of municipal efforts to purchase from, promote, or initiate local businesses.<br>2. Qualitative Assessment, available in the action on our website.<br>3. Documentation of activity's support of expanded development, promotion activities, and/or expanded purchasing opportunities of local businesses from within 12 months of the June submission deadline. | End of Calendar Year | In your certification application, upload:<br><br>1. Full documentation from within 12 months of the June submission deadline. | 10 | | | |

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|---|---|---|---|---|---|---|---|
| **NATURAL RESOURCES** | | | | | | | |
| **Natural Resource Inventory** (PRIORITY) | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. NRI, updated from within 10 years of the June submission deadline, including mapping and explanation of updates if applicable.<br>3. Documentation of NRI's incorporation into the Master Plan.<br>4. Statement of policy for regular update of NRI. | 10 | In your certification application, upload:<br><br>1. NRI, updated from within 10 years of the June submission deadline, including mapping and explanation of updates if applicable. | 20 | | | |
| **Water Conservation Ordinance** (PRIORITY) | **UNDER REVISION** Current requirements are as follows:<br><br>In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Dated adopted Water Conservation Ordinance.<br>3. Outreach materials of ordinance's intent.<br>4. Documentation of notification to appropriate staff (e.g. public works, police, etc.) of the ordinance. | Non-Expiring | NO UPDATE NEEDED | 20 | | | |
| **Environmental Commission**<br><br>***(Pre-Requisite for Environmental Commission Site Plan Review)*** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Either one of the following options:<br>a. Signed adopted ordinance establishing an Environmental Commission<br>b. Online link to list of codes that references ordinance.<br>3. Environmental Commissions' Annual Accomplishment report from within 12 months of the June submission deadline. OR if new, provide members' names, goals, and meeting minutes. | End of Calendar Year | In your certification application, upload:<br><br>1. Environmental Commissions' Annual Accomplishment report from within 12 months of the June submission deadline. If new, additionally provide members' names, goals, and meeting minutes. | 10 | | | |
| **Environmental Commission Site Plan Review** | **Pre-Requisite:** Environmental Commission (EC)<br><br>In your certification application, upload:<br><br>1. Narrative summary describing the review of site plans & subdivision applications.<br>2. Report listing development applications sent to EC for review & action taken.<br>3. Findings of Fact and Recommendations report for one project reviewed from witihin 18 months of the June submission deadline. | 1.5 | | 10 | | | |
| **Open Space Plans** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Open Space and Recreation Plan (OSRP), adopted from within 10 years of the June submission deadline as a part of the Master Plan.<br>3. OSRP sections of Master Plan re-examination report.<br>4. Either one of the following options:<br>a. Resolution or minutes from the Planning Board meeting adopting the OSRP into the Master Plan<br>b. Re-examination Report updating the Master Plan. | 10 | In your certification application, upload:<br><br>1. Open Space and Recreation Plan (OSRP), updated/re-examined 10 years of the June submission deadline as a part of the Master Plan.<br>2. Re-examination Report updating the Master Plan. | 10 | | | |
| **Water Conservation Education Program** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. EACH of the following:<br>a. Completed worksheet or documentation of the effectiveness of program, water conservation tracking, and foreseen improvements based on analysis of the targeted audience (including size, location, type, etc.)<br>b. Identify the type(s) of water use and conservation measures described in program<br>c. Outreach materials -AND- Resources utilized, including costs<br>d. Timeline of implementation of program.<br>3. Examples of materials from program (presentations, handouts, etc.), indicating implementation from within 3.5 years of the June submission deadline. | 3.5 | In your certification application, upload:<br><br>1. Full documentation from within 3.5 years of the June submission deadline. | 10 | | | |
| **Caring For Conservation Easements** | | | | | | | |
| **Easement Inventory and Outreach**<br><br>***(Pre-Requisite for Easement Inspections and Evaluations)*** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Summary of development of Municipal Conservation Easement Stewardship Program.<br>3. Description of the Outreach Program, including materials and means of distribution.<br>4. Municipal Easement Inventory database and any associated mapping. | Non-Expiring | NO UPDATE NEEDED | 10 | | | |

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|---|---|---|---|---|---|---|---|
| **Easement Inspections and Evaluations** | **Pre-Requisite:** Easement Inventory and Outreach<br><br>In your certification application, upload:<br><br>1. Finalized plan that guides the I&E process, including estimated costs, staffing, and timeline for implementation.<br>2. Description of the Outreach and Education program, including at least two outreach materials.<br>3. Completed Municipal Inventory database with easement inspection report data. | Non-Expiring | NO UPDATE NEEDED | 15 | | | |
| **Natural Resource Protection Ordinances** | | | | | | | |
| **Clustering Ordinance** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Either one of the following:<br>a. Link to Clustering Ordinance in web codes<br>b. Certified copy of resolution adopting ordinance<br>c. Certified adopted ordinance.<br>3. Description of the standards that relate to the Ordinance Structure listed in the action on our website. | Non-Expiring | NO UPDATE NEEDED | 10 | | | |
| **Environmental Assessment Ordinance** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Either one of the following:<br>a. Link to Environmental Assessment Ordinance in web codes<br>b. Certified copy of resolution adopting ordinance -<br>c. Certified adopted ordinance.<br>3. Description of the standards that relate to the Ordinance Structure listed in the action on our website. | Non-Expiring | NO UPDATE NEEDED | 10 | | | |
| **Habitat Conservation Ordinance** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Either one of the following:<br>a. Link to Habitat Conservation Ordinance in web codes<br>b. Certified copy of resolution adopting ordinance<br>c. Certified adopted ordinance.<br>3. Description of the standards that relate to the Ordinance Structure listed in the action on our website. | Non-Expiring | NO UPDATE NEEDED | 10 | | | |
| **Tree Protection Ordinance** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Either one of the following:<br>a. Link to Tree Protection Ordinance in web codes<br>b. Certified copy of resolution adopting ordinance<br>c. Certified adopted ordinance.<br>3. Description of the standards that relate to the Ordinance Structure listed in the action on our website. | Non-Expiring | NO UPDATE NEEDED | 10 | | | |
| **Tree & Woodlands Management** | | | | | | | |
| **Community Forestry Plan and Tree Cover Goal**<br><br>***(Pre-Requisite for ALL Tree & Woodlands Management Actions)*** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Municipality's Mid-Year Status Report for the year in which you are applying for certification or a copy of the End Year Status Report letter from within 12 moonths of the June submission deadline showing that the municipality has satisfied the requirements for "Approved Status."<br>3. Dated adopted "Tree Cover Goal." | Option 1 (0.5 pvs yr)<br>Option 2 (1 current yr) | In your certification application, upload:<br><br>1. Full documentation from within 12 months of the June submission deadline. | 20 | | | |
| **Tree Hazard Inventory** | **Pre-Requisite:** Community Forestry Plan and Tree Cover Goal (refer to the action's requirements)<br><br>In your certification application, upload:<br><br>1. Narrative Summary of your Tree Hazard Assessment Program, completed from within 5.5 years of the June submission deadline, including costs.<br>2. Tree Hazard Assessment Report in addition to a map and narrative description of the inventory area . | 5.5 | In your certification application, upload:<br><br>1. Documentation that the inventory has been completed from within 5.5 years of the June submission deadline.<br>2. Verification that the project is updated annually. | 10 | | | |

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|---|---|---|---|---|---|---|---|
| **Tree Maintenance Programs** | **Pre-Requisite:** Community Forestry Plan and Tree Cover Goal (refer to the action's requirements)<br><br>In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Project report of Tree Maintenance Program, completed from within 2.5 years of the June submission deadline, including number of trees removed/pruned and projects costs. | 2.5 | In your certification application, upload:<br><br>1. Full documentation from within 2.5 years of the June submission deadline. | 10 | | | |
| **Tree Planting Programs** | **Pre-Requisite:** Community Forestry Plan and Tree Cover Goal (refer to the action's requirements)<br><br>In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Tree Planting Project Report, including tree species and size list, planting locations/map, project budget and funding, and a maintenance program description from within 3.5 years of the June submission deadline.<br>3. “After” pictures of the tree planting project. | 3.5 | In your certification application, upload:<br><br>1. Full documentation from within 3.5 years of the June submission deadline. | 10 | | | |
| **i-Tree Assessment of Municipal Trees** | **Pre-Requisite:** Community Forestry Plan and Tree Cover Goal (refer to the action's requirements)<br><br>In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Project report of the Computerized Municipal Tree Inventory Program conducted from within 2.5 years of the June submission deadline, including i-Tree assessment reports, project cost summary, how the information is used, and it's impact.<br>3. Newsletter article or fact sheet explaining i-Tree model results, benefits, and impacts. | 2.5 | In your certification application, upload:<br><br>1. Full documentation from within 2.5 years of the June submission deadline. | 10 | | | |
| **OPERATIONS & MAINTENANCE** | | | | | | | |
| **Adopt Behavioral Policies** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Adopted policy.<br>3. Dated communication, occurring from within 18 months of the June submission deadline, materials to verify staff members and facilities managers were made aware of the new behavioral policies and expectations | 1.5 | In your certification application, upload:<br><br>1. Documentation that staff has been reminded of policies from within 18 months of the June submission deadline. | 5 | | | |
| **Green Fleets** | | | | | | | |
| **Fleet Inventory** (PRIORITY)<br><br>***(Pre-Requisite for ALLGreen Fleets Actions)*** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Excel inventory spreadsheet available in action on website.<br>3. Summary of current fleet composition maintenance, driver training practices, an evaluation of efficiency and strategies for improvement, and at least one specific target. | End of Calendar Year | In your certification application, upload:<br><br>1. Full documentation from within 12 months of the June submission deadline. | 10 | | | |
| **Meet Target for Green Fleets** | **Prerequisite:** Fleet Inventory Action (refer to the action's requirements)<br><br>In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Either one of the following:<br>a. Updated fleet inventory that shows an average fuel efficiency of 35 mpg for municipal light duty vehicle fleet<br>b. Baseline fleet inventory completed from within 3.5 years of the June submission deadline and a current fleet inventory to show that the fleet has reduced fuel consumption by 20%.<br>3. Narrative report of targets achieved and future goals. | 3.5 | In your certification application, upload:<br><br>1. Status report from within 12 months of the submission deadline. | 30 | | | |
| **Driver Training** | **Prerequisite:** Fleet Inventory Action (refer to the action's requirements)<br><br>In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Documentation that staff completed a driver training course.<br>3. Dated communication materials covering driver training for fuel efficiency as a course topic within the past 18 months. | 1.5 | In your certification application, upload:<br><br>1. Documentation that staff completed a driver training course from within 18 months of the June submission. | 10 | | | |

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|---|---|---|---|---|---|---|---|
| **Purchase Alternative Fuel Vehicle** | **Prerequisite:** Fleet Inventory Action (refer to the action's requirements)<br><br>In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Documentation (receipt, purchase order, etc.) that one or more alternative fuel vehicle(s) has been purchased and is still in use. | Non-Expiring | NO UPDATE NEEDED | 10 | | | |
| **Vehicle Conversions** | **Prerequisite:** Fleet Inventory Action (refer to the action's requirements)<br><br>In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Documentary evidence of a vehicle conversion to biodiesel, natural gas, propane, or electric. | Non-Expiring | NO UPDATE NEEDED | 10 | | | |
| **Green Purchasing Program** | | | | | | | |
| **Adopt a Green Purchasing Policy by Ordinance** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Adopted Green Purchasing Policy.<br>3. Adopted and dated ordinance that adopts the Green Purchasing Policy.<br>4. Documentation that the ordinance and Policy have been distributed to all Department and Division heads, and has been published to the municipal website. | Non-Expiring | NO UPDATE NEEDED | 10 | | | |
| **Adopt a Green Purchasing Policy by Resolution** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Adopted, dated, and certified Green Purchasing Policy.<br>3. Adopted and dated ordinance that adopts the Green Purchasing Policy.<br>4. Documentation that the ordinance and Policy have been distributed to all Department and Division heads, and has been published to the municipal website. | Non-Expiring | NO UPDATE NEEDED | 5 | | | |
| **Energy Efficient Appliances or Equipment** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Municipal Clerk or Borough certified document stating all electronic purchases from within 4 months of the June submission deadline are ENERGY STAR rated (if applicable).<br>3. List of some ENERGY STAR rated purchased products. | End of Calendar Year | In your certification application, upload:<br><br>1. Full documentation from within 4 months of the June submission deadline. | 10 | | | |
| **Green Cleaning Products** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Documentation that at least 30% of cleaning products purchased from within 12 months of the June submission deadline are "green" as certified by Green Seal, Eco Label, DfE, or Biobased.<br>3. Provider and summary of training provided and list of attendees.<br>4. Training materials. | End of Calendar Year | In your certification application, upload:<br><br>1. Documentation of purchases from within 12 months of the June submission deadline. | 10 | | | |
| **Green Maintenance Equipment and Materials** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Document green maintenance equipment and materials purchased from within 12 months of the June submission deadline. | End of Calendar Year | In your certification application, upload:<br><br>1. Documentation of purchases from within 12 months of the June submission deadline. | 10 | | | |
| **Recycled Paper** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Annual purchasing summary for copy paper demonstrating a minimum of 30% recycled content. | End of Calendar Year | In your certification application, upload:<br><br>1. Documentation of purchases from within 12 months of the June submission deadline. | 10 | | | |
| **Grounds & Maintenance** | | | | | | | |
| **Create a Policy**<br><br>***(Pre-Requisite for ALL Grounds & Maintenance Actions)*** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Municipal adopted Green Grounds and Maintenance Policy which addresses Efficient Landscape Design, Minimize Water Consumption, Recycled Materials and Composting, and Integrated Pest Management.<br>3. Adopted and dated resolution that adopts the Green Grounds and Maintenance Policy.<br>4. Documentation that the Resolution and Policy have been distributed to all Department and Division heads, and has been published to the municipal website. | Non-Expiring | NO UPDATE NEEDED | 10 | | | |

| Action | Abbreviated Submission Requirements | Shelf Life (yrs) | Resubmission Requirements | Points | Status | Project Lead | Due Date |
|---|---|---|---|---|---|---|---|
| **Efficient Landscape Design** | **Prerequisite:** Grounds & Maintenance - Create a Policy (refer to the action's requirements)<br><br>In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Report of efficient landscaped design practices installed on municipal sites, including specific xeriscaping and rainscaping practices utilized in the site design<br>3. (OPTIONAL) Before and after pictures. | Non-Expiring | NO UPDATE NEEDED | 10 | | | |
| **Integrated Pest Management** | **Prerequisite:** Grounds & Maintenance - Create a Policy (refer to the action's requirements)<br><br>In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Integrated Pest Management Policy (IPM) and/or Resolution which includes alternative methods to pesticides. IPM Policy for NJ schools with IPM under 2002 NJ IPM Act is not sufficient to receive credit.<br>3. IPM Implementation plan.<br>4. Documentation of IPM training, list of attendees, and all educational materials. | Non-Expiring | NO UPDATE NEEDED | 10 | | | |
| **Minimize Water Consumption** | **Prerequisite:** Grounds & Maintenance - Create a Policy (refer to the action's requirements)<br><br>In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Report of the coordinating staff member, strategy, and documentation of exact or estimated change of volume of water used in landscape maintenance. | End of Calendar Year | In your certification application, upload:<br><br>1. Full documentation from within 12 months of the June submission deadline. | 10 | | | |
| **Recycled Materials and Composting** | **Prerequisite:** Adopting a Green Grounds and Maintenance Policy (refer to the action's requirements)<br><br>In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Short report of how a municipal composting and landscape material recycling program was initiated or expanded, including reduction of waste outputs and supplies purchased -AND/OR- Reuse of waste products, and the accomplishments and impacts on waste stream and costs. If applicable, include images. | End of Calendar Year | In your certification application, upload:<br><br>1. Full documentation from within 12 months of the June submission deadline. | 10 | | | |
| **SUSTAINABILITY PLANNING** | | | | | | | |
| **Community Asset Mapping** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Final Community Asset Mapping project, completed or updated from within 3.5 years of the June submission deadline.<br>3. Challenges and Opportunities in completing the project, and how the information is being used. | 3.5 | In your certification application, upload:<br><br>1. Final Community Asset Mapping project, completed or updated from within 3.5 years of the June submission deadline. | 10 | | | |
| **Community Visioning** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Documentation that describes the participatory process utilized, documents community participation, and includes the vision statement.<br>3. Resolution or other documentation of vision statement approval by Green Team and governing body, and documentation that vision was distributed to all municipal staff, boards, and commissions.<br>4. If vision is older than within 3.5 years of the June submission deadline, submit a copy of completed plan and use text box to describe the community's implementation, evaluating process, and annual update of the plan. | 3.5 | In your certification application, upload:<br><br>1.Community visioning resolution, completed or updated from within 3.5 years of the June submission deadline. | 10 | | | |
| **Sustainable Community Plan** | | | | | | | |
| **Vision Statement and Goals** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Official adopted Plan, implemented or updated from within 5.5 years of the June submission deadline.<br>2. Resolution/meeting minutes, verifying that the Plan was officially adopted.<br>3. Documentation of significant stakeholder involvement. | 5.5 | In your certification application, upload:<br><br>1. Plans, re-examined or updated from within 5.5 years of the June submission deadline. | 10 | | | |

| Action | Abbreviated Submission Requirements | Shelf Life (yrs) | Resubmission Requirements | Points | Status | Project Lead | Due Date |
|---|---|---|---|---|---|---|---|
| **Indicators and Targets** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Official adopted Plan, implemented or updated within the last 5.5 years.<br>2. Resolution/meeting minutes, verifying that the Plan was officially adopted.<br>3. Documentation of significant stakeholder involvement. | 5.5 | In your certification application, upload:<br><br>1. Plans, re-examined or updated within the last 5.5 years. | 10 | | | |
| **Action Plans** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Official adopted Plan, implemented or updated from within 5.5 years of the June submission deadline.<br>2. Resolution/meeting minutes, verifying that the Plan was officially adopted.<br>3. Documentation of significant stakeholder involvement. | 5.5 | In your certification application, upload:<br><br>1. Action Plans, re-examined or updated from within 5.5 years of the June submission deadline. | 10 | | | |
| **PUBLIC INFORMATION & ENGAGEMENT** | | | | | | | |
| **Communications** | | | | | | | |
| **Municipal Communications Strategy** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Evidence from within the past 6 months that shows the use of municipal communications channels. | End of Calendar Year | In your certification application, upload:<br><br>1. Full documentation from for the year in which you are applying for certification. | 10 | | | |
| **Citizen Engagement** | | | | | | | |
| **Improve Public Engagement in Municipal Government** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so and how the governing body expanded citizen participation.<br>2. Public sign up process for announcements, annual meeting schedules, rules adopted for citizen engagement, and 3 of the following:<br>a. Space where public can review information before meetings<br>b. How agendas were made clearer<br>c. How public comment portion was moved to beginning of meetings<br>d. Link to archived videos/livestream for meetings<br>3. Description of two public input activities from item 5 of the "What to Do" section | Base 10: End of Calendar Year<br>Bonus Points: 1.5 | In your certification application, upload:<br><br>1. Full documentation from for the year in which you are applying for certification. | Variable:<br>10,15 | | | |
| **Improve Public Engagement in Planning and Zoning** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so and how the planning/zoning board expanded citizen participation.<br>2. Annual meeting schedules/agendas/minutes, links to rules adopted for citizen engagement, and links to 2 of the following:<br>a. Webpage where public can sign up for automated notices<br>b. Links to site plan/subdivision application/permit forms, master plan, NRI, or tax maps<br>c. Searchable municipal codes/ordinances<br>d. Link to archived videos/livestream for meetings<br>3. Innovative effort to solicit public input from one of the items listed in item 5 of the "What to Do" section. | Base 10: End of Calendar Year<br>Bonus Points: 1.5 | In your certification application, upload:<br><br>1. Full documentation from for the year in which you are applying for certification. | Variable:<br>10,15 | | | |
| **Online Municipal Public Service Systems** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so and how the planning/zoning board expanded citizen participation.<br>2. Website information on non-emergency municipal services, process to report issues/request non-emergency services, pay items online, sign up system for notification of non-emergency services.<br>3. Hyperlinks to website locations for online/mobile system to track progress on service request/reported issue submissions; or progress on permits/licenses.<br>4. OPTIONAL: Promotional materials to show the publication of the new public service tools available. | End of Calendar Year | In your certification application, upload:<br><br>1. Full documentation from for the year in which you are applying for certification. | Variable:<br>10,15 | | | |
| **Access to Public Information** | | | | | | | |
| **Open Data Inventory and Management** | UNDER DEVELOPMENT | | | Variable:<br>10,15 | | | |
| **Digitizing Public Information** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so and how the planning/zoning board expanded citizen participation.<br>2. Required ditized public information as outline in the "What to Submit" section. | End of Calendar Year | In your certification application, upload:<br><br>1. Full documentation from for the year in which you are applying for certification. | 10 | | | |
| **WASTE MANAGEMENT** | | | | | | | |

| Action | Abbreviated Submission Requirements | Shelf Life (yrs) | Resubmission Requirements | Points | Status | Project Lead | Due Date |
|---|---|---|---|---|---|---|---|
| **Prescription Drug Safety and Disposal (PRIORITY)** | In your certification application, upload:<br><br>**Option 1: Develop and Conduct Two Collection Days per Year**<br><br>1. Narrative Summary of what was accomplished & steps taken to do so. This includes a description and dates of collection program, copies of educational & promotional materials, number of clients and prescriptions, weight collected, and description of final drug disposal.<br>2. Links to national programs.<br>3. Copy of policy for town drop offs and hours.<br>4. Photo of drop off area<br><br>**Option 2: Establish a Permanent Drop-Off Location**<br><br>1. Narrative Summary of what was accomplished & steps taken to do so. This includes a description and dates of collection program, copies of educational & promotional materials, number of clients and prescriptions, weight collected, and description of final drug disposal.<br>2. Links to national programs.<br>3. Copy of policy for town drop offs and hours.<br>4. Photo of drop off area | 1.5 | In your certification application, upload:<br><br>**Option 1:** Full documentation from within 18 months of the June submission deadline.<br><br>**Option 2:** Full documentation from within 18 months of the June submission deadline. | 10 | | | |
| **Recycling** | | | | | | | |
| **Bulky Rigid Plastics** | In your certification application, upload:<br><br>**Option 1: Ordinance in Place**<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Current Bulky Rigid Plastic Recycling Ordinance.<br>3. Promotional materials (articles, flyers, etc.).<br><br>**Option 2: No Ordinance, But Recycles**<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Promotional materials (articles, flyers, etc.).<br>3. County tonnage reports from within 18 months of the June submission deadline. | 1.5 | In your certification application, upload:<br><br>**Option 1:**NO UPDATE NEEDED.<br><br>**Option 2:**County tonnage reports from within 18 months of the June submission deadline. | 10 | | | |
| **Carpet and Foam Padding** | In your certification application, upload:<br><br>**Option 1: Ordinance in Place**<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Current Residential Carpet and Foam Padding Recycling Ordinance.<br>3. Promotional materials (articles, flyers, etc.).<br><br>**Option 2: No Ordinance, But Recycles**<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Promotional materials (articles, flyers, etc.).<br>3. County tonnage reports from within 18 months of the June submission deadline. | 1.5 | In your certification application, upload:<br><br>**Option 1:**NO UPDATE NEEDED.<br><br>**Option 2:**County tonnage reports from within 18 months of the June submission deadline. | 10 | | | |
| **Commercial and Institutional Recycling** | In your certification application, upload:<br><br>**Option 1: Ordinance in Place**<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Current Commercial & Institutional Recycling Ordinance.<br>3. Promotional materials (articles, flyers, etc.).<br><br>**Option 2: No Ordinance, But Recycles**<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Promotional materials (articles, flyers, etc.).<br>3. Implementation Plan Milestones and schedules and tonnage reports from within 18 months of the June submission deadline. | 1.5 | In your certification application, upload:<br><br>**Option 1:**NO UPDATE NEEDED.<br><br>**Option 2:**Implementation Plan Milestones and schedules, and county tonnage reports from within 18 of the June submission deadline. | 10 | | | |
| **Community Paper Shredding Day** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so, including dates of events and logistics.<br>2. Promotional materials (articles, flyers, etc.).<br>3. Estimated number of participants and tons recycled. | 1.5 | In your certification application, upload:<br><br>1. Full documentation from within 18 of the June submission deadline. | 5 | | | |

| Action | Abbreviated Submission Requirements | Shelf Life (yrs) | Resubmission Requirements | Points | Status | Project Lead | Due Date |
|---|---|---|---|---|---|---|---|
| **Construction and Demolition Waste Recycling Ordinance** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so, including impacts of the ordinance based on feedback.<br>2. Either one of the following options:<br>a. Link to Construction and Demolition (C&D) Waste Recycling Ordinance in web codes<br>b. Certified copy of resolution adopting ordinance<br>c. Certified adopted ordinance.<br>3. C&D recycling forms to be used by contractors to track the amount of C&D recycled for each project. | Non-Expiring | NO UPDATE NEEDED | 10 | | | |
| **Food Waste** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so. If pilot program, describe findings and next steps.<br>2. Documentation of beginning and ongoing food waste recycling program.<br>3. Description of program, including analysis of municipality's sources of food waste, collection approach, and the identity of the food waste recycling market.<br>4. Promotional materials and target audience. | End of Calendar Year | In your certification application, upload:<br><br>1. Documentation that food waste recycling program is ongoing.<br>2. Analysis of municipality's sources of food waste, collection approach, and the identity of the food waste recycling market from within 12 months of the June submission deadline. | 10 | | | |
| **Non-Mandated Recycling Initiatives** | In your certification application, upload:<br><br>**Option 1: Ordinance in Place**<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Copy of non-mandated materials Reycling Ordinance.<br>3. Promotional materials (articles, flyers, etc.).<br><br>**Option 2: No Ordinance, But Recycles**<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Promotional materials (articles, flyers, etc.).<br>3. County tonnage reports from within 18 months of the June submission deadline. | 1.5 | In your certification application, upload:<br><br>**Option 1:**NO UPDATE NEEDED.<br><br>**Option 2:**County tonnage reports from within 18 months of the June submission deadline. | 10 | | | |
| **Recycling Depot** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so, including hours of operation.<br>2. List of materials collected from within 18 months of the June submission deadline.<br>3. Promotional material, which states the hours of operation, location, and materials collected.<br>4.Photo of depot that shows a sign, proving it is located in the community. | 1.5 | In your certification application, upload:<br><br>1. Full documentation from within 18 months of the June submission deadline. | 10 | | | |
| **Recycling Education & Enforcement** | In your certification application, upload:<br><br>**Option 1: Ordinance in Place**<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Current Recycling Education & Enforcement Recycling Ordinance.<br>3. Accepted Materials Flyer<br>4. Promotional materials (articles, flyers, etc.).<br>5. Forms, plans, and/or vendor contracts.<br><br>**Option 2: No Ordinance, But Recycles**<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Accepted Materials Recycling Flyer<br>3. Promotional materials (articles, flyers, etc.).<br>4. Forms, plans, and/or vendor contracts. | 1.5 | In your certification application, upload:<br><br>**Option 1:**NO UPDATE NEEDED.<br><br>**Option 2:**Accepted Materials Flyer, promotional materials, and forms, plans and/or vendor contracts from within 18 months of the June submission deadline. | 5 | | | |

| Action | Abbreviated Submission Requirements | Shelf Life (yrs) | Resubmission Requirements | Points | Status | Project Lead | Due Date |
|---|---|---|---|---|---|---|---|
| **Shrink Wrap** | In your certification application, upload:<br><br>**Option 1: Ordinance in Place**<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Current Shrink Wrap Recycling Ordinance.<br>3. Promotional materials (articles, flyers, etc.).<br><br>**Option 2: No Ordinance, But Recycles**<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Promotional materials (articles, flyers, etc.).<br>3. County tonnage reports from within 18 months prior to submission for certification. | 1.5 | In your certification application, upload:<br><br>**Option 1:**NO UPDATE NEEDED.<br><br>**Option 2:**County tonnage reports from within 18 months prior to submission for certification. | 10 | | | |
| **Waste Reduction** | | | | | | | |
| **Backyard Composting Program** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so, including launch date, advertising strategies, and estimated number of participants.<br>2. Promotional materials (articles, flyers, etc.). | 1.5 | In your certification application, upload:<br><br>1.Full documentation from within 18 months of the June submission deadline. | 5 | | | |
| **EPA WasteWise Partner** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. Documentation of municipality's Partnership with or Endorsement of the EPA's WasteWise Program over the course from within 18 months of the June submission deadline<br>3. List of actions implemented within the past year as a result of partnership/endorsement. | 1.5 | In your certification application, upload:<br><br>1.Full documentation from within 18 months of the June submission deadline. | 5 | | | |
| **Grass - Cut It and Leave It Program** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so, including the launch date and promotional tactic.<br>2. Educational materials, developed and promoted from within 18 months of the June submission deadline. | 1.5 | In your certification application, upload:<br><br>1. Full documentation from within 18 months of the June submission deadline. | 5 | | | |
| **Materials Reuse Program** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so, including a tactics that encouraged reuse, key dates of promotional events taken place from within 18 months of the June submission deadline, and the estimated number of people participating and tons reduced.<br>2. Promotional materials (press release, fliers, etc.) | 1.5 | In your certification application, upload:<br><br>1. Full documentation from within 18 months of the June submission deadline. | 10 | | | |
| **Pay-As-You-Throw Program** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so, including launch date.<br>2. Description of program's rate structure, including the rate selected, the waste limit, and whether it is a tag, bag or container system.<br>3. List of municipality's waste reduction and recycling programs, and how long they have been active.<br>4. Educational and promotional materials which highlight waste reduction and recycling opportunities. | End of Calendar Year | In your certification application, upload:<br><br>1. Documentation of active program from within 12 months of the June submission deadline.<br>2. Educational and promotional materials from within 12 months of the June submission deadline. | 10 | | | |
| **Reusable Bag Education Program** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so.<br>2. REQUIRED: Outreach & educational materials that meet the requirements outlined in the "What to do" section of the action.<br>3. REQUIRED: Photos taken during events.<br>4.OPTIONAL: Town Ordinance or Resolution (resolutions must be from within 18 months of the June submission deadline) | 1.5 | In your certification application, upload:<br><br>1. Full documentation from within 18 months of the June submission deadline. If submitting a resolution, it must also be from within 18 months of the June submission deadline. | 5 | | | |

| Action | Abbreviated Submission Requirements | Shelf Life (yrs) | Resubmission Requirements | Points | Status | Project Lead | Due Date |
|---|---|---|---|---|---|---|---|
| **Waste Audit of Municipal Buildings Schools** | In your certification application, upload:<br><br>1. Narrative Summary of what was accomplished & steps taken to do so, including the building(s) where the waste audit was performed, an explanation of why this building was selected, and information about the recycling rate for them -OR- If the building audited was a school, please provide a description of the role the municipality played in the audit.<br>2. Waste audit report, conducted from within 5.5 years of the June submission deadline.<br>3. List of the recycling and waste reduction actions implemented as a result of the audit. | 5.5 | In your certification application, upload:<br><br>1. Waste audit report, conducted or updated from within 5.5 years of the June submission deadline.<br>2. Report on implementation progress from within 12 months of the June submission deadline. | 10 | | | |
| | | | **Total Points Possible** | 1505 | | | |
| | | | **Total Uploaded Points** | | 0 | | |
| | | | **Total Complete with Docs Points** | | 0 | | |
| | | | **Total Complete - No Docs Points** | | 0 | | |
| | | | **Total Active Points** | | 0 | | |
| | | | **Total Under Consideration Points** | | 0 | | |
| | | | **Total Planned Points** | | 0 | | |
| | | | | | | | |
| | | | **Total Awarded Points** | | 0 | | |

# Lists of Potential Control Measures for $PM_{2.5}$ and Precursors

These informational documents are intended to provide a broad, though not comprehensive, listing of potential emissions reduction measures for direct PM2.5 and precursors. The purpose is primarily to assist states in identifying and evaluating potential measures as States develop plans for attaining the PM2.5 NAAQS.

Before examining control measures, an important step for States is to identify the nature of the PM2.5 problem in their areas and the sources contributing to that problem. The severity, nature and sources of the PM2.5 problem vary in each nonattainment area, so the measures that are effective and cost-effective will also vary by area. Similarly, the geographic area in which measures are effectively applied will vary depending on the extent to which pollution sources outside the nonattainment area contribute to the area's PM2.5 problem.

Similarly, the costs of applying a given control measure will have case-specific considerations. While the tables here provide overall control costs and control efficiency estimates derived from the references, there is inherent uncertainty in any estimates of this nature. We do not attempt in these tables to provide any rigorous treatment of these uncertainties, but rather provide the control efficiency and cost estimates as a rough "ballpark" starting point. These documents also do not provide specific emissions monitoring and testing information, such as costs. We encourage the use of source-specific assessments which will be more reliable.

This document contains several tabular lists of PM2.5 control measures. For most measures, the tables provide an estimate of the control efficiency and the cost per ton of pollutant reduced. The tables also identify reference sources that the user may wish to consult for more information. In the interest of making the lists as relevant as possible, we have omitted some measures that we believe are already employed by virtually all sources. For example, for direct PM2.5 sources we did not include an encyclopedic listing of add-on controls such as baghouses, electrostatic precipitators, and venturi scrubbers, since these controls are generally well-known and widely implemented.

Note that this technical document is focused on identification of measures and does not address mechanisms for implementation, such as whether a measure would be implemented on a mandatory or voluntary basis, or whether state adoption of certain mobile measures on a mandatory basis would be pre-empted or require a fuels waiver under the Clean Air Act.

The following control measure lists are included:

**1. Stationary Source Measures Lists.** Separate tables of measures are provided for three pollutants:

- PM2.5
- SO2
- NOx

In addition, for direct PM2.5, the table suggests a number of possible plant-specific engineering evaluations that may yield additional emissions reductions. We have also included a table of references.

**2. On-road Mobile Source Measures Lists.** Separate tables of measures are provided for three pollutants:

- PM2.5
- SO2
- NOx

We have also included a table of references.

**3. Non-road Mobile Source Measures Lists.** Separate tables of measures are provided for three pollutants:

- PM2.5
- SO2
- NOx

We have also included a table of references and a detailed control measures list.

**4. Supplemental Appendix on On-road Ammonia and VOC Measures.** In the notice of proposed rulemaking for PM2.5 implementation (Clean Air Fine Particle Implementation Rule), EPA proposed to make a legal presumption that VOC and ammonia would not be regulated precursors for purposes of a nonattainment area's PM2.5 plan, unless the state or EPA makes a determination to the contrary. In light of this, information on certain selected measures that reduce emissions of ammonia and/or VOC is provided in a separate, supplemental appendix. Tables are provided for:

- On-road VOC measures - measures that are listed in the on-road measures table for PM, SO2 and/or NOx, and that also reduce VOC.
- On-road ammonia measures - measures that are listed in the on-road measures table for PM, SO2 and/or NOx, and that also reduce ammonia.

We have also included a table of references.

**5. Fugitive Dust Measures List.** For completeness, we include a separate table of measures, including references, for sources of fugitive dust. Fugitive dust measures generally have a greater impact on reducing ambient concentrations of PM10 than PM2.5, because crustal material is usually a relatively small fraction of monitored PM2.5. However, dust measures might, in some circumstances, be helpful at reducing ambient PM2.5 concentrations.

Note that some emission reduction measures (e.g., many of the mobile source measures) are listed in more than one table of measures, because they reduce multiple pollutants. For example, a measure that reduces both direct PM and NOx appears once in the PM measures table, and once in the NOx measures table.

EPA has developed a website, at http://www.epa.gov/pm/measures.html, intended to provide information on emissions reduction measures and programs for PM2.5 and precursors. It is our intent to include on this website the information in these tables, including weblinks to the references, in the near future.

**Energy Efficiency and Renewable Energy Measures List.** A list currently under development will include energy efficiency and renewable energy measures that can help reduce emissions of PM2.5 and precursors.

**Agricultural Sources Measures List.** Another separate list under development, being coordinated with the Department of Agriculture, will include control measures for agricultural sources, such as diesel engine retrofits and other measures that can help reduce emissions of PM2.5 and precursors.

**Improved Source Monitoring.** For many of the stationary source measures, it is fundamental to the effectiveness of the measure that implementation include appropriate source monitoring. Effective monitoring to assure ongoing compliance should include periodic emissions testing or other direct measures of compliance, as applicable, and less reliance on generic emissions factors (e.g., from AP-42) for estimating emissions or demonstrating compliance. Moreover, improvements to existing monitoring (e.g., use of fabric filter leak detectors, see EPA-454/R-98-015), or in the frequency of existing monitoring (see Barr and Schaffner, 2003, cited in Stationary Source reference table) will assure that control measures operate within compliance limits and may in fact increase the effectiveness of control measures already in place.

**Contacts.** These documents are a joint effort of EPA's Office of Air Quality Planning and Standards, Office of Transportation and Air Quality, Office of Atmospheric Programs, and Office of Policy Analysis and Review. Contractor assistance was provided by ICF Consulting and subcontractor E.H. Pechan. We regard these as "living documents" and have labeled them as "Draft" to indicate that as we use these documents, we expect to make ongoing revisions as we receive additional information. We invite users to provide suggestions for additional measures, or additional sources of information on measures, that they believe should be included. Please contact:

Tim Smith, Office of Air Quality Planning and Standards, 919-541-4718, Smith.Tim@epa.gov, (stationary sources)

Rudolph Kapichak, Office of Transportation Air Quality, 734-214-4574 Kapichak.Rudolph@epa.gov (mobile sources)

Sam Waltzer, Office of Atmospheric Programs, 202-343-9175, Waltzer.Sam@epa.gov (EGUs)

Tom Driscoll, Office of Air Quality Planning and Standards, 919-541-5135 driscoll.tom@epa.gov (emissions monitoring and testing)

# Stationary Source Control Measures for PM2.5

**See cover note for important notes and caveats on the use of these tables**

| Source category | Emissions reduction measure | Control efficiency (%) | Cost effectiveness ($/ton reduced) | Cost Year | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|---|
| **Generally applicable measures** | | | | | | | |
| All industrial and commercial sources emitting direct PM2.5 | Review uncontrolled or under controlled stack sources for improvements | Variable | Variable | | | | **EPA 2002, EPA 1998b,** AWMA 2000,STAPPA/ALAPCO 2006, Pechan and RTI 2005a, Pechan and RTI 2005b. |
| All industrial and commercial sources currently controlling PM with cyclones or multicylones | Upgrade to high-efficiency collection device to collect fine fraction of PM | Variable | Variable | | | | **EPA 1998b,** AWMA 2000, EPA 2002 |
| All industrial and commercial sources currently controlled by electrostatic precipitators (ESPs) | Upgrade ESP to improve efficiency on fine fraction of PM, for example by increasing size/SCA, flue gas conditioning, use of hybrid technologies to improve performance, or replacement with fabric filter at time of rebuild. | Variable | Variable | | | | **Pechan and RTI 2005b,** EPA 1992, Southern Research Institute 1993. |
| Industrial process fugitives and open dust fugitive emissions sources | Improve fugitive emissions capture | Variable | Variable | | | | **WRAP 2004**, STAPPA/ALAPCO 2006 |
| All sources of condensable PM2.5 | Evaluate whether can feasibly reduce temperature of gas stream and increase collection of condensables, and whether can collect with wet ESPs, afterburner, or other devices | Variable | Variable | | | | [We are looking for references on this topic] |
| **Category specific** | | | | | | | |
| Cement Manufacturing | Process equipment vented to baghouse.<br><br>Various controls for open storage piles, primary crushing operations, and conveying systems. | Not Available | Not available | | Process equipment limits:<br>0.01 gr/dscf for existing equipment;<br>0.005 gr/dscf for new equipment | | SCAQMD, 2005a |

## Stationary Source Control Measures for PM2.5

**See cover note for important notes and caveats on the use of these tables**

| Source category | Emissions reduction measure | Control efficiency (%) | Cost effectiveness ($/ton reduced) | Cost Year | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|---|
| Ferrous Metals Processing - Iron and Steel Production - Blast Furnace Casthouse | Capture Hood Vented to a Baghouse | 85 | Not available | | Based on engineering judgments and data which for some plants may be outdated. | | **EPA 2006a**, Pechan 2006 |
| Ferrous Metals Processing - Iron and Steel Production - BOF | Secondary Capture and Control System | 85 | $5,000 | | Based on engineering judgments and data which for some plants may be outdated. | | **EPA 2006a**, Pechan 2006 |
| Ferrous Metals Processing - Iron and Steel Production - Sinter Plant | Install baghouse to control emissions from sinter cooler | 99 | $5,000 | 2001$ | Based on engineering judgments and data which for some plants may be outdated. | | **EPA 2006a**, Pechan 2006 |
| Petroleum Refinery Catalytic and Thermal Cracking Units | Wet Scrubbing | 85 - 95 | Not Available | | | | **MARAMA, 2006** |
| Petroleum Refinery Catalytic and Thermal Cracking Units | Electrostatic Precipitators | >95% | $3,500 - $6,600 | | | | **MARAMA, 2006;** SCAQMD, 2003 |
| Petroleum Refinery Catalytic and Thermal Cracking Units | Sodium bisulfite (SBS) injection | Not Available | Not Available | | | | **MARAMA, 2006** |
| Stationary diesel engines including generators and other prime service engines | Diesel oxidation catalyst (where DPF not feasible) | 20 | $1,000-$2,000 | 2003$ | Cost effectiveness is based on the combined CO, HC, NOx and PM reduction | | **NESCAUM 2003**, STAPPA and ALAPCO 2006 |
| Stationary diesel engines including generators and other prime service engines | Diesel particulate filter | 80-90 | $2,000-$19,000 | 2003$ | Cost effectiveness is based on the combined CO, HC and PM reduction. | | **NESCAUM 2003**, STAPPA and ALAPCO 2006. |
| Coal-fired Utility Boiler currently controlled by ESPs | Indigo Agglomerator | 40 | Cost effectiveness is variable and based on plant size: the total capital cost of $8 per kW | 2005$ | | | **Khan, EPA. August 21, 2006.** |
| Coal-fired Utility Boiler currently controlled by ESPs | Add enough collection area to equal one field | 44 | Cost effectiveness is variable and based on plant size: the total capital cost of $13.75 per kW | 2005$ | | | **Khan, EPA, August 21, 2006** |

## Stationary Source Control Measures for PM2.5

**See cover note for important notes and caveats on the use of these tables**

| Source category | Emissions reduction measure | Control efficiency (%) | Cost effectiveness ($/ton reduced) | Cost Year | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|---|
| Coal-fired Utility Boiler currently controlled by ESPs | Add enough collection area to equal two fields | 67 | Cost effectiveness is variable and based on plant size: the total capital cost of $17.50 per kW | 2005$ | CE is incremental to ESP controls | | **Khan, EPA, August 21, 2006** |
| Residual Oil-Fired Utility and Industrial Boilers currently without add-on controls | ESP | Not Available | Not available | | | | **EPA, 2006b.** |
| Ferroalloy production | Improve capture on open furnaces | Not Available | Not available | | | | **EPA, 2006b.** |
| Ferroalloy production | Capture of fugitive emissions from pouring and casting | Not Available | Not available | | | | **EPA, 2006b.** |
| Refractory products manufacturing - non-clay with organic binders | thermal oxidizer on plants below MACT applicability cutoff | Not Available | Not available | | | | **EPA, 2006b.** |
| Refractory products manufacturing - non-clay with chromium | Fabric filter | Not Available | Not available | | | | **EPA, 2006b.** |
| Refractory products manufacturing - clay | Wet or dry lime scrubber for plants below MACT applicability limit | Not Available | Not available | | | | **EPA, 2006b.** |
| Commercial Cooking -- conveyorized charbroiler | Catalytic Oxidizer | 83 | $3,000 | 2001$ | | 90 % co-control of VOCs | **Ventura County 2004,** CE-ERT 2002 |
| Commercial Cooking -- large underfired grilling operations | Small ESP (e.g., SMOG-HOG) or scrubber | 99 | $6,000 | 2003$ | | | **Sorrels 2006** |
| Open Burning of Land Clearing Debris | Substitution of landfilling for open burning | 50 to 100 | $3,500 | 1999$ | Development measure from PM NAAQS RIA | | EPA 2006a, Pechan 2006 |
| Residential Wood Combustion | Education and Advisory Program | 5-10 | Variable, depending on availability and effectiveness of resources allocated. | 1990$ | Includes all programs other than woodstove changeout programs | | Pechan 1997 |
| Residential Wood Stoves | Woodstove Changeout Program, including financial incentives and information/encouragement when houses are sold | variable depending on outreach and incentives | $2,000 | 1999$ | 'Development measure from PM NAAQS RIA | | EPA Communication |
| Residential Wood Stoves | Mandatory changeout when houses are sold | 5-7% per year | Not available | | 5-7% is based on typical rates of housing turnover | | |
| Residential Fireplaces | Promote use of Gas Logs/ elimination of wood burning | Not Available | Not available | | | | |
| Outdoor wood hydronic heaters | Emissions standards or siting requirements | Not Available | Not available | | | | **NESCAUM 2007** |

# Stationary Source Control Measures for SO2

**See cover note for important notes and caveats on the use of these tables**

| Source category | Emissions reduction measure | Control efficiency (%) | Cost effectiveness ($/ton reduced) | Cost Year | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|---|
| Cement Kilns - Wet Process | Wet Gas Scrubber | 90 | $6,000-$8,000 | 2002$ | | | **NESCAM 2005a** |
| Cement Kilns - Long Dry Process | Wet Gas Scrubber | 90 | $3,000-$5,000 | 2002$ | | | **NESCAM 2005a** |
| Cement Kilns - Long Dry Process | Spray Dryer Absorber | 90 | $3,000-$5,000 | 2002$ | | | **NESCAM 2005a** |
| Cement Kilns - Preheater Process Kiln | Wet Gas Scrubber | 90 | $20,000-$50,000 | 2002$ | | | **NESCAM 2005a** |
| Cement Kilns - Preheater Process Kiln | Spray Dryer Absorber | 90 | $20,000-$50,000 | 2002$ | | | **NESCAM 2005a** |
| Cement Kilns - Preheater/Precalciner Kiln | Wet Gas Scrubber | 90 | $20,000-$30,000 | 2002$ | | | **NESCAM 2005a** |
| Cement Kilns - Preheater/Precalciner Kiln | Spray Dryer Absorber | 90 | $20,000-$30,000 | 2002$ | | | **NESCAM 2005a** |
| ICI Boilers-Coal--High Sulfur | In duct sorbent injection | 40 | $633-$1,292 | 2003$ | | | **EPA 2003a** |
| ICI Boilers-Coal--High Sulfur | Flue Gas Desulfurization | 90 | $373-$1,046 | 2003$ | | | **EPA 2003a** |
| ICI Boilers-Coal--Low Sulfur | In duct Sorbent Injection | 40 | $697-$1,504 | 2003$ | | | **EPA 2003a** |
| ICI Boilers-Coal--Low Sulfur | Flue Gas Desulfurization | 90 | $461-$1,326 | 2003$ | | | **EPA 2003a** |
| ICI Boilers-Residual Oil | Flue Gas Desulfurization | 90 | $2,295-$3,500 | 1999$ | The cost effectiveness is a function of boiler capacity. For boilers below 100 million BTU the cost per ton is $4524, for 100-250 million BTU the cost per ton is 3489 and for larger than 250 million BTU the cost per ton is $2295. | | **EPA 2003a** |
| ICI Boiler - Distillate Oil | Reduce sulfur content from 2500 ppm to 500 ppm | 80 | $2,350 | 1999$ | Developmental measure from PM NAAQS RIA | 80% PM2.5 co-benefit | **EPA 2006a** |
| Inorganic Chemical Manufacture Operations--Carbon Black Production | Reduce Sulfur in Feedstock | up to 50? | Not available | | EPA information indicates US facilities use feedstock with about 4% sulfur, while European facilities use feedstock with about 2 % sulfur. | | **EPA 2006b** |

# Stationary Source Control Measures for SO2

**See cover note for important notes and caveats on the use of these tables**

| Source category | Emissions reduction measure | Control efficiency (%) | Cost effectiveness ($/ton reduced) | Cost Year | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|---|
| Iron and Steel--Coke Ovens | Coke oven gas desulfurization | 90+ | Not available | | | | **Pechan 2006** |
| Oil and Gas Production--Process heaters | Flue Gas Desulfurization | 90 | Not available | | | | **EPA 1981** |
| Petroleum refining--catalytic and thermal cracking units | Catalyst additives | 35 - 50 | $ 1,096 - $1,889 | | This type of SO2 control is required in some refinery industry cases and settlements | | **MARAMA 2006,** Eagleson et al., 2004, |
| Petroleum refining--catalytic and thermal cracking units | Wet gas scrubbers | 95 - 99.9 | $ 499 - 880 | 2004$ | This type of SO2 control is required in some refinery industry cases and settlements | | **MARAMA 2006,** Eagleson et al., 2004, |
| Petroleum refining -- catalytic and thermal cracking units | Feed hydrotreatment | Not available | Not available | | | | **MARAMA, 2006** |
| Petroleum refining--flares | Process changes to reduce flaring | Variable depending on suite of measures selected | Variable depending on suite of measures selected | | | | **MARAMA, 2006** |
| Petroleum refining--process heaters | Scrubbing: Wet Scrubbers, Spray Dry Scrubbers, Dry Scrubbers | 90 - 99.9 | $7,674 - $45,384 | | | | **MARAMA, 2006** |
| Petroleum refining--oil-burning process heaters | Eliminate the combustion of fuel oil (>0.05% sulfur by weight) | >95 | Not available | | | | **MARAMA, 2006** |
| Petroleum refining--sulfur recovery units | Increased recovery efficiency, tail gas treatment such that H2 S content of fuels meets 0.10 gr/dscf (162 ppm) limit | variable depending on current recovery efficiency | Variable depending on current recovery efficiency | | | | **MARAMA, 2006** |
| Primary aluminum plants | Addition of scrubbers to control system for captured emissions from anode bake furnaces | Not available | Not available | | | | **EPA, 2006b** |
| Primary aluminum plants | Use of coke and pitch with lower sulfur content | Not available | Not available | | | | **EPA, 2006b** |

# Stationary Source Control Measures for SO2

**See cover note for important notes and caveats on the use of these tables**

| Source category | Emissions reduction measure | Control efficiency (%) | Cost effectiveness ($/ton reduced) | Cost Year | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|---|
| Primary Lead Smelters - Sintering | Dual Absorption Acid Plant | 90 | Not available | | | | **EPA 1981** |
| Primary Zinc Smelters - Sintering | Dual Absorption Acid Plant | 90 | Not available | | | | **EPA 1981** |
| Pulp and Paper--acid sulfite pulping | Alkaline scrubber | Not available | Not available | | | | **STAPPA/ALAPCO 2006** |
| Pulp and Paper--acid sulfite pulping | Raise pH of digester before releasing excess gas | Not available | Not available | | | | **STAPPA/ALAPCO 2006** |
| Pulp and paper--recovery furnaces | Reduce sulfur content of black liquor before combustion | Not available | Not available | | | | **AWMA 2000** |
| Pulp and paper--recovery furnaces | Regulate temperatures in the furnace to minimize SO2 formation | Not available | Not available | | | | **STAPPA/ALAPCO 2006** |
| Residential fuel combustion--Home Heating Oil | Reduce sulfur content from 2500 ppm to 500 ppm | 80 | $2,350 | 1999$ | Some areas currently have 500 ppm limits. | | **NESCAUM 2005** |
| Sulfur Recovery Plants at Elemental Sulfur Plants, Oil and Gas Production, and other sulfur recovery plants not located at refineries | Increased recovery efficiency, tail gas treatment | Variable depending on current recovery efficiency | Variable depending on current recovery efficiency | | | | **EPA 2002** |
| Sulfuric Acid Plants | Increased recovery efficiency | Variable depending on current recovery efficiency | Variable depending on current recovery efficiency | | | | **Pechan 2006** |
| Utility Boilers | * (see footnote) | | | | | | |

* This document does not address SO2 and NOx controls for EGU. These controls are relatively well known and are the subject of policy discussions among states, multi-state bodies and the EPA.

# Stationary Source Control Measures for NOx

**See cover note for important notes and caveats on the use of these tables**

| Source category | Emissions reduction measure | Control efficiency (%) | Cost effectiveness ($/ton reduced) | Cost Year | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|---|
| Ammonia - Natural Gas - Fired Reformers | Low NOx Burner | 50 | $820 | 1990$ | | | **EPA 1994a, EPA 2002, Pechan 1998, Pechan 2001** |
| Ammonia - Natural Gas - Fired Reformers | Low NOx Burner + Flue Gas Recirculation | 60 | $2,560 | 1990$ | | | **EPA 1994a, EPA 2002, Pechan 1998, Pechan 2001** |
| Ammonia - Natural Gas - Fired Reformers | Oxygen Trim + Water Injection | 65 | $680 | 1990$ | | | **EPA 1994a, EPA 2002, Pechan 1998, Pechan 2001** |
| Ammonia - Natural Gas - Fired Reformers | Selective Catalytic Reduction (SCR) | 80 | $2,230 | 1990$ | | | **EPA 1994a, EPA 2002, Pechan 1998, Pechan 2001** |
| Ammonia - Natural Gas - Fired Reformers | Selective Non-Catalytic Reduction (SNCR) | 50 | $3,780 | 1990$ | | | **EPA 1994a, EPA 2002, Pechan 1998, Pechan 2001** |
| Ammonia Products; Feedstock Desulfurization | Low NOx Burner + Flue Gas Recirculation | 60 | $2,560 | 1990$ | | | **EPA 1994a, EPA 2002, Pechan 1998, Pechan 2001** |
| Asphalt Plant Manufacture | Low NOx Burner + Flue Gas Recirculation | 30-50 | Not available | | | | |
| Asphaltic Conc; Rotary Dryer; Conv Plant | Low NOx Burner | 50 | $2,200 | 1990$ | | | **EPA 1993, EPA 2002, Pechan 1998** |
| By-Product Coke Manufacturing; Oven Underfiring | Selective Non-Catalytic Reduction (SNCR) | 60 | $1,640 | 1990$ | | | **EPA 1994, EPA 2002, Pechan 1998, Pechan 2001** |
| Cement Kilns | Biosolids injection | 23 | $310 | 1999$ | | | **Pechan 2006** |
| Cement Kilns | Changing feed composition | | Not available | | | | **LADCO 2005** |
| Cement Kilns | Low NOx Burner | 27-40 | $166-$1,299 | 2004$ | | | **LADCO 2005** |
| Cement Kilns | Mid-Kiln Firing | 33-41 | -$460 to $730 | 2004$ | | | **LADCO 2005** |
| Cement Kilns | Process control systems | | Not available | | | | **LADCO, 2005** |
| Cement Kilns | Selective Catalytic Reduction (SCR) | 31-95 | $600-$3,700 | 1999$ | Uncertain -- currently used on cement kilns in France; may apply to U.S. cement kilns in future | | **Pechan 2006, STAPPA/ALAPCO 2006** |
| Cement Kilns | SNCR-ammonia based | 50 | $850 | 1999$ | | | **EC/R 2000** |
| Cement Kilns | SNCR-urea based | 50 | $770 | 1999$ | | | **EC/R 2000** |
| Ceramic Clay Manufacturing; Drying - Small Sources | Low NOx Burner | 50 | $2,200 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Coal Cleaning-Thrml Dryer; Fluidized Bed - Small Sources | Low NOx Burner | 50 | $200-$1,000 | 2003$ | | | **Reaction Engineering International and Energy & Environmental Strategies** |
| Combustion Turbine Aeroderivative Gas Turbines | Water Injection | 40 | $44,000 | 2005$ | | | **NJDEP 2005** |

## Stationary Source Control Measures for NOx

**See cover note for important notes and caveats on the use of these tables**

| Source category | Emissions reduction measure | Control efficiency (%) | Cost effectiveness ($/ton reduced) | Cost Year | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|---|
| Combustion Turbines - Jet Fuel, Oil | Selective Catalytic Reduction (SCR) + Water Injection | 90 | $2,300 | 1990$ | | | **EPA 2002** |
| Combustion Turbines - Jet Fuel, Oil | Water Injection | 68 | $1,290 | 1990$ | | | **EPA 2002** |
| Combustion Turbines - Natural Gas | Dry Low NOx Combustors | 84 | $100 (large) $490 (small) | 1990$ | | | **EPA 2002** |
| Combustion Turbines - Natural Gas | Selective Catalytic Reduction (SCR) + Low NOx Burner (LNB) | 95 | $2,570 | 1990$ | Cost effectivness is $19,120 per ton NOx reduced from RACT baseline | | **EPA 2002** |
| Combustion Turbines - Natural Gas | Selective Catalytic Reduction (SCR) + Steam Injection | 95 | $2,010 | 1990$ | Cost effectiveness is $8,960 per ton NOx reduced from RACT baseline | | **EPA 2002** |
| Combustion Turbines - Natural Gas | Selective Catalytic Reduction (SCR) + Water Injection | 95 | $2,730 | 1990$ | | | **EPA 2002** |
| Combustion Turbines - Natural Gas | Steam Injection | 80 | $1,040 | 1990$ | | | **Pechan 1998 and Pechan 2001** |
| Combustion Turbines - Natural Gas | Water Injection | 76 | $1,510 | 1990$ | | | **Pechan 1998 and Pechan 2001** |
| Commercial/Institutional - Natural Gas | Water Heaters + LNB Space Heaters | 7 | $1,230 | 1990$ | | | **SCAQMD 1996** |
| Commercial/Institutional Incinerators | Selective Non-Catalytic Reduction (SNCR) | 45 | $1,130 | 1990$ | | | **EPA 2002** |
| Conv Coating of Prod; Acid Cleaning Bath | Low NOx Burner | 50 | $2,200 | 1990$ | | | **EPA 2002** |
| Fiberglass Manufacture; Textile-Type; Recuperative Furnaces | Low NOx Burner | 40 | $1,690 | 1990$ | | | **EPA 2002** |
| Fluid Catalytic Cracking Units | Low NOx Burner + Flue Gas Recirculation | 55 | $3,190 | 1990$ | | | **EPA 2002** |
| Fuel Fired Equipment - Process Heaters | Low NOx Burner + Flue Gas Recirculation | 50 | $570 | 1990$ | | | **EPA 2002** |
| Fuel Fired Equipment; Furnaces; Natural Gas | Low NOx Burner | 50 | $570 | 1990$ | | | **EPA 2002** |
| Glass Manufacturing - Containers | Cullet Preheat | 25 | $490 | 1990$ | | | **Pechan 1998** |
| Glass Manufacturing - Containers | Electric Boost | 10 | $7,150 | 1990$ | | | **Pechan 1998** |
| Glass Manufacturing - Containers | Low NOx Burner | 40 | $1,690 | 1990$ | | | **EPA 2002 and Pechan 1998** |

## Stationary Source Control Measures for NOx

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| Source category | Emissions reduction measure | Control efficiency (%) | Cost effectiveness ($/ton reduced) | Cost Year | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|---|
| Glass Manufacturing - Containers | OXY-Firing | 85 | $4,590 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Glass Manufacturing - Containers | Selective Catalytic Reduction (SCR) | 75 | $2,200 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Glass Manufacturing - Containers | Selective Non-Catalytic Reduction (SNCR) | 40 | $1,770 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Glass Manufacturing - Flat Glass | Low NOx Burner | 40 | $700 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Glass Manufacturing - Flat Glass | OXY-Firing | 85 | $1,900 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Glass Manufacturing - Flat Glass | Selective Catalytic Reduction (SCR) | 75 | $710 (large), $3,370 (small) | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Glass Manufacturing - Flat Glass | Selective Non-Catalytic Reduction (SNCR) | 40 | $740 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Glass Manufacturing - Pressed Glass | Cullet Preheat | 25 | $810 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Glass Manufacturing - Pressed Glass | Electric Boost | 10 | $2,320 - $8,760 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Glass Manufacturing - Pressed Glass | Low NOx Burner | 40 | $1,500 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Glass Manufacturing - Pressed Glass | OXY-Firing | 85 | $3,900 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Glass Manufacturing - Pressed Glass | Selective Catalytic Reduction (SCR) | 75 | $2,530 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Glass Manufacturing - Pressed Glass | Selective Non-Catalytic Reduction (SNCR) | 40 | $1,640 | 1990$ | | | **EPA 1994c and Pechan 2006** |
| IC Engines - Gas | Selective Catalytic Reduction (SCR) | 90 | $2,769 | 1990$ | | | **EPA 1993b** |
| IC Engines - Gas, Diesel, LPG | Ignition Retard | 25 | $770 | 1990$ | | | **EPA 1993b** |
| IC Engines - Gas, Diesel, LPG | Selective Catalytic Reduction (SCR) | 80 | $2,340 | 1990$ | | | **EPA 1993b** |
| IC Engines - Gas--Lean burn | Low emission combustion | 87 | $422 | 1993$ | The cost effectiveness is in ozone season dollars per ton. | | **Pechan 2000** |
| IC Engines-Gas--Rich burn | Non-Selective Catalytic Reduction | 90 | $342 | 1993$ | The cost effectiveness is in ozone season dollars per ton. | | **Pechan 2000** |
| ICI Boilers-Coal | Selective Catalytic Reduction (SCR) | 80 | $876-$2,141 | 2003$ | | | **EPA 2003** |
| ICI Boilers-Coal | Selective Non-Catalytic Reduction (SNCR) | 40 | $1,285-$2,073 | 2003$ | | | **EPA 2003** |

## Stationary Source Control Measures for NOx

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| Source category | Emissions reduction measure | Control efficiency (%) | Cost effectiveness ($/ton reduced) | Cost Year | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|---|
| ICI Boilers-Coal-bituminous | Low NOx Burner plus Overfire Air | 51 | $392-$1,239 | 2003$ | | | **EPA 2003** |
| ICI Boilers-Coal-subbituminous | Low NOx Burner | 51 | $256-$850 | 2003$ | The cost effectiveness is for boilers operating at capacity factors in the range of 50-83 percent. Unit sizes range from 100 million BTU/hr (highest cost per ton) to 1000 million BTU/Hr (lowest cost per ton) | | **EPA 2003** |
| ICI Boilers-Coal-subbituminous | Low NOx Burner plus Overfire Air | 65 | $306-$972 | 2003$ | | | **EPA 2003** |
| ICI Boilers-Gas | LNB plus Overfire air plus gas recirculation | 80 | $368-$1,278 | 2003$ | | | **EPA 2003** |
| ICI Boilers-Gas | Low NOx Burner plus Overfire Air | 60 | $280-$1,052 | 2003$ | | | **EPA 2003** |
| ICI Boilers-Gas | Selective Catalytic Reduction (SCR) | 80 | $986-$2,933 | 2003$ | | | **EPA 2003** |
| ICI Boilers-Gas | Selective Non-Catalytic Reduction (SNCR) | 40 | $280-$1,052 | 2003$ | | | **EPA 2003** |
| ICI Boilers-Oil | Low NOx Burner plus Overfire Air | 30-50 | $306-$1,052 | 2003$ | | | **EPA 2003** |
| ICI Boilers-Oil | Selective Catalytic Reduction (SCR) | 80 | $760-$2,014 | 2003$ | | | **EPA 2003** |
| ICI Boilers-Oil | Selective Non-Catalytic Reduction (SNCR) | 40 | $1,485-$2,367 | 2003$ | | | **EPA 2003** |
| Internal Combustion Engines - Gas | Air/Fuel + Ignition Retard | 30 | $460 | 1990$ | | | **EPA 1993b** |
| Internal Combustion Engines - Gas | Air/Fuel Ratio Adjustment | 20 | $380 | 1990$ | | | **EPA 1993b** |
| Internal Combustion Engines - Gas | Ignition Retard | 20 | $550 | 1990$ | | | **EPA 1993b** |
| Iron & Steel Mills - Annealing | Low NOx Burner + Selective Catalytic Reduction | 90 | $4,080 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Iron & Steel Mills - Annealing | Low NOx Burner + Selective Catalytic Reduction | 80 | $1,720 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Iron & Steel Mills - Annealing | Selective Catalytic Reduction (SCR) | 85 | $3,830 | 1990$ | | | **EPA 2002 and Pechan 1998** |

## Stationary Source Control Measures for NOx

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| Source category | Emissions reduction measure | Control efficiency (%) | Cost effectiveness ($/ton reduced) | Cost Year | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|---|
| Iron & Steel Mills - Annealing | Selective Non-Catalytic Reduction (SNCR) | 60 | $1,640 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Iron & Steel Mills - Annealing, Galvanizing, Reheating | Low NOx Burner | 50 - 65 | $300 -$570 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Iron & Steel Mills - Annealing, Galvanizing, Reheating | Low NOx Burner + Flue Gas Recirculation | 60 - 77 | $380-$750 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Iron & Steel Mills - Reheating | Low Excess Air | 13 | $1,320 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Iron Production; Blast Furnaces; Blast Heating Stoves | Low NOx Burner + Flue Gas Recirculation | 77 | $380 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Lime Kilns | Low NOx Burner | 30 | $560 | 1999$ | | | **EPA 1994** |
| Medical Waste Incinerators | Selective Non-Catalytic Reduction (SNCR) | 45 | $4,510 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Municipal Waste Combustors | Selective Non-Catalytic Reduction (SNCR) | 45 | $1,130 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Natural Gas Production; Compressors | Selective Catalytic Reduction (SCR) | 20 | $1,650 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Nitric Acid Manufacturing | Extended Absorption | 95 | $480 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Nitric Acid Manufacturing | Non-Selective Catalytic Reduction | 98 | $550 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Nitric Acid Manufacturing | Selective Catalytic Reduction (SCR) | 97 | $590 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Open Burning | Episodic Ban | Daily control efficiency is 100% | Not available | | | | **Pechan 2006** |
| Process Heaters - Distillate and Residual Oil | Low NOx Burner + Flue Gas Recirculation | 34-48 | $3,500-$4,500 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Process Heaters - Distillate and Residual Oil | Low NOx Burner + Selective Catalytic Reduction | 75 | $2,300 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Process Heaters - Distillate and Residual Oil | Selective Catalytic Reduction (SCR) | 75 | $5,350-$9,230 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Process Heaters - Distillate and Residual Oil | Selective Non-Catalytic Reduction (SNCR) | 60 | $1,930-$3,180 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Process Heaters - Distillate and Residual Oil | Ultra Low NOx Burner | 74 | $1,290-$2,140 | 1990$ | | | **EPA 2002 and Pechan 1998** |

## Stationary Source Control Measures for NOx

**See cover note for important notes and caveats on the use of these tables**

| Source category | Emissions reduction measure | Control efficiency (%) | Cost effectiveness ($/ton reduced) | Cost Year | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|---|
| Process Heaters - Distillate Oil | Low NOx Burner | 37 - 45 | $2,500 - $3,740 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Process Heaters - Distillate Oil | Low NOx Burner + Selective Catalytic Reduction | 92 | $9,120 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Process Heaters - Distillate Oil | Low NOx Burner + Selective Non-Catalytic Reduction (SNCR) | 78 | $3,620 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Process Heaters - LPG | Selective Catalytic Reduction (SCR) | 75 | $5350-$12,040 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Process Heaters - LPG, NG, Process Gas | Low NOx Burner | 45-50 | $2,200 -$3,740 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Process Heaters - LPG, NG, Process Gas | Low NOx Burner + Flue Gas Recirculation | 48-55 | $3,200-$4,200 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Process Heaters - LPG, NG, Process Gas | Low NOx Burner + Selective Catalytic Reduction | 88- 92 | $9,120-$11,500 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Process Heaters - LPG, NG, Process Gas | Low NOx Burner + Selective Catalytic Reduction | 80 | $2,320-$3,620 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Process Heaters - LPG, NG, Process Gas | Selective Non-Catalytic Reduction (SNCR) | 60 | $1,930-$3,180 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Process Heaters - LPG, NG, Process Gas | Ultra Low NOx Burner | 75 | $1,290-$2,140 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Process Heaters - Process Gas | Low NOx Burner + Selective Non-Catalytic Reduction (SNCR) | 80 | $3,520 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Process Heaters - Residual Oil | Low NOx Burner + Selective Catalytic Reduction | 90 | $5,420 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Reciprocating Internal Combustion Engines - Oil -All | Selective Catalytic Reduction (SCR) | 80 | $1,066 | 1993$ | | | **Pechan 2000** |
| Reciprocating Internal Combustion Engines-Oil-All | Ignition retard | 25 | $770 | 1999$ | | | **Pechan 2006** |
| Residential Natural Gas | Water Heater + LNB Space Heaters | 7 | $1,230 | | | | **Pechan 2006** |
| Rich-Burn Stationary Reciprocating Internal Combustion Engines (RICE) | Non-Selective Catalytic Reduction | 90 | $342 | 1990$ | | VOC and CO emissions are also reduced. | **EPA 1993** |
| Sand/Gravel; Dryer | Low NOx Burner + Flue Gas Recirculation | 55 | $3,190 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Secondary Aluminum Production; Smelting Furnaces | Low NOx Burner | 50 | $570 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Solid Waste Disposal; Government | Selective Non-Catalytic Reduction (SNCR) | 45 | $1,130 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Space Heaters - Distillate Oil | Low NOx Burner | 50 | $1,180 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Space Heaters - Distillate Oil | Low NOx Burner + Flue Gas Recirculation | 60 | $2,500 | 1990$ | | | **EPA 2002 and Pechan 1998** |

## Stationary Source Control Measures for NOx

**See cover note for important notes and caveats on the use of these tables**

| Source category | Emissions reduction measure | Control efficiency (%) | Cost effectiveness ($/ton reduced) | Cost Year | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|---|
| Space Heaters - Distillate Oil | Selective Catalytic Reduction (SCR) | 80 | $2,780 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Space Heaters - Distillate Oil | Selective Non-Catalytic Reduction (SNCR) | 50 | $4,640 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Space Heaters - Natural Gas | Low NOx Burner | 50 | $820 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Space Heaters - Natural Gas | Low NOx Burner + Flue Gas Recirculation | 60 | $2,650 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Space Heaters - Natural Gas | Oxygen Trim + Water Injection | 65 | $680 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Space Heaters - Natural Gas | Selective Catalytic Reduction (SCR) | 80 | $2,860 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Space Heaters - Natural Gas | Selective Non-Catalytic Reduction (SNCR) | 50 | $3,870 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Starch Manufacturing; Combined Operation | Low NOx Burner + Flue Gas Recirculation | 55 | $3,190 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Steel Foundries; Heat Treating | Low NOx Burner | 50 | $570 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Steel Production; Soaking Pits | Low NOx Burner + Flue Gas Recirculation | 60 | $750 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Sulfate Pulping - Recovery Furnaces | Low NOx Burner | 50 | $820 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Sulfate Pulping - Recovery Furnaces | Low NOx Burner + Flue Gas Recirculation | 60 | $2,560 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Sulfate Pulping - Recovery Furnaces | Oxygen Trim + Water Injection | 65 | $680 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Sulfate Pulping - Recovery Furnaces | Selective Catalytic Reduction (SCR) | 80 | $2,230 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Sulfate Pulping - Recovery Furnaces | Selective Non-Catalytic Reduction (SNCR) | 50 | $3,870 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Surface Coat Oper; Coating Oven Htr; Nat Gas | Low NOx Burner | 50 | $2,200 | 1990$ | | | **EPA 2002 and Pechan 1998** |
| Utility Boilers* | | | | | | | |

* This document does not address SO2 and NOx controls for EGU. These controls are relatively well known and are the subject of policy discussions among states, multi-state bodies and the EPA.

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**See cover note from important notes and caveats on the use of these tables**

| Source Category | Emission Reduction Measure | Control Efficiency | Cost Effectiveness | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|
| School Bus | Diesel Retrofit - Diesel Oxidation Catalysts | 20 | 12000 - 49100 | Applies to 1990-2006 model years | VOC, CO | EPA 2006b, EPA 2006d, EPA 2006 |
| School Bus | Diesel Retrofit - Catalyzed Diesel Particulate Filters | 90 | 12400 - 50500 | Applies to 1995-2006 model years | VOC, CO | EPA 2006b, EPA 2006d, EPA 2006 |
| Class 6 & 7 HDDVs | Diesel Retrofit - Diesel Oxidation Catalysts | 20 | 27600 - 67900 | Applies to 1990-2006 model years | VOC, CO | EPA 2006b, EPA 2006d, EPA 2006 |
| Class 6 & 7 HDDVs | Diesel Retrofit - Catalyzed Diesel Particulate Filters | 90 | 28400 - 69900 | Applies to 1995-2006 model years | VOC, CO | EPA 2006b, EPA 2006d, EPA 2006 |
| Class 8B HDDV | Diesel Retrofit - Diesel Oxidation Catalysts | 20 | 11100 - 40600 | Applies to 1990-2006 model years | VOC, CO | EPA 2006b, EPA 2006d, EPA 2006 |
| Class 8B HDDV | Diesel Retrofit - Catalyzed Diesel Particulate Filters | 90 | 12100 - 44100 | Applies to 1995-2006 model years | VOC, CO | EPA 2006b, EPA 2006d, EPA 2006 |
| HDDVs | Diesel Retrofit - Active Diesel Particulate Filter | 80 - 90+ | | | VOC, CO | STAPPA/ALAPCO 2006, EPA 2006 |
| Class 8 HDDVs | Diesel Retrofit - Lean NOx Catalyst and Diesel Particulate Filter | 85 | | Applies to 1993 - 2003 model years; needs 15 ppm sulfur diesel | NOX | CARB 2006a, EPA 2006 |
| Class 8 HDDVs | Diesel Retrofit - Exhaust Gas Recirculation/Diesel Particulate Filter | 85 | | Applies to specific engine families from 1998-2002 model years; needs 15 ppm sulfur diesel | NOX | CARB 2006a, EPA 2006 |
| HDDVs | Diesel Retrofit - Flow Through Filter | 50 - 76 | | Applies to 1991 - 2002 model years; needs 15 ppm sulfur diesel or CARB diesel | VOC, CO | STAPPA/ALAPCO 2006; CARB 2006a, EPA 2006 |
| Class 8 HDDVs | Diesel Retrofit - Diesel Oxidation Catalysts + Flow Through Filters | 50 | | Applies to 1988 - 1993 model years; needs 15 ppm sulfur diesel | | CARB 2006a, EPA 2006 |
| HDDVs | Diesel Retrofit - Closed Crankcase Ventilation | 10 | | | | EPA 2006e, EPA 2006 |
| HDDVs | Diesel Retrofit - Closed Crankcase Filter System | 5 - 10 | | | | STAPPA/ALAPCO 2006, EPA 2006 |
| Class 8 HDDVs | Diesel Retrofit - Diesel Oxidation Catalyst + Crankcase Filter | 25 | | Applies to 1988-2002 model years; needs 15 ppm sulfur diesel | | CARB 2006a, EPA 2006 |
| Class 5 and above HDDVs and buses | Replacement | 90 - 98 | | Applies to 1990-2006 model years | NOX, VOC | EPA 2006d |
| Class 8 HDDVs | Eliminate Long Duration Idling with Truck Stop Electrification | 3.4 | 0 | Upfront capital costs fully recovered by fuel savings | NOX, VOC, SO2, CO | EPA 2006d, EPA 2004 |
| Class 8 HDDVs | Eliminate Long Duration Idling with Mobile Idle Reduction Technologies | 3.4 | 0 | Upfront capital costs fully recovered by fuel savings | NOX, VOC, SO2, CO | EPA 2006d, EPA 2004 |
| Class 8 HDDVs | Intermodal - shift of transportation of goods from truck to rail transport | 1.0 | 0 | Would result in a 0.3-0.4% increase in all pollutants from locomotive and rail SCCs; represents a 1% shift from truck-only transport to rail | NOX, SO2, NH3, VOC | EPA 2006d |
| HDDVs | Alternative Fuel - Oxygenated Diesel | 0 - 50 | | Oxygenated with ethanol; Nox emissions likely to increase | VOC, CO, CO2 | STAPPA/ALAPCO 2006 |

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| Source Category | Emission Reduction Measure | Control Efficiency | Cost Effectiveness | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|
| HDDVs | Alternative Fuel - Fuel-borne Catalyst | 0 - 50 | | | NOX, VOC, CO | STAPPA/ALAPCO 2006 |
| Class 8 HDDVs | Alternative Fuel - Lubrizol PuriNOX | 50 | | Applies to 1988 - 2003 model years | NOX | CARB 2006a |
| HDDVs | Alternative Fuel - Emulsified Diesel | 16 - 58 | | Increases VOC, CO | NOX | EPA 2006e; STAPPA/ALAPCO 2006 |
| HDDVs | Alternative Fuel - Biodiesel | 10 - 12 | | Increases NOX | VOC, CO | EPA 2006e; STAPPA/ALAPCO 2006 |
| LDGVs and LDGTs | Best Workplaces for Commuters-all measures combined | | | Reductions based on the following measures: Regional Rideshare, Vanpool Programs, Park-and-ride lots, Regional TDM, Employer trip reduction programs; control efficiency depends on penetration--0.4% reduction at 10% penetration and 1.0% reduction at 25% penetration | NOX, VOC, SO2, NH3, CO | EPA 2006d, EPA 2005b |
| LDGVs and LDGTs | MPG/Emissions Requirements for Large Fleets | | | | VOC, NOX, SO2 | NJDEP 2005b |
| LDGVs and LDGTs | Registration fee based on VMT | | | | VOC, NOX, SO2, NH3 | NJDEP 2005b |
| LDGVs and LDGTs | Electric Shuttles in Structured Communities | | | | VOC, NOX, SO2, NH3 | NJDEP 2005b |
| LDGVs and LDGTs | Electric Vehicle Charging Stations | | | | VOC, NOX, SO2 | NJDEP 2005b |
| LDGVs and LDGTs | Expansion of Bike/hiking trails | | | | VOC, NOX, SO2, NH3 | NJDEP 2005b |
| HDDVs | Voluntary Programs - National Clean Diesel Campaign | | | | NOX | EPA 2005 |
| HDDVs | Voluntary Programs - SmartWay Transport Partnership | | | | NOX | EPA 2005 |
| HDDVs | Driver incentive/training program to reduce idling | | | | VOC, NOX, SO2 | NJDEP 2005a |
| HDDVs and Diesel Buses | Heavy-Duty Vehicle Inspection Program | | | NOx benefits result from reflashing vehicles subject to the heavy duty diesel consent decree | NOX | CARB 2006b, NJDEP 2005a |
| HDDV Fleet and Diesel Bus Fleet | Periodic Smoke Inspection Program | | | NOx benefits result from reflashing vehicles subject to the heavy duty diesel consent decree | NOX | CARB 2006b |
| HDDVs | Incentive Programs (e.g., Carl Moyer Program) | | | | NOX | CARB 2006b |
| LDGVs and LDGTs | Incentives for hybrids and other ULEV, SULEV, ZEV vehicles | | | | VOC, NOX, SO2 | CARB 2006b |

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| Source Category | Emission Reduction Measure | Control Efficiency | Cost Effectiveness | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|
| All Highway Vehicles | Smoking Vehicle Hotline | | | | NOX, VOC | CARB 2006b |

**Notes:**

LDGV=Light-duty Gasoline Vehicle
LDGT=Light-duty Gasoline Truck
HDGV=Heavy-duty Gasoline Vehicle
MC=Motorcycle
LDDV=Light-duty Diesel Vehicle
LDDT=Light-duty Diesel Truck
HDDV=Heavy-duty Diesel Vehicle

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**See cover note for important notes and caveats on the use of these tables**

| Source Category | Emission Reduction Measure | Control Efficiency | Cost Effectiveness | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|
| Class 8 HDDVs | Eliminate Long Duration Idling with Truck Stop Electrification | 3.4 | 0 | Upfront capital costs fully recovered by fuel savings | PM, NOX, VOC, CO | EPA 2006d, EPA 2004 |
| Class 8 HDDVs | Eliminate Long Duration Idling with Mobile Idle Reduction Technologies | 3.4 | 0 | Upfront capital costs fully recovered by fuel savings | PM, NOX, VOC, CO | EPA 2006d, EPA 2004 |
| Class 8 HDDVs | Intermodal - shift of transportation of goods from truck to rail transport | 1.0 | 0 | Would result in a 0.3-0.4% increase in all pollutants from locomotive and rail SCCs; represents a 1% shift from truck-only transport to rail | PM, NOX, NH3, VOC | EPA 2006d |
| LDGVs and LDGTs | Best Workplaces for Commuters-all measures combined | 0.4-1.0 | | Reductions based on the following measures: Regional Rideshare, Vanpool Programs, Park-and-ride lots, Regional TDM, Employer trip reduction programs; control efficiency depends on penetration--0.4% reduction at 10% penetration and 1.0% reduction at 25% penetration | PM, NOX, VOC, NH3, CO | EPA 2006d, EPA 2005b |
| LDGVs and LDGTs | MPG/Emissions Requirements for Large Fleets | | | | VOC, NOX, PM | NJDEP 2005b |
| LDGVs and LDGTs | Fee based on VMT | | | | VOC, NOX, PM, NH3 | NJDEP 2005b |
| LDGVs and LDGTs | Electric Shuttles in Structured Communities | | | | VOC, NOX, PM, NH3 | NJDEP 2005b |
| LDGVs and LDGTs | Electric Vehicle Charging Stations | | | | VOC, NOX, PM | NJDEP 2005b |
| LDGVs and LDGTs | Expansion of Bike/hiking trails | | | | VOC, NOX, PM, NH3 | NJDEP 2005b |
| HDDVs | Driver incentive/training program to reduce idling | | | | VOC, NOX, PM | NJDEP 2005a |
| LDGVs and LDGTs | Incentives for hybrids and other ULEV, SULEV, ZEV vehicles | | | | VOC, NOX, PM | CARB 2006b |

**Notes:**

LDGV=Light-duty Gasoline Vehicle
LDGT=Light-duty Gasoline Truck
HDGV=Heavy-duty Gasoline Vehicle
MC=Motorcycle
LDDV=Light-duty Diesel Vehicle
LDDT=Light-duty Diesel Truck
HDDV=Heavy-duty Diesel Vehicle

# Onroad NOx Control Measures

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**See cover note for important notes and caveats on the use of these tables**

| Source Category | Emission Reduction Measure | Control Efficiency | Cost Effectiveness | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|
| HDDVs | Diesel Retrofit - NOX Reducing Catalyst | 20 - 30 | | | | STAPPA/ALAPCO 2006, EPA 2006 |
| HDDVs | Diesel Retrofit - NOX Adsorber | 90+ | | | PM, VOC, CO | STAPPA/ALAPCO 2006, EPA 2006 |
| Class 8 HDDVs | Diesel Retrofit - Selective Catalytic Reduction (SCR) | 70 to 99 | 3000 - 15000 | Cost effectiveness based on pre-1989 to 2006 model years | | ENVIRON 2006, EPA 2006 |
| Class 5 and above HDDVs and Diesel Buses | Replacement | 90 - 97 | | Applies to 1990-2006 model years | PM, VOC | EPA 2006d |
| Class 8 HDDVs | Eliminate Long Duration Idling with Truck Stop Electrification | 3.4 | 0 | Upfront capital costs fully recovered by fuel savings | PM, VOC, SO2, CO | EPA 2006d, EPA 2004 |
| Class 8 HDDVs | Eliminate Long Duration Idling with Mobile Idle Reduction Technologies | 3.4 | 0 | Upfront capital costs fully recovered by fuel savings | PM, VOC, SO2, CO | EPA 2006d, EPA 2004 |
| Class 8 HDDVs | Intermodal - shift of transportation of goods from truck to rail transport | 1.0 | 0 | Would result in a 0.3-0.4% increase in all pollutants from locomotive and rail SCCs; represents a 1% shift from truck-only transport to rail | PM, SO2, NH3, VOC | EPA 2006d |
| Class 8 HDDVs | Diesel Retrofit - Lean NOx Catalyst and Diesel Particulate Filter | 25 | | Applies to 1993 - 2003 model years; needs 15 ppm sulfur diesel | PM | CARB 2006a, EPA 2006 |
| Class 8 HDDVs | Diesel Retrofit - Exhaust Gas Recirculation/Diesel Particulate Filter | 40 | | Applies to specific engine families from 1998-2002 model years; needs 15 ppm sulfur diesel | PM | CARB 2006a, EPA 2006 |
| Class 8 HDDVs | Alternative Fuel - Lubrizol PuriNOX | 15 | | Applies to 1988 - 2003 model years | PM | CARB 2006a |
| LDGVs and LDGTs | Best Workplaces for Commuters-all measures combined | 0.4-1.0 | 19200 | Average cost effectiveness based on the following measures: Regional Rideshare, Vanpool Programs, Park-and-ride lots, Regional TDM, Employer trip reduction programs; control efficiency depends on penetration--0.4% reduction assumes 10% penetration and 1.0% reduction assumes 25% reduction | PM, VOC, SO2, NH3, CO | EPA 2006d, EPA 2005b |
| LDGVs and LDGTs | Best Workplaces for Commuters - Regional Rideshare | | 1200 - 16000*(see notes) | Control efficiency depends on penetration; Cost effectiveness based on weighted sum of Nox and VOC reductions (i.e., total cost/((VOC*1)+(NOx*4)) | PM, VOC, SO2, NH3, CO | EPA 2006d, EPA 2005b |
| LDGVs and LDGTs | Best Workplaces for Commuters - Vanpool Programs | | 5200 - 89000*(see notes) | Control efficiency depends on penetration; Cost effectiveness based on weighted sum of Nox and VOC reductions (i.e., total cost/((VOC*1)+(NOx*4)) | PM, VOC, SO2, NH3, CO | EPA 2006d, EPA 2005b |

# Onroad NOx Control Measures

*Draft Version 1.0*

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| Source Category | Emission Reduction Measure | Control Efficiency | Cost Effectiveness | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|
| LDGVs and LDGTs | Best Workplaces for Commuters - Park-and-ride lots | | 8600 - 70700*(see notes) | Control efficiency depends on penetration; Cost effectiveness based on weighted sum of Nox and VOC reductions (i.e., total cost/((VOC*1)+(NOx*4)) | PM, VOC, SO2, NH3, CO | EPA 2006d, EPA 2005b |
| LDGVs and LDGTs | Best Workplaces for Commuters - Regional Transportation Demand Management (TDM) | | 2300 - 33200*(see notes) | Control efficiency depends on penetration; Cost effectiveness based on weighted sum of Nox and VOC reductions (i.e., total cost/((VOC*1)+(NOx*4)) | PM, VOC, SO2, NH3, CO | EPA 2006d, EPA 2005b |
| LDGVs and LDGTs | Best Workplaces for Commuters - Employer trip reduction programs | | 5800 - 175500*(see notes) | Control efficiency depends on penetration; Cost effectiveness based on weighted sum of Nox and VOC reductions (i.e., total cost/((VOC*1)+(NOx*4)) | PM, VOC, SO2, NH3, CO | EPA 2006d, 2005b |
| HDDVs | Diesel Retrofit - Lean NOX Catalyst | 5 - 40 | 6000 - 28000 | | | ENVIRON 2006, EPA 2006e, EPA 2006 |
| HDDVs | Diesel Retrofit - Exhaust Gas Recirculation | 40 - 50 | | | | EPA 2006e, EPA 2006 |
| HDDVs | Alternative Fuel - Emulsified Diesel | 9 - 20 | | Increases VOC, CO | PM | EPA 2006e |
| LDGVs, LDGTs, HDGVs, and MCs | Federal Reformulated Gasoline (RFG) | 7 | | | VOC, CO | Pechan 2006, EPA 1999 |
| LDGVs and LDGTs | High Enhanced I/M Program | 0.4 - 13.4 | | Reduction is based on emissions from entire fleet | VOC, CO | Pechan 2006 |
| HDDVs | Alternative Fuel - Fuel-borne Catalyst | 0 - 10 | | | PM, VOC, CO | STAPPA/ALAPCO 2006 |
| LDGVs and LDGTs | Repair assistance for low-income owners of older poorly maintained vehicles | | | | VOC | NJDEP 2005b |
| LDGVs and LDGTs | MPG/Emissions Requirements for Large Fleets | | | | VOC, PM, SO2 | NJDEP 2005b |
| LDGVs and LDGTs | Fee based on VMT | | | | VOC, PM, SO2, NH3 | NJDEP 2005b |
| LDGVs and LDGTs | Electric Shuttles in Structured Communities | | | | VOC, PM, SO2, NH3 | NJDEP 2005b |
| LDGVs and LDGTs | Electric Vehicle Charging Stations | | | | VOC, PM, SO2 | NJDEP 2005b |
| LDGVs and LDGTs | Expansion of Bike/hiking trails | | | | VOC, PM, SO2, NH3 | NJDEP 2005b |
| HDDVs | Voluntary Programs - National Clean Diesel Campaign | | | | PM | EPA 2005 |
| HDDVs | Voluntary Programs - SmartWay Transport Partnership | | | | PM | EPA 2005 |
| HDDVs | Driver incentive/training program to reduce idling | | | | VOC, PM, SO2 | NJDEP 2005a |

# Onroad NOx Control Measures

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| Source Category | Emission Reduction Measure | Control Efficiency | Cost Effectiveness | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|
| All Highway Vehicles | Intelligent Transport System - Speed Limit Restriction (65 mph) | | | | | TCEQ2006 |
| HDDVs and Diesel Buses | Heavy-Duty Vehicle Inspection Program | | | NOx benefits result from reflashing vehicles subject to the heavy duty diesel consent decree | PM | CARB 2006b, NJDEP 2005a |
| HDDV Fleet, and Diesel Bus Fleet | Periodic Smoke Inspection Program | | | NOx benefits result from reflashing vehicles subject to the heavy duty diesel consent decree | PM | CARB 2006b |
| HDDVs | Software Upgrade for Diesel Trucks ("Chip Reflash") | | 1800 - 2500 | Rebuild kits are free to any truck operator requesting one from truck manufacturer as a result of the Consent Decree with EPA. Each kit costs about $20-$30/vehicle. | | CARB 2006b, OTC 2006 |
| HDDVs | Incentive Programs (e.g., Carl Moyer Program) | | | | PM | CARB 2006b |
| LDGVs and LDGTs | Incentives for hybrids and other ULEV, SULEV, ZEV vehicles | | | | VOC, PM, SO2 | CARB 2006b |
| All Highway Vehicles | Smoking Vehicle Hotline | | | | VOC, PM | CARB 2006b |

**Notes:**

LDGV=Light-duty Gasoline Vehicle
LDGT=Light-duty Gasoline Truck
HDGV=Heavy-duty Gasoline Vehicle
MC=Motorcycle
LDDV=Light-duty Diesel Vehicle
LDDT=Light-duty Diesel Truck
HDDV=Heavy-duty Diesel Vehicle

# Onroad Control Measures References

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**See cover note for important notes and caveats on the use of these tables**

| Key | Reference |
|---|---|
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| CARB 2006b | California Air Resources Board, "ARB Programs," updated May 4, 2006 http://www.arb.ca.gov/html/programs.htm |
| ENVIRON 2006 | ENVIRON International Corporation, "Evaluation of Candidate Mobile Source Control Measures", Final Report, prepared for Lake Michigan Air Directors Consortium, 2250 E. Devon Ave., #250, Des Plaines, IL 60018, February 28, 2006. http://www.ladco.org/reports/rpo/Regional%20Air%20Quality/LADCO%20Control%20Report_Final.pdf |
| EPA 1999 | U.S. Environmental Protection Agency, Office of Air and Radiation, "Phase II Reformulated Gasoline: The Next Major Step Toward Cleaner Air", EPA420-F-99-042, November 1999. http://www.epa.gov/OMSWWW/rfg/f99042.pdf |
| EPA 2004 | Guidance for Quantifying and Using Long DurationTruck Idling Emission Reductions In State Implementation Plans and Transportation Conformity, EPA420-B-04-001, January 2004. http://www.epa.gov/otaq/stateresources/transconf/policy/truckidlingguidance.pdf |
| EPA 2005 | Draft list of potential RACT and RACM from PM rule preamble (see EPA websites on verified retrofit technologies) http://www.epa.gov/otaq/retrofit/retroverifiedlist.htm |
| EPA 2005b | Guidance for Quantifying and Using Emissions Reductions from Best Workplaces for Commuter Programs in State Implementation Plans and Transportation Conformity Determinations, EPA420-B-05-016, October 2005, http://www.epa.gov/otaq/stateresources/policy/transp/commuter/420b05016.pdf |
| EPA 2006 | Diesel Retrofits: Quantifying and Using Their Benefits in SIPs and Conformity, EPA420-B-06-005, June 2006. http://www.epa.gov/otaq/stateresources/transconf/policy/420b06005.pdf |
| EPA 2006b | U.S. Environmental Protection Agency, Office of Transportation and Air Quality, "Diesel Retrofit Technology, An Analysis of the Cost-Effectiveness of Reducing Particulate Matter Emissions from Heavy-Duty Diesel Engines Through Retrofits", EPA420-S-06-002, March 2006. http://www.epa.gov/cleandiesel/documents/420s06002.pdf |
| EPA 2006d | EPA Staff Communication: "Mobile Source Control Measures in PM NAAQS RIA", EPA, 2006 |
| EPA 2006e | Clean Ports USA, "Emission Reduction Strategies by Application, Trucks," as of September 2006 http://www.epa.gov/cleandiesel/ports/stratapp.htm#highway |
| NJDEP 2005a | NJDEP Diesel Initiatives Workgroup, "A Collaborative Report Presenting Air Quality Strategies for Further Consideration by the State of New Jersey," October 31, 2005. http://www.nj.gov/dep/airworkgroups/docs/final_di_workgroup_report.pdf |
| NJDEP 2005b | NJDEP Gasoline Cars & Trucks Workgroup, "A Collaborative Report Presenting Air Quality Strategies for Further Consideration by the State of New Jersey," October 31, 2005. http://www.state.nj.us/dep/airworkgroups/docs/final_gct_report.pdf |
| OTC 2006 | Ozone Transport Commission (OTC) “Candidate Control Measures.” http://www.otcair.org/projects_details.asp?FID=93&fview=stationary |
| Pechan 2006 | E.H. Pechan & Associates, Inc., "AirControlNET, Version 4.1 Control Measure Documentation Report," Draft Report, prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC, Pechan Report No. 06.05.003/9011.002, May 2006. |
| San Joaquin Valley UAPCD, 2003 | San Joaquin Valley Unified Air Pollution Control District (UAPCD). Final BACM Technological and Economic Feasibility Analysis, prepared by Sierra Research, March 21, 2003. www.soiltac.com/PDF/Final_BACM_Chapter 20 - Fugitive Dust 287Feasibility_Analysis.pdf. |
| STAPPA/ALAPCO 2006 | The State and Territorial Air Pollution Program Administrators and the Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options, " March 2006 http://www.4cleanair.org/PM25Menu-Final.pdf |
| TCEQ 2006 | Texas Commission on Environmental Quality, Texas Air Quality Control Measures, as of September 2006 http://www.tceq.state.tx.us/implementation/air/sip/sipstrategies.html#mobile |

## Nonroad PM Control Measures

**See cover note for important notes and caveats on the use of these tables**

| Source Category | Emissions Reduction Measure | Control Efficiency (%) | Cost Effectiveness, $/ton | Notes/Caveats | Other Pollutants Controlled | References for More Information |
|---|---|---|---|---|---|---|
| Nonroad Diesel Engines except locomotive, marine, pleasure craft, and aircraft engine | Nonroad Retrofit DOC | 20 | 11,600 - 63,300 | Low end of range represents most cost-effective retrofits (first 50% of retrofit potential). High end of range represents least cost-effective retrofits (second 50% of retrofit potential). PM cost effectiveness values apply for all retrofit measures combined (DOC, DPF, and rebuild). Cost effectiveness values were calculated by EPA based on the cost for DOC applied to a 250 hp bulldozer. However, this measure is intended to apply to all nonroad engines, model year 1988-2007, except for locomotive, marine, pleasure craft, and aircraft engines. | VOC | EPA, 2006a<br>EPA, 2006b |
| Nonroad Diesel Engines except locomotive, marine, pleasure craft, and aircraft engine | Nonroad Retrofit DPF | 90 | 9,700 - 52,700 | Low end of range represents most cost-effective retrofits (first 50% of retrofit potential). High end of range represents least cost-effective retrofits (second 50% of retrofit potential). PM cost effectiveness values apply for all retrofit measures combined (DOC, DPF, and rebuild). Cost effectiveness values were calculated by EPA based on the cost for DOC applied to a 250 hp bulldozer. However, this measure is intended to apply to all nonroad engines, model year 1988-2007, except for locomotive, marine, pleasure craft, and aircraft engines. | VOC | EPA, 2006a<br>EPA, 2006b |
| Nonroad Diesel Engines except locomotive, marine, pleasure craft, and aircraft engine | Nonroad Engine Upgrade | 20 | | | NOx, VOC | EPA, 2006a |
| Nonroad Diesel Engines | Early Use of Ultra-Low Sulfur Diesel | | | Some direct PM reductions would result due to lower S content of fuel | SO2 | EPA, 2006c |
| Nonroad Diesel Engines | Early Use of Ultra-Low Sulfur Diesel + Retrofit | | | Some retrofits that rely on ULSD (e.g., DPFs) that have been verified by EPA and/or CARB require a S content of no more than 15-50ppm. | SO2 | EPA, 2006c |
| Nonroad Diesel Construction | Engine/Equipment Replacement (Scrappage) | | 2,000-25,000 | Only emission reductions reported, no control efficiencies. Emission reductions and Cost effectiveness values by equipment application, horsepower and technology type are reported in Appendices to LADCO report. Cost effectiveness expressed as dollar per ton NOx reduced. | NOx | ENVIRON, 2006<br>EPA, 2005 |
| Nonroad Diesel Engines | Establish Opacity or other Emission Standards for "Gross-Emitting" Diesel Equipment or Vessels | | | | | EPA, 2005 |
| Nonroad Engines | Low Emission Specifications - Limit emissions for construction projects, industrial facilities, ship yards, airports | | | | | EPA, 2005 |
| Nonroad Engines | Expand Use of Clean Burning Fuels | | | | | EPA, 2005 |
| Nonroad Gasoline | Equipment Replacement - Lawn Mower Buy Back Program | | | Program encourages trading of gasoline-powered mowers by providing funds to offset the purchase cost of electric mowers. | | SCAQMD, 2006 |
| Recreational Marine | Variable Registration Fees for Boat Engines | | | This control measure would require owners to register boat engines. The boat engine registration fee schedule would be designed so that lower fees would be assessed for the newest engines. | VOC | NJDEP, 2005 |
| Nonroad Diesel Industrial | Operational Changes at Ports - Reduce Use of Mobile Diesel-powered Material-Handling Equipment | | | Reduce use of mobile diesel-powered material-handling equipment in favor of electric-powered stationary cranes. No emission reduction or cost information provided. | | STAPPA/ALAPCO, 2006<br>CARB, 2005 |
| Nonroad Diesel Industrial | ARB Cargo Handling Equipment Rule - Application of Best Available Control Technology | 25-85 | 6,500-18,000 | Range of CE values represents Level 1, 2 and 3, which are three benchmarks that control systems can be verified to. Cost effectiveness expressed as dollar per ton of NOx + diesel PM reduced. | NOx | CARB, 2006 |
| Locomotives | Idling Reduction - SmartStart and Diesel Driven Heating System | 40-60 | 809 | Idle reduction technologies can reduce idling up to 90 percent, depending on which technology is employed in which application. Control efficiencies provided correspond to a 90 percent reduction in idling, which is expected to reduce fuel consumption by 40 to 60 percent. PM and NOx cost per ton is an upper bound value, since savings due to reduced maintenance costs not accounted for. | NOx | NJDEP, 2005<br>Union Pacific, 2006<br>Vancouver, 2005, EPA 2004 |
| Locomotives | Reduce Idling for Locomotives | | | | | EPA, 2005; EPA 2004 |
| Locomotives | I&M for Locomotives - Conduct Opacity Testing and Conduct Repairs | | | This program is a voluntary agreement with the BNSF Railway Company and the Union Pacific Railroad Company to reduce PM emissions in California rail yards. | | STAPPA/ALAPCO, 2006<br>CARB, 2005 |
| Switch Locomotive | Upgrade Engines in Switcher Locomotives - Diesel-electric hybrid locomotives | 80 | 6,500-18,000 | Hybrid switch locomotives have significantly reduced diesel PM and NOx emissions, idling time, and fuel use compared to conventional switchers. Cost effectiveness expressed as dollar per ton of NOx + diesel PM reduced. | NOx | CARB, 2006 |

## Nonroad PM Control Measures

**See cover note for important notes and caveats on the use of these tables**

| Source Category | Emissions Reduction Measure | Control Efficiency (%) | Cost Effectiveness, $/ton | Notes/Caveats | Other Pollutants Controlled | References for More Information |
|---|---|---|---|---|---|---|
| Switch Locomotive | Upgrade Engines in Switcher Locomotives - Install multiple off-road diesel engines | 80 | 6,500-18,000 | Remanufactured switchers are powered with two or three (700 hp) Tier 3 non-road diesel engines call gen-sets instead of conventional diesel locomotive engines. Gen-set locomotive manufacturers report that these locomotives can reduce fuel consumption by 20 to 35 percent. Cost effectiveness expressed as dollar per ton of NOx + diesel PM reduced. | NOx | CARB, 2006 |
| Locomotives | Locomotive Retrofit - DPF | >85 | | Has not been tested or used in rail yard applications in the U.S. | | CARB, 2006 |
| Locomotives | Locomotive Retrofit - DOC | 20-50 | | Has not been tested or used in rail yard applications in the U.S. | | CARB, 2006 |
| Locomotives | Use of Alternative Fuels - Biodiesel | >50 | 6,500-18,000 | Biodiesel generally results in a NOx increase, and is best used in combination with NOx control strategies. Cost effectiveness expressed as dollar per ton of NOx + diesel PM reduced. | | CARB, 2006 |
| Locomotives | Use of Alternative Fuels - Fisher-Tropsch Diesel | | 6,500-18,000 | Made from converting synthetic gas to a liquid hydrocarbon diesel, this synthetic diesel fuel contains less than 10 ppm sulfur, which directly reduces diesel PM and SOx emissions. Cost effectiveness expressed as dollar per ton of NOx + diesel PM reduced. | | CARB, 2006 |
| Commercial Marine Vessels | Add-On Controls - DPF | >85 | | | | CARB, 2006 |
| Commercial Marine Vessels | Add-On Controls - DOC | ~30 | | | | CARB, 2006 |
| Commercial Marine Vessels-Harbor Vessels | Cleaner Marine Fuels - Emulsified Diesel Fuel | | | ARB estimates that emulsified diesel fuel used in on-road engines can reduce NOx by 15 percent and PM by 50 percent. Additional testing is required to determine whether similar reductions are possible in marine engines. | | CARB, 2006 |
| Commercial Marine Vessels-Harbor Vessels | Cleaner Marine Fuels - Biodiesel | >50 | | Generally results in a NOx increase. Biodiesel is best used in combination with NOx control strategies. | | CARB, 2006 |
| Commercial Marine Vessels-Harbor Vessels | Cleaner Marine Fuels - Compressed or liquefied natural gas or diesel/CNG dual fuel | | | Can result in significant reductions in NOx and PM. The results vary with specific application and the ratio of diesel to CNG used. Additional testing is required to determine whether similar reductions are possible in marine engines. | | CARB, 2006 |
| Commercial Marine Vessels-Ocean Going Vessels | Cleaner Marine Fuels for Main Engines - Marine distillate fuels | 75 | 6,500-18,000 | Cost effectiveness expressed as dollar per ton of NOx + diesel PM reduced. | SO2 | CARB, 2006 |
| Commercial Marine Vessels-Ocean Going Vessels | Cleaner Marine Fuels for Main Engines - Lower sulfur content | 35 | 6,500-18,000 | Control efficiencies assume use of lower sulfur content fuel oil of 5000 ppm. Cost effectiveness expressed as dollar per ton of NOx + diesel PM reduced. | SO2 | CARB, 2006 |
| Commercial Marine Vessels-Ocean Going Vessels | Cleaner Marine Fuels for Auxiliary Engines - Lower sulfur content | 35 | 6,500-18,000 | Control efficiencies assume use of lower sulfur content fuel oil of 5000 ppm. Cost effectiveness expressed as dollar per ton of NOx + diesel PM reduced. | SO2 | CARB, 2006 |
| Commercial Marine Vessels Recreational Marine | Reduce Fuel Sulfur Content for Smaller Commercial and Recreational Vessels | 10 | | Emission reductions based on assumption that current sulfur level of 3,000 parts per million (ppm) is reduced to 500 and to 15 ppm. | SO2 | NJDEP, 2005 |
| Commercial Marine Vessels-Ocean Going Vessels | Shore Based Electrical Power - Cold Ironing | 90 | 6,500-18,000 | ARB assumes 90% control and participation of 20% of fleet in 2010 and 80% of fleet in 2020. Cost effectiveness expressed as dollar per ton of NOx + diesel PM reduced. | NOx | CARB, 2006 |
| Commercial Marine Vessels-Harbor Vessels | Shore Based Electrical Power - Cold Ironing | 12-27 | | No cost effectiveness values provided; likely to be cost-effective for ships that frequently visit ports equipped with shore power. Control efficiencies based on participation of 40% of tugboat fleet in 2010 and 80-100% of tugboat fleet in 2025. | NOx | CARB, 2006 |
| Commercial Marine Vessels | Shore Based Electrical Power - Cold Ironing | 83-97 | 69,000 (average) 16,000 (average weighted across all ships in study) | Cost effectiveness expressed as dollar per ton of VOC, NOx, CO, PM10 and SO2 reduction combined. Cost effectiveness would improve in the case of new terminals or new vessels, due to the lack of operational, safety, and engineering challenges associated with retrofitting shore power into existing port facilities. | NOx, SO2, VOC, CO | Environ, 2004<br>NJDEP, 2005 |

NOTES: Unless otherwise noted, control efficiencies represent control values per engine or equipment; overall cost effectiveness would need to account for the fraction of the fleet to which controls were applied.

**Acronyms**

EGR - Exhaust Gas Recirculation
SCR - Selective Catalytic Reduction
DOC - Diesel Oxidation Catalysts
DPF - Diesel Particulate Filters
CCV - Closed Crankcase Ventilation
APU - Auxiliary Power Units
GSE - Ground Support Equipment
CNG - Compressed Natural Gas
LPG - Liquefied Petroleum Gas
IMO - International Marine Organization
ULSD - Ultra-Low Sulfur Diesel

# Nonroad SO2 Measures

*Draft Version 1.0*

**See cover note for important notes and caveats on the use of these tables**

| Source Category | Emissions Reduction Measure | Control Efficiency (%) | Cost Effectiveness, $/ton | Notes/Caveats | Other Pollutants Controlled | References for More Information |
|---|---|---|---|---|---|---|
| Nonroad Diesel Engines | Early Use of Ultra-Low Sulfur Diesel | | | Proportionate SO2 reductions would result due to lower S content of fuel | PM | EPA, 2006c |
| Nonroad Diesel Engines | Early Use of Ultra-Low Sulfur Diesel + Retrofit | | | Some retrofits that rely on ULSD (e.g., DPFs) that have been verified by EPA and/or CARB require a S content of no more than 15-50ppm. | PM | EPA, 2006c |
| Commercial Marine Vessels-Ocean Going Vessels | Cleaner Marine Fuels for Main Engines - Marine distillate fuels | 75 | 6,500-18,000 | | PM | CARB, 2006 |
| Commercial Marine Vessels-Ocean Going Vessels | Cleaner Marine Fuels for Main Engines - Lower sulfur content | 80 | 6,500-18,000 | Control efficiencies assume use of lower sulfur content fuel oil of 5000 ppm. Cost effectiveness expressed as dollar per ton of NOx + diesel PM reduced. | PM | CARB, 2006 |
| Commercial Marine Vessels-Ocean Going Vessels | Cleaner Marine Fuels for Auxiliary Engines - Lower sulfur content | 80 | 6,500-18,000 | Control efficiencies assume use of lower sulfur content fuel oil of 5000 ppm. Cost effectiveness expressed as dollar per ton of NOx + diesel PM reduced. | PM | CARB, 2006 |
| Commercial Marine Vessels Recreational Marine | Reduce Fuel Sulfur Content for Smaller Commercial and Recreational vVessels | 82-99.5 | | Emission reductions based on assumption that current sulfur level of 3,000 parts per million (ppm) is reduced to 500 and to 15 ppm. | PM | NJDEP, 2005 |

**Acronyms**

EGR - Exhaust Gas Recirculation
SCR - Selective Catalytic Reduction
DOC - Diesel Oxidation Catalysts
DPF - Diesel Particulate Filters
CCV - Closed Crankcase Ventilation
APU - Auxiliary Power Units
GSE - Ground Support Equipment
CNG - Compressed Natural Gas
LPG - Liquefied Petroleum Gas
IMO - International Marine Organization
ULSD - Ultra-Low Sulfur Diesel

# Nonroad NOx Control Measures

*Draft Version 1.0*

**See cover note for important notes and caveats on the use of these tables**

| Source Category | Emissions Reduction Measure | Control Efficiency (%) | Cost Effectiveness, $/ton | Notes/Caveats | Other Pollutants Controlled | References for More Information |
|---|---|---|---|---|---|---|
| Nonroad Diesel Construction | Engine/Equipment Replacement (Scrappage) | | 2,000-25,000 | Only emission reductions reported, no control efficiencies. Emission reductions and Cost effectiveness values by equipment application, horsepower and technology type are reported in Appendices to LADCO report. | PM | ENVIRON, 2006<br>EPA, 2005 |
| Nonroad Diesel Construction | Nonroad NOx Retrofit - Lean NOx Catalyst | 40 | 3,000-54,000 | Cost effectiveness values by equipment application, horsepower and technology type reported in Appendices to LADCO report. Earlier technology type engines are generally more cost-effective. | | ENVIRON, 2006<br>EPA, 2005 |
| Nonroad Diesel Construction | Nonroad NOx Retrofit - EGR+DPF | 50 | 7,000-108,000 | Cost effectiveness values by equipment application, horsepower and technology type reported in Appendices to LADCO report. Earlier technology type engines are generally more cost-effective. | | ENVIRON, 2006<br>EPA, 2005 |
| Nonroad Diesel Construction | Nonroad NOx Retrofit - SCR | 70-99 | 2,000-40,000 | Cost effectiveness values by equipment application, horsepower and technology type reported in Appendices to LADCO report. Earlier technology type engines are generally more cost-effective. | | ENVIRON, 2006<br>EPA, 2005 |
| Nonroad Diesel Engines | Nonroad Engine Upgrade - Low end | 30 | 1,600 | Low end represents most cost-effective retrofits (first 50% of retrofit potential). Cost effectiveness based on low-end of range for DOC applied to 250 hp bulldozers. Cost effectiveness based on the same methodology as used in the PM cost effectiveness paper. | PM, VOC | EPA, 2006a EPA, 2006b |
| Nonroad Diesel Engines | Nonroad Engine Upgrade - High end | 30 | 7,200 | High end represents least cost-effective retrofits (second 50% of retrofit potential). Cost effectiveness based on average of range for DOC applied to 250 hp bulldozers. Cost effectiveness based on the same methodology as used in the PM cost effectiveness paper. | PM, VOC | EPA, 2006a EPA, 2006b |
| Nonroad Diesel | "Carl Moyer/TERP"-Type Voluntary Program - Nonroad Diesel Retrofit | | 1,800-7,300 | | | OTC, 2006 |
| Nonroad Gasoline Industrial | ARB Forklift and Other Industrial Equipment Rule - Tighter NOx and VOC Limits Plus Accelerated Replacement | | | | | CARB, 2006 |
| Nonroad Diesel Construction | Emulsified Diesel Fuel | 18 | 15,000-160,000 | Cost effectiveness values by equipment application, horsepower and technology type are reported in Appendices to LADCO report. Smaller horsepower and earlier technology type engines are generally more cost-effective. | | ENVIRON, 2006<br>EPA, 2005 |

# Nonroad NOx Control Measures

**See cover note for important notes and caveats on the use of these tables**

| Source Category | Emissions Reduction Measure | Control Efficiency (%) | Cost Effectiveness, $/ton | Notes/Caveats | Other Pollutants Controlled | References for More Information |
|---|---|---|---|---|---|---|
| Nonroad Diesel Construction | Nonroad Idling Reduction - Automatic Shut-off Devices | | | Control efficiencies will be variable. For example, if 20% reduction in idling is achievable, 225 tpy NOx and 18 tpy PM2.5 reduction would result in NJ. Reduction in fuel and engine maintenance costs, increased equipment life, and decreased noise complaints. Cost of technology would be recouped within the life of the equipment, probably sooner in many cases, providing a net cost savings for equipment owner. | | NJDEP, 2005 |
| Locomotives | Idling Reduction - SmartStart and Diesel Driven Heating System | 40-60 | $809 | Idle reduction technologies can reduce idling up to 90 percent. Control efficiencies provided correspond to a 90 percent reduction in idling, which is expected to reduce fuel consumption by 40 to 60 percent. Cost per ton is an upper bound value, since savings due to reduced maintenance costs not accounted for. | PM | NJDEP, 2005<br>Union Pacific, 2006<br>Vancouver, 2005, EPA 2004 |
| Switch Locomotive | Upgrade Engines in Switcher Locomotives - Diesel-electric hybrid locomotives | 80 | 6,500-18,000 | Hybrid switch locomotives have significantly reduced diesel PM and NOx emissions, idling time, and fuel use compared to conventional switchers. Cost effectiveness expressed as dollar per ton of NOx + diesel PM reduced. | PM | CARB, 2006 |
| Switch Locomotive | Upgrade Engines in Switcher Locomotives - Install multiple off-road diesel engines | 80 | 6,500-18,000 | Remanufactured switchers are powered with two or three (700 hp) Tier 3 non-road diesel engines call gen-sets instead of conventional diesel locomotive engines. Gen-set locomotive manufacturers report that these locomotives can reduce fuel consumption by 20 to 35 percent. Cost effectiveness expressed as dollar per ton of NOx + diesel PM reduced. | PM | CARB, 2006 |
| Commercial Marine Vessels | Add-On Controls - SCR | 65-90 | | May reduce diesel PM emissions. | PM | CARB, 2006 |
| Commercial Marine Vessels-Ocean Going Vessels | Cleaner Marine Fuels - Emulsified Diesel Fuel | 30 | 6,500-18,000 | Slight increase in fuel consumption and PM emissions. Cost effectiveness expressed as dollar per ton of NOx + diesel PM reduced. | | CARB, 2006 |
| Commercial Marine Vessels-Harbor Vessels | Cleaner Marine Fuels - Emulsified Diesel Fuel | | | ARB estimates that emulsified diesel fuel used in on-road engines can reduce NOx by 15 percent and PM by 50 percent. Additional testing is required to determine whether similar reductions are possible in marine engines. | PM | CARB, 2006 |
| Commercial Marine Vessels-Ocean Going Vessels | Vessel Speed Reduction Program - Extending Speed Reduction Zones Offshore | | 6,500-18,000 | Slower speeds reduce main engine fuel consumption and result in significant NOx reductions. There is the potential for increases in diesel PM emissions for some vessels operating at slow speeds. Cost effectiveness expressed as dollar per ton of NOx + diesel PM reduced. | | CARB, 2006 |
| Commercial Marine Vessels-Ocean Going Vessels | Shore Based Electrical Power - Cold Ironing | 90 | 6,500-18,000 | ARB assumes 90% control and participation of 20% of fleet in 2010 and 80% of fleet in 2020. Cost effectiveness expressed as dollar per ton of NOx + diesel PM reduced. | PM | CARB, 2006 |
| Commercial Marine Vessels - Ocean-Going Vessels | Shore Based Electrical Power - Cold Ironing | 99 | 69,000 (average)<br>16,000 (average weighted across all ships in study) | Cost effectiveness expressed as dollar per ton of VOC, NOx, CO, PM10 and SO2 reduction combined. Cost effectiveness would improve in the case of new terminals or new vessels, due to the lack of operational, safety, and engineering challenges associated with retrofitting shore power into existing port facilities. | PM | NJDEP, 2005<br>Environ, 2004 |
| Commercial Marine Vessels-Harbor Vessels | Shore Based Electrical Power - Cold Ironing | 12-27 | | No cost effectiveness values provided; likely to be cost-effective for ships that frequently visit ports equipped with shore power. Control efficiency represents overall control effectiveness based on participation of 40% of tugboat fleet in 2010 and 80-100% of tugboat fleet in 2025. | | CARB, 2006 |
| Commercial Marine Vessels-Ocean Going Vessels | Build or Retrofit New Ships that Far Exceed IMO Standards | 90 | 6,500-18,000 | Cost effectiveness expressed as dollar per ton of NOx + diesel PM reduced. | PM | CARB, 2006 |
| Aircraft Ground Support Equipment | Alternative Fuels for Airport GSE - Replace Diesel GSE with CNG/LPG | 65 | 1,000 - 3,000 | Cost-effectiveness is expressed in dollar per ton VOC/CO/NOx combined | VOC | MRPO, 2005<br>NESCAUM, 2003 |

# Nonroad NOx Control Measures

**See cover note for important notes and caveats on the use of these tables**

| Source Category | Emissions Reduction Measure | Control Efficiency (%) | Cost Effectiveness, $/ton | Notes/Caveats | Other Pollutants Controlled | References for More Information |
|---|---|---|---|---|---|---|
| Aircraft Ground Support Equipment | Alternative Fuels for Airport GSE - Convert Gas GSE to CNG/LPG | 25 | Overall cost savings from reduced fuel use | | VOC | MRPO, 2005<br>NESCAUM, 2003 |
| Aircraft Ground Support Equipment | Alternative Fuels for Airport GSE - Replace Diesel GSE with Electric | 100 | Cost savings - $5,800 | Cost savings or net costs dependent on type of GSE. Savings for belt loader, costs incurred for baggage tractor and aircraft tug. | | MRPO, 2005<br>NESCAUM, 2003 |
| Aircraft Ground Support Equipment | Alternative Fuels for Airport GSE - Replace Gas GSE with Electric | 100 | Cost savings - $1,900 | Cost savings or net costs dependent on type of GSE. Savings for belt loader and aircraft tug, costs incurred for baggage tractor. | | MRPO, 2005<br>NESCAUM, 2003 |
| Aircraft Ground Support Equipment | Gate Electrification to Reduce GSE/APU Use - Retrofit Airport Gates with Power and Preconditioned Air | | | No emission reduction or Cost effectiveness values provided. Gate electrification requires an up-front capital investment but, once installed, the system produces fuel and labor savings that typically result in a relatively short payback time of less than two years. | | NESCAUM, 2003 |
| Aircraft Ground Support Equipment | Nonroad Idling Reduction | | | Control efficiencies will be variable. For example, applying the current 3-minute idling law to the approx. 2000 non-road GSEs in NJ will result in fuel savings and reduced engine wear and is a low cost strategy. | | NJDEP, 2005 |

NOTES: Unless otherwise noted, control efficiencies represent control values per engine or equipment; overall cost effectiveness would need to account for the fraction of the fleet to which controls were applied.

**Acronyms**

EGR - Exhaust Gas Recirculation
SCR - Selective Catalytic Reduction
DOC - Diesel Oxidation Catalysts
DPF - Diesel Particulate Filters
CCV - Closed Crankcase Ventilation
APU - Auxiliary Power Units
GSE - Ground Support Equipment
CNG - Compressed Natural Gas
LPG - Liquefied Petroleum Gas
IMO - International Marine Organization
ULSD - Ultra-Low Sulfur Diesel

# Nonroad Control Measures References

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**See cover note for important notes and caveats on the use of these tables**

| Key | Reference |
|---|---|
| CARB 2005 | California Environmental Protection Agency, Air Resources Board (CARB). "ARB/Railroad Statewide Agreement Particulate Emissions Reduction Program at California Rail Yards," June 2005. http://www.arb.ca.gov/railyard/083005mouexecuted.pdf |
| CARB 2006 | California Air Resources Board, "Proposed Emission Reduction Plan for Ports and Good Movement in California, March 21, 2006 http://www.arb.ca.gov/planning/gmerp/gmerp.htm |
| ENVIRON 2004 | "Cold Ironing Cost Effectiveness Study", ENVIRON International Corporation, prepared for Port of Long Beach, California, March 30, 2004. http://www.polb.com/civica/filebank/blobdload.asp?BlobID=2157 |
| ENVIRON 2006 | ENVIRON International Corporation, "Evaluation of Candidate Mobile Source Control Measures", Final Report, prepared for Lake Michigan Air Directors Consortium, 2250 E. Devon Ave., #250, Des Plaines, IL 60018, February 28, 2006. http://www.ladco.org/reports/rpo/Regional%20Air%20Quality/LADCO%20Control%20Report_Final.pdf |
| EPA 2004 | Guidance for Quantifying and Using Long-Duration Switch Yard Locomotive Idling Emission Reductions in State Implementation Plans. EPA420-B-04-002. January 2004. http://www.epa.gov/oms/smartway/idle-guid.htm |
| EPA 2005 | Draft list of potential RACT and RACM from PM rule preamble (see EPA websites on verified retrofit technologies) http://www.epa.gov/otaq/retrofit/retroverifiedlist.htm |
| EPA 2006a | E.H. Pechan & Associates, Inc., "PM NAAQS Modeling, Technical Memorandum", Draft Report, prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC, July 2006. |
| EPA 2006b | U.S. Environmental Protection Agency, Office of Transportation and Air Quality, "Diesel Retrofit Technology, An Analysis of the Cost-Effectiveness of Reducing Particulate Matter Emissions from Heavy-Duty Diesel Engines Through Retrofits", EPA420-S-06-002, March 2006. http://www.epa.gov/cleandiesel/documents/420s06002.pdf |
| EPA 2006c | EPA staff communication via e-mail from R. Kapichak, OTAQ/EPA, to J. Ketcham-Colwill, OPAR/OAR/EPA on September 9, 2006 |
| MRPO 2005 | Midwest RPO, Interim White Paper - Midwest RPO Candidate Control Measures, Source Category: Airport Related Activities, December 20, 2005. http://www.ladco.org/reports/rpo/Regional%20Air%20Quality/White%20Papers%20March%202006/Airports_Operations_Ver1.pdf |
| NESCAUM 2003 | Northeast States for Coordinated Air Use Management (NESCAUM). Controlling Airport-Related Air Pollution. June 2003. http://www.nescaum.org/documents/aviation_final_report.pdf/view?searchterm=Airport |
| NJDEP 2005 | NJDEP Diesel Initiatives Workgroup, "A Collaborative Report Presenting Air Quality Strategies for Further Consideration by the State of New Jersey," October 31, 2005. http://www.nj.gov/dep/airworkgroups/docs/final_di_workgroup_report.pdf |

# Nonroad Control Measures References

**See cover note for important notes and caveats on the use of these tables**

| Key | Reference |
|---|---|
| OTC 2006 | Ozone Transport Commission (OTC) “Candidate Control Measures.” http://www.otcair.org/projects_details.asp?FID=93&fview=stationary |
| SCAQMD 2006 | South Coast Air Quality Management District (SCAQMD) Air Quality Summit, June 5 & 6, 2006. http://www.aqmd.gov/aqmp/07aqmp/aqsummit/aqsummit.html |
| STAPPA/ALAPCO 2006 | The State and Territorial Air Pollution Program Administrators and the Association of Local Air Pollution Control Officials, "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options, " March 2006 http://www.4cleanair.org/PM25Menu-Final.pdf |
| Union Pacific 2006 | “Union Pacific and the Environment” fact sheet. www.up.com |
| Vancouver 2005 | “Vancouver, Wa. Switchyard Locomotive Idle Reduction Project, Final Report to EPA”, Southwest Clean Air Agency, Vancouver, Wa., October 18, 2005. http://www.epa.gov/SmartwayLogistics/documents/vancouver-locomotive.pdf |

# Nonroad Detailed Control Measure List

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**See cover note for important notes and caveats on the use of these tables**

| Primary Reference | Major Pollutant | Source Category | Source Sector | Control Measure | Technology | Model Year | Applicable SCC Codes | Control Efficiency (%) | | | | | | CE Reference | Cost Effectiveness | Cost Year | Cost Reference | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | PM 2.5 | PM | SO2 | NH3 | NOx | VOC | | | | | |
| ENVIRON, 2006 | NOx | Nonroad diesel | Nonroad Mobile Sources | California Diesel Fuel | Aromatic hydrocarbon content of 10% | | 2270xxxxxx | | | | | 6 | | ENVIRON, 2006 | 8,000 | 2007 | ENVIRON, 2006 | California Fuels measure will also reduce sulfur levels and decrease PM, but Federal Diesel Regulations will provide equivalent PM reductions |
| SCAQMD, 2006 | NOx | Nonroad Diesel | Nonroad Mobile Sources | Nonroad Diesel Retrofit | SCR | | 2270xxxxxx | | | | | 98 | | SCAQMD, 2006 | | | | Reduction on new installations. NOx reduction technologies may result in larger PM emissions and reduced fuel efficiency. |
| OTC, 2006 | NOx | Nonroad Diesel Construction Locomotives Commercial Marine Vessels | Nonroad Mobile Sources | "Carl Moyer/TERP"-Type Voluntary Program | Nonroad Diesel Retrofit | | 2270002xxx 2285002xxx 2280002xxx | | | | | | | | $1,800-$7,300 | | OTC, 2006 | |
| ENVIRON, 2006 | NOx | Nonroad Diesel Construction | Nonroad Mobile Sources | Emulsified Diesel Fuel | Emulsified Diesel Fuel | Tier 0 | 2270002xxx | | | | | 18 | | EPA, 2005 | 15,000-50,000 | 2007 | ENVIRON, 2006 | C-E values by equipment application, horsepower and technology type are reported in Appendices to LADCO report. Smaller horsepower engines are generally more cost-effective. |
| ENVIRON, 2006 | NOx | Nonroad Diesel Construction | Nonroad Mobile Sources | Emulsified Diesel Fuel | Emulsified Diesel Fuel | Tier 1 | 2270002xxx | | | | | 18 | | EPA, 2005 | 21,000-68,000 | 2007 | ENVIRON, 2006 | C-E values by equipment application, horsepower and technology type are reported in Appendices to LADCO report. Smaller horsepower engines are generally more cost-effective. |

# Nonroad Detailed Control Measure List

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| Primary Reference | Major Pollutant | Source Category | Source Sector | Control Measure | Technology | Model Year | Applicable SCC Codes | Control Efficiency (%) | | | | | | CE Reference | Cost Effectiveness | Cost Year | Cost Reference | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | PM 2.5 | PM | SO2 | NH3 | NOx | VOC | | | | | |
| ENVIRON, 2006 | NOx | Nonroad Diesel Construction | Nonroad Mobile Sources | Emulsified Diesel Fuel | Emulsified Diesel Fuel | Tier 2 | 2270002xxx | | | | | 18 | | EPA, 2005 | 31,000-100,000 | 2007 | ENVIRON, 2006 | C-E values by equipment application, horsepower and technology type are reported in Appendices to LADCO report. Smaller horsepower engines are generally more cost-effective. |
| ENVIRON, 2006 | NOx | Nonroad Diesel Construction | Nonroad Mobile Sources | Emulsified Diesel Fuel | Emulsified Diesel Fuel | Tier 3 | 2270002xxx | | | | | 18 | | EPA, 2005 | 50,000-160,000 | 2007 | ENVIRON, 2006 | C-E values by equipment application, horsepower and technology type are reported in Appendices to LADCO report. Smaller horsepower engines are generally more cost-effective. |
| ENVIRON, 2006 | NOx | Nonroad Diesel Construction | Nonroad Mobile Sources | Engine/Equipment Replacement (Scrappage) | Replace Tier 0 with Tier 2 engines | Tier 0 | 2270002xxx | | | | | | | EPA, 2005 | 2,000-8,000 | 2007 | ENVIRON, 2006 | Only emission reductions reported, no control efficiencies. Emission reductions and C-E values by equipment application, horsepower and technology type are reported in Appendices to LADCO report. |
| ENVIRON, 2006 | NOx | Nonroad Diesel Construction | Nonroad Mobile Sources | Engine/Equipment Replacement (Scrappage) | Replace Tier 1 with Tier 3 engines | Tier 1 | 2270002xxx | | | | | | | EPA, 2005 | 4,000-11,000 | 2007 | ENVIRON, 2006 | Only emission reductions reported, no control efficiencies. Emission reductions and C-E values by equipment application, horsepower and technology type are reported in Appendices to LADCO report. |

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| Primary Reference | Major Pollutant | Source Category | Source Sector | Control Measure | Technology | Model Year | Applicable SCC Codes | Control Efficiency (%) | | | | | | CE Reference | Cost Effectiveness | Cost Year | Cost Reference | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | PM 2.5 | PM | SO2 | NH3 | NOx | VOC | | | | | |
| ENVIRON, 2006 | NOx | Nonroad Diesel Construction | Nonroad Mobile Sources | Engine/Equipment Replacement (Scrappage) | Replace Tier 2 with Tier 3 engines | Tier 2 | 2270002xxx | | | | | | | EPA, 2005 | 9,000-25,000 | 2007 | ENVIRON, 2006 | Only emission reductions reported, no control efficiencies. Emission reductions and C-E values by equipment application, horsepower and technology type are reported in Appendices to LADCO report. |
| ENVIRON, 2006 | NOx | Nonroad Diesel Construction | Nonroad Mobile Sources | Nonroad NOx Retrofit | Lean NOx Catalyst | Tier 0 | 2270002xxx | | | | | 40 | | EPA, 2005 | 3,000-16,000 | 2007 | ENVIRON, 2006 | C-E values by equipment application, horsepower and technology type reported in Appendices to LADCO report. |
| ENVIRON, 2006 | NOx | Nonroad Diesel Construction | Nonroad Mobile Sources | Nonroad NOx Retrofit | Lean NOx Catalyst | Tier 1 | 2270002xxx | | | | | 40 | | EPA, 2005 | 4,000-22,000 | 2007 | ENVIRON, 2006 | C-E values by equipment application, horsepower and technology type reported in Appendices to LADCO report. |
| ENVIRON, 2006 | NOx | Nonroad Diesel Construction | Nonroad Mobile Sources | Nonroad NOx Retrofit | Lean NOx Catalyst | Tier 2 | 2270002xxx | | | | | 40 | | EPA, 2005 | 6,000-33,000 | 2007 | ENVIRON, 2006 | C-E values by equipment application, horsepower and technology type reported in Appendices to LADCO report. |
| ENVIRON, 2006 | NOx | Nonroad Diesel Construction | Nonroad Mobile Sources | Nonroad NOx Retrofit | Lean NOx Catalyst | Tier 3 | 2270002xxx | | | | | 40 | | EPA, 2005 | 12,000-54,000 | 2007 | ENVIRON, 2006 | C-E values by equipment application, horsepower and technology type reported in Appendices to LADCO report. |
| ENVIRON, 2006 | NOx | Nonroad Diesel Construction | Nonroad Mobile Sources | Nonroad NOx Retrofit | EGR+DPF | Tier 0 | 2270002xxx | | | | | 50 | | EPA, 2005 | 7,000-32,000 | 2007 | ENVIRON, 2006 | C-E values by equipment application, horsepower and technology type reported in Appendices to LADCO report. |

# Nonroad Detailed Control Measure List

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| Primary Reference | Major Pollutant | Source Category | Source Sector | Control Measure | Technology | Model Year | Applicable SCC Codes | Control Efficiency (%) | | | | | | CE Reference | Cost Effectiveness | Cost Year | Cost Reference | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | PM 2.5 | PM | SO2 | NH3 | NOx | VOC | | | | | |
| ENVIRON, 2006 | NOx | Nonroad Diesel Construction | Nonroad Mobile Sources | Nonroad NOx Retrofit | EGR+DPF | Tier 1 | 2270002xxx | | | | | 50 | | EPA, 2005 | 9,000-45,000 | 2007 | ENVIRON, 2006 | C-E values by equipment application, horsepower and technology type reported in Appendices to LADCO report. |
| ENVIRON, 2006 | NOx | Nonroad Diesel Construction | Nonroad Mobile Sources | Nonroad NOx Retrofit | EGR+DPF | Tier 2 | 2270002xxx | | | | | 50 | | EPA, 2005 | 13,000-66,000 | 2007 | ENVIRON, 2006 | C-E values by equipment application, horsepower and technology type reported in Appendices to LADCO report. |
| ENVIRON, 2006 | NOx | Nonroad Diesel Construction | Nonroad Mobile Sources | Nonroad NOx Retrofit | EGR+DPF | Tier 3 | 2270002xxx | | | | | 50 | | EPA, 2005 | 26,000-108,000 | 2007 | ENVIRON, 2006 | C-E values by equipment application, horsepower and technology type reported in Appendices to LADCO report. |
| ENVIRON, 2006 | NOx | Nonroad Diesel Construction | Nonroad Mobile Sources | Nonroad NOx Retrofit | SCR | Tier 0 | 2270002xxx | | | | | 70-99 | | EPA, 2005 | 2,000-12,000 | 2007 | ENVIRON, 2006 | C-E values by equipment application, horsepower and technology type reported in Appendices to LADCO report. |
| ENVIRON, 2006 | NOx | Nonroad Diesel Construction | Nonroad Mobile Sources | Nonroad NOx Retrofit | SCR | Tier 1 | 2270002xxx | | | | | 70-99 | | EPA, 2005 | 3,000-17,000 | 2007 | ENVIRON, 2006 | C-E values by equipment application, horsepower and technology type reported in Appendices to LADCO report. |
| ENVIRON, 2006 | NOx | Nonroad Diesel Construction | Nonroad Mobile Sources | Nonroad NOx Retrofit | SCR | Tier 2 | 2270002xxx | | | | | 70-99 | | EPA, 2005 | 4,000-25,000 | 2007 | ENVIRON, 2006 | C-E values by equipment application, horsepower and technology type reported in Appendices to LADCO report. |
| ENVIRON, 2006 | NOx | Nonroad Diesel Construction | Nonroad Mobile Sources | Nonroad NOx Retrofit | SCR | Tier 3 | 2270002xxx | | | | | 70-99 | | EPA, 2005 | 9,000-40,000 | 2007 | ENVIRON, 2006 | C-E values by equipment application, horsepower and technology type reported in Appendices to LADCO report. |

# Nonroad Detailed Control Measure List

**See cover note for important notes and caveats on the use of these tables**

| Primary Reference | Major Pollutant | Source Category | Source Sector | Control Measure | Technology | Model Year | Applicable SCC Codes | Control Efficiency (%) | | | | | | CE Reference | Cost Effectiveness | Cost Year | Cost Reference | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | PM 2.5 | PM | SO2 | NH3 | NOx | VOC | | | | | |
| NJDEP, 2005 | NOx | Nonroad Diesel Construction | Nonroad Mobile Sources | Nonroad Idling Requirements | Automatic Shut-off Devices | | 2270002xxx | | | | | | | | | | | Control efficiencies will be variable. For example, if 20% reduction in idling is achievable, 225 tpy NOx and 18 tpy PM2.5 reduction would result in NJ. Reduction in fuel and engine maintenance costs, increased equipment life, and decreased noise complaints. Cost of technology would be recouped within the life of the equipment, probably sooner in many cases, providing a net cost savings for equipment owner. |
| OTC, 2006 | PM | Nonroad Diesel Construction | Nonroad Mobile Sources | Clean Air Construction Initiative | Nonroad Diesel Retrofit | | 2270002xxx | | | | | | | | $ per ton varies | | OTC, 2006 | |
| EPA, 2006a | PM | Nonroad Diesel Engines | Nonroad Mobile Sources | Nonroad Retrofit - Low end | DPF | 1988-2007 | 2270xxxxxx | | 90 | | | | 90 | | 18,100 | 2007 | EPA, 2006b | Low end represents most cost-effective retrofits (first 50% of retrofit potential). Cost-effectiveness based on low-end of range for DOC applied to 250 hp bulldozers. PM cost-effectiveness values apply for all retrofit measures combined (DOC, DPF, and rebuild) |

# Nonroad Detailed Control Measure List

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| Primary Reference | Major Pollutant | Source Category | Source Sector | Control Measure | Technology | Model Year | Applicable SCC Codes | Control Efficiency (%) | | | | | | CE Reference | Cost Effectiveness | Cost Year | Cost Reference | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | PM 2.5 | PM | SO2 | NH3 | NOx | VOC | | | | | |
| EPA, 2006a | PM | Nonroad Diesel Engines | Nonroad Mobile Sources | Nonroad Retrofit - High end | DPF | 1988-2007 | 2270xxxxxx | | 90 | | | | 90 | | 33,900 | 2007 | EPA, 2006b | High end represents least cost-effective retrofits (second 50% of retrofit potential). Cost-effectiveness based on average of range for DOC applied to 250 hp bulldozers. PM cost-effectiveness values apply for all retrofit measures combined (DOC, DPF, and rebuild) |
| EPA, 2006a | PM | Nonroad Diesel Engines | Nonroad Mobile Sources | Nonroad Retrofit - Low end | DOC | 1988-2007 | 2270xxxxxx | | 20 | | | | 50 | | 18,100 | 2007 | EPA, 2006b | Low end represents most cost-effective retrofits (first 50% of retrofit potential). Cost-effectiveness based on low-end of range for DOC applied to 250 hp bulldozers. PM cost-effectiveness values apply for all retrofit measures combined (DOC, DPF, and rebuild) |
| EPA, 2006a | PM/NOx | Nonroad Diesel Engines | Nonroad Mobile Sources | Nonroad Retrofit - Low end | Rebuild | 1988-2007 | 2270xxxxxx | | 20 | | | 30 | 60 | | 18,100 | 2007 | EPA, 2006b | Low end represents most cost-effective retrofits (first 50% of retrofit potential). Cost-effectiveness based on low-end of range for DOC applied to 250 hp bulldozers. PM cost-effectiveness values apply for all retrofit measures combined (DOC, DPF, and rebuild) |

# Nonroad Detailed Control Measure List

**See cover note for important notes and caveats on the use of these tables**

| Primary Reference | Major Pollutant | Source Category | Source Sector | Control Measure | Technology | Model Year | Applicable SCC Codes | Control Efficiency (%) | | | | | | CE Reference | Cost Effectiveness | Cost Year | Cost Reference | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | PM 2.5 | PM | SO2 | NH3 | NOx | VOC | | | | | |
| EPA, 2006a | PM | Nonroad Diesel Engines | Nonroad Mobile Sources | Nonroad Retrofit - High end | DOC | 1988-2007 | 2270xxxxxx | | 20 | | | | 50 | | 33,900 | 2007 | EPA, 2006b | High end represents least cost-effective retrofits (second 50% of retrofit potential). Cost-effectiveness based on average of range for DOC applied to 250 hp bulldozers. PM cost-effectiveness values apply for all retrofit measures combined (DOC, DPF, and rebuild) |
| EPA, 2006a | PM/NOx | Nonroad Diesel Engines | Nonroad Mobile Sources | Nonroad Retrofit - High end | Rebuild | 1988-2007 | 2270xxxxxx | | 20 | | | 30 | 60 | | 33,900 | 2007 | EPA, 2006b | High end represents least cost-effective retrofits (second 50% of retrofit potential). Cost-effectiveness based on average of range for DOC applied to 250 hp bulldozers. PM cost-effectiveness values apply for all retrofit measures combined (DOC, DPF, and rebuild) |
| EPA, 2006c | PM | Nonroad Diesel Engines | Nonroad Mobile Sources | Early Use of Ultra-Low Sulfur Diesel | Early Use of Ultra-Low Sulfur Diesel | | 2270xxxxxx | | | | | | | | | | | Some direct PM reductions would result due to lower S content of fuel |
| EPA, 2006c | PM | Nonroad Diesel Engines | Nonroad Mobile Sources | Early Use of Ultra-Low Sulfur Diesel + Retrofit | Early Use of Ultra-Low Sulfur Diesel + Retrofit | | 2270xxxxxx | | | | | | | | | | | Some retrofits that rely on ULSD (e.g., DPFs) that have been verified by EPA and/or CARB require a S content of no more than 15-50ppm. |
| EPA, 2005 | PM | Nonroad Diesel Engines | Nonroad Mobile Sources | Clean Burning Fuels | Prohibit Sale and Use of Diesel that Exceeds High S Content | | 2270xxxxxx | | | | | | | | | | | |

# Nonroad Detailed Control Measure List

**See cover note for important notes and caveats on the use of these tables**

| Primary Reference | Major Pollutant | Source Category | Source Sector | Control Measure | Technology | Model Year | Applicable SCC Codes | Control Efficiency (%) | | | | | | CE Reference | Cost Effectiveness | Cost Year | Cost Reference | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | PM 2.5 | PM | SO2 | NH3 | NOx | VOC | | | | | |
| EPA, 2005 | PM | Nonroad Diesel Engines | Nonroad Mobile Sources | Standards for "Gross-Emitting" Equipment | Establish Opacity or other Emission Standards for Diesel Equipment or Vessels | | 2270xxxxxx<br>2280002xxx | | | | | | | | | | | |
| EPA, 2006c | SO2 | Nonroad Diesel Engines | Nonroad Mobile Sources | Early Use of Ultra-Low Sulfur Diesel | Early Use of Ultra-Low Sulfur Diesel | | 2270xxxxxx | | | | | | | | | | | Proportionate SO2 reductions would result due to lower S content of fuel |
| CARB, 2006 | PM | Nonroad diesel industrial | Nonroad Mobile Sources | ARB Cargo Handling Equipment Rule | Application of Best Available Control Technology | Level 3 | 2270003xxx<br>2270002xxx | | 85 | | | | | CARB, 2006 | $6,500-$18,000 per ton of NOx + diesel PM reduced | 2005 | CARB, 2006 | Level 1, 2 and 3 represent three benchmarks that control systems can be verified to. |
| CARB, 2006 | PM | Nonroad diesel industrial | Nonroad Mobile Sources | ARB Cargo Handling Equipment Rule | Application of Best Available Control Technology | Level 2 | 2270003xxx<br>2270002xxx | | 50 | | | | | CARB, 2006 | $6,500-$18,000 per ton of NOx + diesel PM reduced | 2005 | CARB, 2006 | Level 1, 2 and 3 represent three benchmarks that control systems can be verified to. |
| CARB, 2006 | PM | Nonroad diesel industrial | Nonroad Mobile Sources | ARB Cargo Handling Equipment Rule | Application of Best Available Control Technology | Level 1 | 2270003xxx<br>2270002xxx | | 25 | | | | | CARB, 2006 | $6,500-$18,000 per ton of NOx + diesel PM reduced | 2005 | CARB, 2006 | Level 1, 2 and 3 represent three benchmarks that control systems can be verified to. |
| STAPPA/ALAPCO, 2006 | PM | Nonroad diesel industrial | Nonroad Mobile Sources | Operational Changes at Ports | Reduce Use of Mobile Diesel-powered Material-Handling Equipment In Favor of Electric-powered | | 2270003xxx<br>2270002xxx | | | | | | | CARB, 2005 | | | | This program is a voluntary agreement with the BNSF Railway Company and the Union Pacific Railroad Company to reduce PM emissions in California rail yards. |
| EPA, 2005 | PM | Nonroad Engines | Nonroad Mobile Sources | Early Retirement/Scrappage | Programs to Reduce Emissions and Accelerate Retirement of Boats and Lawn and Garden Equipment | | 2260xxxxxx<br>2265xxxxxx<br>2270xxxxxx | | | | | | | | | | | |

# Nonroad Detailed Control Measure List

*Draft Version 1.0*

**See cover note for important notes and caveats on the use of these tables**

| Primary Reference | Major Pollutant | Source Category | Source Sector | Control Measure | Technology | Model Year | Applicable SCC Codes | Control Efficiency (%) | | | | | | CE Reference | Cost Effectiveness | Cost Year | Cost Reference | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | PM 2.5 | PM | SO2 | NH3 | NOx | VOC | | | | | |
| EPA, 2005 | PM | Nonroad Engines | Nonroad Mobile Sources | Low Emission Specifications | Limit emissions for construction projects, industrial facilities, ship yards, airports | | 2260xxxxxx<br>2265xxxxxx<br>2270xxxxxx | | | | | | | | | | | |
| EPA, 2005 | PM | Nonroad Engines | Nonroad Mobile Sources | Clean Burning Fuels | Expand Use of Clean Burning Fuels | | 2260xxxxxx<br>2265xxxxxx<br>2270xxxxxx | | | | | | | | | | | |
| SCAQMD, 2006 | PM | Nonroad Gasoline | Nonroad Mobile Sources | Equipment Replacement | Lawn Mower Buy Back Program | | 2260004xxx<br>2265004xxx | | | | | | | | | | | Program encourages trading of gasoline-powered mowers by providing funds to offset the purchase cost of electric mowers. |
| CARB, 2006 | NOx | Nonroad gasoline industrial | Nonroad Mobile Sources | ARB Forklift and Other Industrial Equipment Rule | Tighter NOx and VOC Limits Plus Accelerated Replacement | | 2260003xxx<br>2265003xxx | | | | | | | | | | | |
| NJDEP, 2005 | PM/VOC | Recreational Marine | Nonroad Mobile Sources | Variable Registration Fees for Boat Engines | Boat Engine Registration | | 228202xxxx | | | | | | | | | | | This control measure would require owners to register boat engines. The boat engine registration fee schedule would be designed so that lower fees would be assessed for the newest engines. |
| MRPO, 2005 | NOx | Aircraft Ground Support Equipment | Nonroad Mobile Sources | Alternative Fuels for Airport GSE | Replace Diesel GSE with CNG/LPG | | 2270008xxx | | | | | 65 | 30 | NESCAUM, 2003 | 1,000 - 3,000 | | NESCAUM, 2003 | Cost-effectiveness is expressed in dollar per ton VOC/CO/NOx combined |
| MRPO, 2005 | NOx | Aircraft Ground Support Equipment | Nonroad Mobile Sources | Alternative Fuels for Airport GSE | Convert Gas GSE to CNG/LPG | | 2260008xxx<br>2265008xxx | | | | | 25 | 50-70 | NESCAUM, 2003 | Overall cost savings from reduced fuel use | | NESCAUM, 2003 | |
| MRPO, 2005 | NOx | Aircraft Ground Support Equipment | Nonroad Mobile Sources | Alternative Fuels for Airport GSE | Replace Diesel GSE with Electric | | 2270008xxx | | | | | 100 | | NESCAUM, 2003 | Cost savings - $5,800 | | NESCAUM, 2003 | Cost savings or net costs dependent on type of GSE. Savings for belt loader, costs incurred for baggage tractor and aircraft tug. |

# Nonroad Detailed Control Measure List

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| Primary Reference | Major Pollutant | Source Category | Source Sector | Control Measure | Technology | Model Year | Applicable SCC Codes | Control Efficiency (%) | | | | | | CE Reference | Cost Effectiveness | Cost Year | Cost Reference | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | PM 2.5 | PM | SO2 | NH3 | NOx | VOC | | | | | |
| MRPO, 2005 | NOx | Aircraft Ground Support Equipment | Nonroad Mobile Sources | Alternative Fuels for Airport GSE | Replace Gas GSE with Electric | | 2260008xxx<br>2265008xxx | | | | | 100 | | NESCAUM, 2003 | Cost savings - $1,900 | | NESCAUM, 2003 | Cost savings or net costs dependent on type of GSE. Savings for belt loader and aircraft tug, costs incurred for baggage tractor. |
| NESCAUM, 2003 | NOx | Aircraft Ground Support Equipment | Nonroad Mobile Sources | Gate Electrification to Reduce GSE/APU Use | Retrofit airport gates with power and preconditioned air | | 2260008xxx<br>2265008xxx<br>2270008xxx<br>2275070000 | | | | | | | | | | | No emission reduction or C-E values provided. Gate electrification requires an up-front capital investment but, once installed, the system produces fuel and labor savings that typically result in a relatively short payback time of less than two years. |
| NJDEP, 2005 | NOx | Aircraft Ground Support Equipment | Nonroad Mobile Sources | Nonroad Idling Requirements | Restrict Idling to 3 minutes | | 2270008xxx | | | | | | | | | | | Control efficiencies will be variable. For example, applying the current 3-minute idling law to the approx. 2000 non-road GSEs in NJ will result in fuel savings and reduced engine wear and is a low cost strategy. |
| CARB, 2006 | PM/NOx | Switch Locomotive | Nonroad Mobile Sources | Upgrade Engines in Switcher Locomotives | Diesel-electric hybrid locomotives | | 2285002010 | | 80 | | | 80 | | CARB, 2006 | $6,500-$18,000 per ton of NOx + diesel PM reduced | 2005 | CARB, 2006 | Hybrid switch locomotives have significantly reduced diesel PM and NOx emissions, idling time, and fuel use compared to conventional switchers. |

# Nonroad Detailed Control Measure List

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| Primary Reference | Major Pollutant | Source Category | Source Sector | Control Measure | Technology | Model Year | Applicable SCC Codes | Control Efficiency (%) | | | | | | CE Reference | Cost Effectiveness | Cost Year | Cost Reference | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | PM 2.5 | PM | SO2 | NH3 | NOx | VOC | | | | | |
| CARB, 2006 | PM/NOx | Switch Locomotive | Nonroad Mobile Sources | Upgrade Engines in Switcher Locomotives | Locomotives comprised of multiple off-road diesel engines | | 2285002010 | | 80 | | | 80 | | CARB, 2006 | $6,500-$18,000 per ton of NOx + diesel PM reduced | 2005 | CARB, 2006 | Remanufactured switchers are powered with two or three (700 hp) Tier 3 non-road diesel engines call gen-sets instead of conventional diesel locomotive engines. Gen-set locomotive manufacturers report that these locomotives can reduce fuel consumption by 20 to 35 percent. |
| NJDEP, 2005 | NOx/PM | Locomotives | Nonroad Mobile Sources | Idling Reduction | SmartStart and Diesel Driven Heating System | | 2285002xxx | | 40-60 | | | 40-60 | | Union Pacific, 2006 | $809 | 2005 | Vancouver, 2005 | Idle reduction technologies can reduce idling up to 90 percent, depending on which technology is employed in which application. Control efficiencies provided correspond to a 90 percent reduction in idling, which is expected to reduce fuel consumption by 40 to 60 percent. PM and NOx cost per ton is an upper bound value, since savings due to reduced maintenance costs not accounted for. |
| CARB, 2006 | PM | Locomotives | Nonroad Mobile Sources | Locomotive Retrofit | DOC | | 2285002xxx | | 20-50 | | | | | CARB, 2006 | $6,500-$18,000 per ton of NOx + diesel PM reduced | 2005 | CARB, 2006 | Has not been tested or used in rail yard applications in the U.S. |
| CARB, 2006 | PM | Locomotives | Nonroad Mobile Sources | Locomotive Retrofit | DPF | | 2285002xxx | | >85 | | | | | CARB, 2006 | $6,500-$18,000 per ton of NOx + diesel PM reduced | 2005 | CARB, 2006 | Has not been tested or used in rail yard applications in the U.S. |
| CARB, 2006 | PM | Locomotives | Nonroad Mobile Sources | Use of Alternative Fuels | Biodiesel | | 2285002xxx | | >50 | | | | | CARB, 2006 | $6,500-$18,000 per ton of NOx + diesel PM reduced | 2005 | CARB, 2006 | Biodiesel generally results in a NOx increase, and is best used in combination with NOx control strategies. |

# Nonroad Detailed Control Measure List

**See cover note for important notes and caveats on the use of these tables**

| Primary Reference | Major Pollutant | Source Category | Source Sector | Control Measure | Technology | Model Year | Applicable SCC Codes | Control Efficiency (%) | | | | | | CE Reference | Cost Effectiveness | Cost Year | Cost Reference | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | PM 2.5 | PM | SO2 | NH3 | NOx | VOC | | | | | |
| EPA, 2005 | PM | Locomotives | Nonroad Mobile Sources | Diesel Idling Programs | Reduce Idling for Locomotives | | 2285002xxx | | | | | | | | | | | |
| STAPPA/ALAPCO, 2006 | PM | Locomotives | Nonroad Mobile Sources | I&M for Locomotives | Conduct Opacity Testing and Conduct Repairs | | 2285002xxx | | | | | | | CARB, 2005 | | | | This program is a voluntary agreement with the BNSF Railway Company and the Union Pacific Railroad Company to reduce PM emissions in California rail yards. |
| CARB, 2006 | PM | Locomotives | Nonroad Mobile Sources | Use of Alternative Fuels | Fisher-Tropsch Diesel | | 2285002xxx | | | | | | | | $6,500-$18,000 per ton of NOx + diesel PM reduced | 2005 | CARB, 2006 | Made from converting synthetic gas to a liquid hydrocarbon diesel, this synthetic diesel fuel contains less than 10 ppm sulfur, which directly reduces diesel PM and SOx emissions. |
| NJDEP, 2005 | NOx/PM | Commercial Marine Vessels | Nonroad Mobile Sources | Provide Electric Power to Ships at the Ports | Cold Ironing | | 2280002xxx | | 83-97 | | | 99 | | Environ, 2004 | $69,000/ton = average $16,000/ton = weighted average | | Environ, 2004 | Cost-effectiveness would improve in the case of new terminals or new vessels, due to the lack of operational, safety, and engineering challenges associated with retrofitting shorepower into existing port facilities. |
| CARB, 2006 | PM | Commercial Marine Vessels | Nonroad Mobile Sources | Add-On Controls | DPF | | 2280002xxx | | >85 | | | | | CARB, 2006 | | | | There are two kinds of filters available - passive and active. |
| CARB, 2006 | PM | Commercial Marine Vessels | Nonroad Mobile Sources | Add-On Controls | DOC | | 2280002xxx | | ~30 | | | | | CARB, 2006 | | | | |
| NJDEP, 2005 | SO2/PM | Commercial Marine Vessels | Nonroad Mobile Sources | Reduce Fuel Sulfur Content in Main Engines of Ocean-going vessels | Switch to Low Sulfur Fuel | | 2280002xxx | | 5 | 40 | | | | NJDEP, 2005 | | | | This measure must be implemented through petitioning EPA to generate a SECA application associated with MARPOL. |
| CARB, 2006 | NOx | Commercial Marine Vessels | Nonroad Mobile Sources | Add-On Controls | SCR | | 2280002xxx | | | | | 65-90 | | CARB, 2006 | | | | May reduce diesel PM emissions. |

# Nonroad Detailed Control Measure List

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| Primary Reference | Major Pollutant | Source Category | Source Sector | Control Measure | Technology | Model Year | Applicable SCC Codes | Control Efficiency (%) | | | | | | CE Reference | Cost Effectiveness | Cost Year | Cost Reference | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | PM 2.5 | PM | SO2 | NH3 | NOx | VOC | | | | | |
| NJDEP, 2005 | SO2/PM | Commercial Marine Vessels | Nonroad Mobile Sources | Limit Sulfur Content of Auxiliary Engine Fuel | Switch to Low Sulfur Fuel | | 2280002xxx | | | | | | | | | | | California has predicted that their auxiliary engine rule will yield the following reductions: 2.7 tons per day (TPD) of PM in 2007 and 3.7 TPD of PM in 2010.<br><br>California has predicted that their auxiliary engine fuel sulfur limit will cost the container and bulk shipping industry to reduce sulfur content of the fuel from 1% to 0.5% approximately $34 million in 2007. To further reduce the sulfur content of the fuel from 0.5% to 0.1% would cost approximately $38 million in 2010. |
| NJDEP, 2005 | SO2/PM | Commercial Marine Vessels Recreational Marine | Nonroad Mobile Sources | Reduce Fuel Sulfur Content for Smaller Commercial and Recreational Vessels | Switch to Low Sulfur Fuel | | 2280002xxx 228202xxxx | | 10 | 82-99.5 | | | | NJDEP, 2005 | | | | Emission reductions based on assumption that current sulfur level of 3,000 parts per million (ppm) is reduced to 500 and to 15 ppm. |
| CARB, 2006 | NOx/PM | Commercial Marine Vessels-Harbor Vessels | Nonroad Mobile Sources | Shore Based Electrical Power | Cold Ironing | | 2280002020 | | 12-27 | | | 12-27 | | CARB, 2006 | | | | No C-E values provided; likely to be cost-effective for ships that frequently visit ports equipped with shore power. Control efficiencies based on participation of 40% of tugboat fleet in 2010 and 80-100% of tugboat fleet in 2025. |
| CARB, 2006 | PM | Commercial Marine Vessels-Harbor Vessels | Nonroad Mobile Sources | Cleaner Marine Fuels | Biodiesel | | 2280002020 | | >50 | | | | | CARB, 2006 | | | | Generally results in a NOx increase. Biodiesel is best used in combination with NOx control strategies. |

# Nonroad Detailed Control Measure List

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| Primary Reference | Major Pollutant | Source Category | Source Sector | Control Measure | Technology | Model Year | Applicable SCC Codes | Control Efficiency (%) | | | | | | CE Reference | Cost Effectiveness | Cost Year | Cost Reference | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | PM 2.5 | PM | SO2 | NH3 | NOx | VOC | | | | | |
| CARB, 2006 | NOx | Commercial Marine Vessels-Harbor Vessels | Nonroad Mobile Sources | Cleaner Marine Fuels | Emulsified Diesel Fuel | | 2280002020 | | | | | | | CARB, 2006 | | | | ARB estimates that emulsified diesel fuel used in on-road engines can reduce NOx by 15 percent and PM by 50 percent. Additional testing is required to determine whether similar reductions are possible in marine engines. |
| CARB, 2006 | PM | Commercial Marine Vessels-Harbor Vessels | Nonroad Mobile Sources | Cleaner Marine Fuels | Compressed or liquefied natural gas or diesel/CNG dual fuel | | 2280002020 | | | | | | | | | | | Can result in significant reductions in NOx and PM. The results vary with specific application and the ratio of diesel to CNG used. Additional testing is required to determine whether similar reductions are possible in marine engines. |
| CARB, 2006 | NOx/PM | Commercial Marine Vessels-Ocean Going Vessels | Nonroad Mobile Sources | Shore Based Electrical Power | Cold Ironing | | 2280002010 | | 90 | | | 90 | | | $6,500-$18,000 per ton of NOx + diesel PM reduced | 2005 | CARB, 2006 | ARB assumes 90% control and participation of 20% of fleet in 2010 and 80% of fleet in 2020 |
| CARB, 2006 | SO2/PM | Commercial Marine Vessels-Ocean Going Vessels | Nonroad Mobile Sources | Cleaner Marine Fuels for Main Engines | Marine distillate fuels | | 2280002010 | | 75 | 75 | | 6 | | CARB, 2006 | $6,500-$18,000 per ton of NOx + diesel PM reduced | 2005 | CARB, 2006 | |
| CARB, 2006 | NOx/PM | Commercial Marine Vessels-Ocean Going Vessels | Nonroad Mobile Sources | Build New Ships that Far Exceed IMO Standards | New or Retrofitted Engines | | 2280002010 | | 60 | | | 90 | | CARB, 2006 | $6,500-$18,000 per ton of NOx + diesel PM reduced | 2005 | CARB, 2006 | |
| CARB, 2006 | SO2 | Commercial Marine Vessels-Ocean Going Vessels | Nonroad Mobile Sources | Cleaner Marine Fuels for Main Engines | Lower sulfur content | | 2280002010 | | 35 | 80 | | | | CARB, 2006 | $6,500-$18,000 per ton of NOx + diesel PM reduced | 2005 | CARB, 2006 | Control efficiencies assume use of lower sulfur content fuel oil of 5000 ppm |

# Nonroad Detailed Control Measure List

**See cover note for important notes and caveats on the use of these tables**

| Primary Reference | Major Pollutant | Source Category | Source Sector | Control Measure | Technology | Model Year | Applicable SCC Codes | Control Efficiency (%) | | | | | | CE Reference | Cost Effectiveness | Cost Year | Cost Reference | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | PM 2.5 | PM | SO2 | NH3 | NOx | VOC | | | | | |
| CARB, 2007 | SO2 | Commercial Marine Vessels-Ocean Going Vessels | Nonroad Mobile Sources | Cleaner Marine Fuels for Auxiliary Engines | Lower sulfur content | | 2280002010 | | 35 | 80 | | | | CARB, 2006 | $6,500-$18,000 per ton of NOx + diesel PM reduced | 2005 | CARB, 2006 | Control efficiencies assume use of lower sulfur content fuel oil of 5000 ppm |
| CARB, 2006 | NOx | Commercial Marine Vessels-Ocean Going Vessels | Nonroad Mobile Sources | Cleaner Marine Fuels | Emulsified Diesel Fuel | | 2280002010 | | | | | 30 | | | $6,500-$18,000 per ton of NOx + diesel PM reduced | 2005 | CARB, 2006 | Slight increase in fuel consumption and PM emissions. |
| CARB, 2006 | NOx | Commercial Marine Vessels-Ocean Going Vessels | Nonroad Mobile Sources | Vessel Speed Reduction Program | Extending speed reduction zones offshore | | 2280002010 | | | | | | | | $6,500-$18,000 per ton of NOx + diesel PM reduced | 2005 | CARB, 2006 | Slower speeds reduce main engine fuel consumption and result in significant NOx reductions. There is the potential for increases in diesel PM emissions for some vessels operating at slow speeds. |

**Acronyms**

EGR - Exhaust Gas Recirculation
SCR - Selective Catalytic Reduction
DOC - Diesel Oxidation Catalysts
DPF - Diesel Particulate Filters
CCV - Closed Crankcase Ventilation
APU - Auxiliary Power Units
GSE - Ground Support Equipment
CNG - Compressed Natural Gas
LPG - Liquefied Petroleum Gas
IMO - International Marine Organization
ULSD - Ultra-Low Sulfur Diesel

# Onroad VOC Measures

*Draft Version 1.0*

**See cover note for important notes and caveats on the use of these tables**

| Source Category | Emission Reduction Measure | Control Efficiency | Cost Effectiveness | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|
| School Bus | Diesel Retrofit - Diesel Oxidation Catalysts | 50 | 12000 - 49100 | Applies to 1990-2006 model years | PM, CO | EPA 2006b, EPA 2006d, EPA 2006 |
| School Bus | Diesel Retrofit - Catalyzed Diesel Particulate Filters | 90 | 12400 - 50500 | Applies to 1995-2006 model years | PM, CO | EPA 2006b, EPA 2006d, EPA 2006 |
| Class 6 & 7 HDDVs | Diesel Retrofit - Diesel Oxidation Catalysts | 50 | 27600 - 67900 | Applies to 1990-2006 model years | PM, CO | EPA 2006b, EPA 2006d, EPA 2006 |
| Class 6 & 7 HDDVs | Diesel Retrofit - Catalyzed Diesel Particulate Filters | 90 | 28400 - 69900 | Applies to 1995-2006 model years | PM, CO | EPA 2006b, EPA 2006d, EPA 2006 |
| Class 8B HDDVs | Diesel Retrofit - Diesel Oxidation Catalysts | 50 | 11100 - 40600 | Applies to 1990-2006 model years | PM, CO | EPA 2006b, EPA 2006d, EPA 2006 |
| Class 8B HDDVs | Diesel Retrofit - Catalyzed Diesel Particulate Filters | 90 | 12100 - 44100 | Applies to 1995-2006 model years | PM, CO | EPA 2006b, EPA 2006d, EPA 2006 |
| HDDVs | Diesel Retrofit - Active Diesel Particulate Filter | 60 - 93 | | | PM, CO | STAPPA/ALAPCO 2006, EPA 2006 |
| HDDVs | Diesel Retrofit - Flow Through Filter | 50 - 89 | | Applies to 1991 - 2002 model years; needs 15 ppm sulfur diesel or CARB diesel | PM, CO | STAPPA/ALAPCO 2006; CARB 2006a, EPA 2006 |
| HDDVs | Diesel Retrofit - NOX Adsorber | 10 - 90 | | | PM, NOX, CO | STAPPA/ALAPCO 2006, EPA 2006 |
| HDDVs | Alternative Fuel - Biodiesel | 0 - 50 | | Increases NOX | PM, CO | EPA 2006e; STAPPA/ALAPCO 2006 |
| HDDVs | Alternative Fuel - Oxygenated Diesel | 0 - 50 | | Oxygenated with ethanol; Nox emissions likely to increase | PM, CO, CO2 | STAPPA/ALAPCO 2006 |
| HDDVs | Alternative Fuel - Fuel-borne Catalyst | 0 - 50 | | | PM, NOX, CO | STAPPA/ALAPCO 2006 |
| Class 5 and above HDDVs and Diesel Buses | Replacement | 72 - 89 | | Applies to 1990-2006 model years | PM, NOX | EPA 2006d |
| Class 8 HDDVs | Intermodal - shift of transportation of goods from truck to rail transport | 1.0 | 0 | Would result in a 0.3-0.4% increase in all pollutants from locomotive and rail SCCs; represents a 1% shift from truck-only transport to | PM, NOX, SO2, NH3 | EPA 2006d |
| Class 8 HDDVs | Eliminate Long Duration Idling with Truck Stop Electrification | 3.4 | 0 | Upfront capital costs fully recovered by fuel savings | PM, NOX, SO2, CO | EPA 2006d, EPA 2004 |
| Class 8 HDDVs | Eliminate Long Duration Idling with Mobile Idle Reduction Technologies | 3.4 | 0 | Upfront capital costs fully recovered by fuel savings | PM, NOX, SO2, CO | EPA 2006d, EPA 2004 |

# Onroad VOC Measures

**See cover note for important notes and caveats on the use of these tables**

| Source Category | Emission Reduction Measure | Control Efficiency | Cost Effectiveness | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|
| Light-Duty Gasoline Vehicles and Trucks | Best Workplaces for Commuters-all measures combined | 0.4-1.0 | | Reductions based on the following measures: Regional Rideshare, Vanpool Programs, Park-and-ride lots, Regional TDM, Employer trip reduction programs; control efficiency depends on penetration--0.4% reduction at 10% penetration and 1.0% reduction at 25% penetration | PM, NOX, SO2, NH3, CO | EPA 2006d, EPA 2005b |
| LDGVs, LDGTs, HDGVs, and MCs | Federal Reformulated Gasoline | 27 | | | NOX, CO | Pechan 2006, EPA 1999 |
| LDGVs and LDGTs | High Enhanced I/M Program | 1.8 - 19.8 | | Reduction is based on emissions from entire fleet | NOX, CO | Pechan 2006 |
| LDGVs and LDGTs | Repair assistance for low-income owners of older poorly maintained vehicles | | | | NOX | NJDEP 2005b |
| LDGVs and LDGTs | MPG/Emissions Requirements for Large Fleets | | | | NOX, PM, SO2 | NJDEP 2005b |
| LDGVs and LDGTs | Fee based on VMT | | | | NOX, PM, SO2, | NJDEP 2005b |
| LDGVs and LDGTs | Alternative Fuels Tax Credit | | | | | NJDEP 2005b |
| LDGVs and LDGTs | Electric Shuttles in Structured Communities | | | | NOX, PM, SO2, NH3 | NJDEP 2005b |
| LDGVs and LDGTs | Electric Vehicle Charging Stations | | | | NOX, PM, SO2 | NJDEP 2005b |
| LDGVs and LDGTs | Expansion of Bike/hiking trails | | | | NOX, PM, SO2, NH3 | NJDEP 2005b |
| HDDVs | Driver incentive/training program to reduce idling | | | | NOX, PM, SO2 | NJDEP 2005a |

# Onroad VOC Measures

**See cover note for important notes and caveats on the use of these tables**

| Source Category | Emission Reduction Measure | Control Efficiency | Cost Effectiveness | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|
| LDGVs and LDGTs | Incentives for hybrids and other ULEV, SULEV, ZEV vehicles | | | | NOX, PM, SO2 | CARB 2006b |
| All Highway Vehicles | Smoking Vehicle Hotline | | | | PM, NOX | CARB 2006b |

**Acronyms:**

LDGV=Light-duty Gasoline Vehicle

LDGT=Light-duty Gasoline Truck

HDGV=Heavy-duty Gasoline Vehicle

MC=Motorcycle

LDDV=Light-duty Diesel Vehicle

LDDT=Light-duty Diesel Truck

HDDV=Heavy-duty Diesel Vehicle

# Onroad NH3 Measures

*Draft Version 1.0*

**See cover note for important notes and caveats on the use of these tables**

| Source Category | Emission Reduction Measure | Control Efficiency | Cost Effectiveness | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|
| Class 8 HDDVs | Intermodal - shift of transportation of goods from truck to rail transport | 1.0 | 0 | Would result in a 0.3-0.4% increase in all pollutants from locomotive and rail SCCs; represents a 1% shift from truck-only transport to rail | PM, NOX, SO2, VOC | EPA 2006d |
| LDGVs and LDGTs | Best Workplaces for Commuters-all measures combined | 0.4-1.0 | | Reductions based on the following measures: Regional Rideshare, Vanpool Programs, Park-and-ride lots, Regional TDM, Employer trip reduction programs; control efficiency depends on penetration--0.4% reduction at 10% penetration and 1.0% reduction at 25% penetration | PM, NOX, VOC, SO2, CO | EPA 2006d, EPA 2005B |
| LDGVs and LDGTs | Fee based on VMT | | | | VOC, NOX, PM, | NJDEP 2005b |
| LDGVs and LDGTs | Electric Shuttles in Structured Communities | | | | VOC, NOX, PM, SO2 | NJDEP 2005b |
| LDGVs and LDGTs | Expansion of Bike/hiking trails | | | | VOC, NOX, PM, | NJDEP 2005b |

**Acronyms:**
LDGV=Light-duty Gasoline Vehicle
LDGT=Light-duty Gasoline Truck
HDGV=Heavy-duty Gasoline Vehicle
MC=Motorcycle
LDDV=Light-duty Diesel Vehicle
LDDT=Light-duty Diesel Truck
HDDV=Heavy-duty Diesel Vehicle

# Onroad VOC and NH3 Measure References

*Draft Version 1.0*

**See cover note for important notes and caveats on the use of these tables**

| Key | Reference |
|---|---|
| **References for Onroad VOC and NH3** | |
| CARB 2006a | California Air Resources Board, "Currently Verified Diesel Emission Control Technologies," as of September 6, 2006 http://www.arb.ca.gov/diesel/verdev/verifiedtechnologies/cvt.htm |
| CARB 2006b | California Air Resources Board, "ARB Programs," updated May 4, 2006 http://www.arb.ca.gov/html/programs.htm |
| ENVIRON 2006 | ENVIRON International Corporation, "Evaluation of Candidate Mobile Source Control Measures", Final Report, prepared for Lake Michigan Air Directors Consortium, 2250 E. Devon Ave., #250, Des Plaines, IL 60018, February 28, 2006. http://www.ladco.org/reports/rpo/Regional%20Air%20Quality/LADCO%20Control%20Report_Final.pdf |
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# Fugitive Dust Measures

Draft Version 1.0

**See cover note for important notes and caveats on the use of these tables**

**Stationary Source Fugitive Dust Measures**

| Source category | Emissions reduction measure | Control efficiency (%) | Cost effectiveness ($/ton reduced) | Cost Year | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|---|
| Abrasive blasting | Water spray | 50-93% (PM10) | Not available | | | | **WRAP 2006** |
| Abrasive blasting | Enclosure, fabric filter | 95% (PM10) | Not available | | | | **WRAP 2006** |
| Mineral products industry wide variety of sources | Control measures identified in WRAP fugitive dust manual, chapter 11 | Variable | Not available | | | | **WRAP 2006** |
| Open area wind erosion | Control measures identified in WRAP fugitive dust manual, chapter 8 | Variable | Not available | | | | **WRAP 2006** |
| Storage pile wind erosion | Control measures identified in WRAP fugitive dust manual, chapter 9 | Variable | Not available | | | | **WRAP 2006** |

**Ref: Western Regional Air Partnership (WRAP) Fugitive Dust Handbook**
**http://www.wrapair.org/forums/dejf/fdh/index.html**

# Fugitive Dust Measures

Draft Version 1.0

**See cover note for important notes and caveats on the use of these tables**

**On-road fugitive dust measures**

| Source category | Emissions reduction measure | Control efficiency (%) | Cost effectiveness ($/ton reduced) | Cost Year | Notes/caveats | Other pollutants controlled | References for more information |
|---|---|---|---|---|---|---|---|
| Paved Roads | Street Sweeping | Effectiveness varies with frequency | | | | | |
| Paved Roads | Require 4 foot paved shoulders | | (all new paved roads) $13,800 - $554,000, (50% of existing paved roads) $7,290-$11,300 - per ton of PM10 | 2002$ | | | San Joaquin Valley UAPCD 2003 |
| Paved Roads | Require wind- and water-borne deposition to be removed within 24 hours of discovery | | $2,850 per ton PM10 reduced | 2002$ | | | San Joaquin Valley UAPCD 2003 |
| Unpaved Roads | Chemical Stabilization/ Dust Suppressant Application | 25 | $2,753 per ton PM removed | 1990$ | | | EPA 1986 |
| Unpaved Roads | Implement rules to limit visible dust emissions to 20% opacity on unpaved parking areas receiving up to 100 trips per day | | $5,230-$30,500 per ton PM10 | 2002$ | | | San Joaquin Valley UAPCD 2003 |
| Unpaved Roads | Limit max speed on unpaved roads to 25 mph | | $1,080 per ton PM10 | 2002$ | | | San Joaquin Valley UAPCD 2003 |
| Unpaved Roads | Pave unpaved roads and unpaved parking lots | 25 | $2,160-$5,920 per ton PM10 (2002$) | 2002$ | | | San Joaquin Valley UAPCD 2003 |
| Unpaved Roads | Require paving, 4 inches gravel, or dust suppressant at special event parking | | $5,980-$63,200 per ton PM10 | 2002$ | | | San Joaquin Valley UAPCD 2003 |


**Ref: San Joaquin Valley UAPCD 2003**

San Joaquin Valley Unified Air Pollution Control District (UAPCD). Final BACM Technological and Economic Feasibility Analysis, prepared by Sierra Research, March 21, 2003.
www.soiltac.com/PDF/Final_BACM_Chapter 20 - Fugitive Dust 287Feasibility_Analysis.pdf.

**Ref: EPA 1986**

"Identification, Assessment, and Control of Fugitive Particulate Emissions," EPA/600/8-86/023. Prepared by Midwest Research Institute, August 1986.

With the recent release of the ISO 37120 standard, "Sustainable development of communities – Indicators for city services and quality of life," participating STAR communities have asked how these new international standards fit in to their work on the US-based STAR Community Rating System (STAR). In early June, STAR Communities conducted a gap analysis of the new ISO standard (released May 15, 2014) and version 1.1 of the STAR Community Rating System (released in January 2014). Our intent was to explore similarities and differences and inform our process as we continuously improve metrics and reporting for communities engaged in holistically tracking their sustainability progress.

For context, STAR is a national rating system and certification program built by and for local governments and the communities they serve. The intent of STAR is not to rank cities across a standard set of indicators, but rather provide a verified rating of their efforts given a menu of sustainability goals and objectives. These goals and objectives are defined through hundreds of evaluation measures – both quantitative community-level outcome measures and qualitative local action measures. Communities select what they will report on. The ISO Standard establishes data collection requirements that will allow cities to rank each other based on a common indicator. Once certified, a STAR community maintains its certification for three years. The ISO requires annual reporting for compliance.

Here are a few general similarities between STAR and the ISO 37120:

- Both systems divide quantitative metrics into multiple categories covering an array of sustainability topics;
- They allow for cities and counties to participate (counties as individuals in STAR; as aggregates in ISO);
- Each provide methodologies and describe limitations on data reporting;
- They intend to provide communities a standardized means of performance measurement and sharing of best practices; and
- Both offer tools for tracking and monitoring progress.

Before we do a deeper dive into the evaluation, we wanted to highlight that our review focused on STAR's community level outcome measures, the condition-level indicators that depict a community's progress toward a preferred state or condition. Represented as trend lines, targets or thresholds in the rating system, they are most similar to the indicators structure of the ISO standard.

***Framework and Design***

As discussed above, each system has delineated metrics into theme or goal areas based on the aspect of sustainability being addressed. ISO 37120 includes 17 Theme Areas.

STAR provides a framework of 7 goal areas, 44 objectives, and an optional innovation category.

| **ISO 37120 Theme Areas** | |
|---|---|
| Economy | Safety |
| Education | Shelter |
| Energy | Solid Waste |
| Environment | Telecommunications and Innovation |
| Finance | Transportation |
| Fire and Emergency Response | Urban Planning |
| Governance | Wastewater |
| Health | Water and Sanitation |
| Recreation | |

**STAR's Menu of Goals & Objectives**

| Built Environment | Climate & Energy | Economy & Jobs | Education, Arts & Community | Equity & Empowerment | Health & Safety | Natural Systems |
|---|---|---|---|---|---|---|
| Ambient Noise & Light | Climate Adaptation | Business Retention & Development | Arts & Culture | Civic Engagement | Active Living | Green Infrastructure |
| Community Water Systems | Greenhouse Gas Mitigation | Green Market Development | Community Cohesion | Civil & Human Rights | Community Health & Health System | Invasive Species |
| Compact & Complete Communities | Greening the Energy Supply | Local Economy | Educational Opportunity & Attainment | Environmental Justice | Emergency Prevention & Response | Natural Resource Protection |
| Housing Affordability | Industrial Sector Resource Efficiency | Quality Jobs & Living Wages | Historic Preservation | Equitable Services & Access | Food Access & Nutrition | Outdoor Air Quality |
| Infill & Redevelopment | Resource Efficient Buildings | Targeted Industry Development | Social & Cultural Diversity | Human Services | Indoor Air Quality | Water in the Environment |
| Public Spaces | Resource Efficient Public Infrastructure | Workforce Readiness | | Poverty Prevention & Alleviation | Natural & Human Hazards | Working Lands |
| Transportation Choices | Waste Minimization | | | | Safe Communities | |

Since the ISO Theme Areas and STAR's Goals and Objectives are not exact matches, each STAR outcome measure was evaluated against the ISO Theme Area it most closely matched. Next, the STAR outcome measures were compared to related ISO indicators in terms of the type of data collected, the methodology used, and the constraints on the indicator. The analysis of each Theme Area, provided below, does not delve into minor differences, such as the use of Metric versus US units. Also, a number of the ISO indicators measure on a per capita or per 100,000 population basis. STAR outcome measures use per capita on a very limited basis.

Regarding the indicators, we were surprised to find that only a third of the ISO indicators overlapped with STAR outcome measures. The reasons for this vary, but in many cases it relates to STAR's use of compliance with a national standard in place of an actual value. For example, if a community is in attainment for air quality, they can provide supporting documentation to that effect. They only need to provide values for PM 2.5, PM 10, and Ozone if they are in non-attainment. Similarly, STAR's wastewater management outcome is a measure of compliance with EPA effluent standards.

In other cases, ISO indicators focus on topics that represent greater disparities or issues in non-US cities, such as *Number of two-wheel motorized vehicles per capita, Percentage of city population living in slums,* and *Percentage of city population with authorized electrical service*.

Finally, a reason for low overlap might be that STAR is based on thresholds and some of the omitted indicators do not have a reputable source for what "doing well" would be, such as *Number of firefighters per 100,000 population* or *Number of police officers per 100,000 population*.

There are two Theme Areas where STAR does not have any corresponding outcome measures: Finance and Telecommunications/Innovations. There are 8 STAR outcome measures that did not fit neatly into any of the ISO Theme Areas, including Vulnerability Reduction, Creative Industries, Attendance and Participation in Arts, Social and Cultural Events, Volunteerism, Local Fresh Foods, School Nutrition, and Certified Sustainable Harvests.

**Next Steps**

Speaking from a STAR perspective, there were several ISO indicators that could be developed into the STAR Community Rating System in the future, such as youth unemployment rate; debt service ratio; number of fire related deaths per 100k population; and number of physicians per 100k population. Most were evaluated during STAR's development and at the time it was determined that either trend lines, targets and/or thresholds were not in place or that data sets were not consistently available. STAR's technical and governance committees review metrics and complimentary systems annually to ensure that STAR remains relevant, feasible, timely, useful, systemic, reliable and valid.

Quantified rating systems that are standardized are relatively new for communities. While we discovered that the new ISO standard and STAR do not overlap as much as we thought they might, we found new potential outcomes that may be valuable to include and alternative ways of quantifying metrics. STAR understands that municipalities will want to minimize their data collection efforts and prefer to submit one metric for multiple areas. Over the coming years, we will be working closely with ISO as well as

other state and regional programs to determine ways of streamlining the collection process and improving our system.

**Appendix A:** Side x Side Analysis of the ISO 37120 and STAR Community Rating System Alignment

| In Economy, both systems cover… | |
|---|---|
| • Poverty<br>• Number of businesses<br>• Unemployment Rate<br>• Employment Rate | |
| ISO Standard | STAR Community Rating System |
| • Poverty threshold is set by the World Bank for each country. Poverty rate determined by multiplying the number of city households living at or below by the current average number of persons per household (core) | • Outcome considers reduction in poverty to none by 2025. Data from Small Area Income and Poverty Estimates (SAIPE) Program. |
| • Businesses per 100K population (supporting) | • Businesses establishments increased over 3 years; based on County Business Pattern data |
| • Unemployment: Working-age city residents available and seeking work/labour force (core) | • Unemployment rate outcome is combined with Employment rate, but recorded separately; data provided by the US Census; considers a demonstrated decrease over 3 years or more |
| • Employment: constrained to full-time employment (35+ hours) (supporting) | • Employment rate outcome is combined with Unemployment Rate, but recorded separately; data provided by the US Census; allows for part-time work; considers a demonstrated increase over 3 years or more. |
| • Also includes:<br>○ Assessed value of commercial and industrial properties as a % of total assessed value of all properties (core)<br>○ Youth unemployment rate (supporting)<br>○ Number of new patents per 100K population per year (supporting) | • Also includes:<br>○ Housing & Transportation Costs<br>○ Economic Impact of Historic Preservation<br>○ Equitable Poverty Reduction<br>○ Annual sales<br>○ Community self-reliance (import sectors; LQ)<br>○ Local Bank Deposits<br>○ Median Household Income<br>○ Targeted Industry Business<br>○ Targeted Industry Sales<br>○ Targeted Industry Employment<br>○ Food Security and Assistance |

| In Education, both systems cover… | |
|---|---|
| • Graduation rates (i.e. completion of secondary education)<br>• Higher education degrees | |
| ISO Standard | STAR Community Rating System |
| • Completion of secondary education as a percent of students (i.e. survival rate) (core) | • Graduation rate: Achievement of 90% average 4-year adjusted cohort or incremental progress in past 3 years |
| • Number of higher education degrees per 100K population; aggregated (supporting) | • Workforce Mobility: increasing trend in percent of population with associate, bachelors, and professional (masters/doctorate) degrees. Not aggregated; Census based. |
| • Also includes:<br>○ % female school-aged population enrolled in schools (core)<br>○ % students completing primary education (core)<br>○ Ratio of students to teacher in primary education (core)<br>○ % male school-aged population enrolled in schools (supporting)<br>○ % of school-aged population enrolled in schools (supporting) | • Also includes:<br>○ Reading proficiency (3rd grade)<br>○ Graduation Rate Equity (for selected underperforming groups of race/ethnicity, disability, English proficiency, or income)<br>○ Trained Workforce (workforce training outcomes)<br>○ IAQ Complaints to School District |

| In Energy, both systems cover… | |
|---|---|
| • Renewable Energy Sources<br>• Electrical Energy Use<br>• Residential Energy Use<br>• Public Building Energy Use | |
| ISO Standard | STAR Community Rating System |
| • Renewable Energy as a percent of total energy, including combustible (i.e. WTE) and non-combustible. Allows for hydro and request breakdown of derivative sources of total energy consumption. (core) | • Electrical Energy Supply: based on a portion of overall energy supply from renewable sources; allows use of RECs |
| • Electrical Energy Use – kWh/year per capita for all uses (commercial, industrial, residential) (supporting) | • Energy Efficiency is measured in three separate outcomes: Industrial, Buildings, and Public Infrastructure. Buildings blend commercial and residential, including public building that might be typically considered commercial (i.e. libraries, city hall, rec centers, etc). "Energy" is inclusive of all energy types: electricity, natural gas, propane, etc. Energy measured as MMBTU. Industrial and Public Infrastructure are measured as trends for total energy use. Buildings are measured based on Energy Use Intensity (energy use per sf) |
| • Residential Electrical Use per capita (core) | • Residential is lumped with Commercial in "Buildings" category. Measured as Energy Use Intensity, not per capita. Threshold is target reduction of 80% by 2050. Energy measured as MMBTU |
| • Energy consumption of public buildings per year (kWh/m2) (core) | • Public buildings (not infrastructure) are lumped with Buildings. Threshold is target reduction of 80% by 2050. Energy measured as MMBTU |
| • Also includes:<br>○ % of city population with authorized electrical service (core)<br>○ Average number of electrical interruptions per customer per year (supporting)<br>○ Average length of electrical interruptions (in hours) (supporting) | • Also includes:<br>○ Green-Certified Building Stock<br>○ Energy Efficiency of public infrastructure<br>○ Green Retrofits of historic structures<br>○ Renewable Energy Use – RECs purchased by residents annually |

| In Environment, both systems cover… | |
|---|---|
| • Noise pollution<br>• GHG<br>• Fine particulate matter (PM2.5) concentration<br>• Particulate matter (PM10) concentration<br>• O3 (ozone) concentration | |
| ISO Standard | STAR Community Rating System |
| • Noise quantified as L(den)>55 dB(A); indicator expressed as % of population affected by noise pollution. Alternative measure of L(n)>50 dB(A), at night. (supporting) | • Noise threshold of 70 dB(A) in commercial areas. |
| • GHG per capita; uses GPC's GHG Protocol. Annual quantified emissions for 4 sources: stationary units, mobile units, waste, and industrial process/product use sectors. (core) | • GHG straight number for entire community. Threshold of 80% reduction by 2050. |
| • Fine particulate matter (PM2.5) (core) | • Lumped with 3 other criteria pollutants and AQI as an alternative outcome if a city is in non-attainment. |
| • Particulate matter (PM10) concentration (core) | • Lumped with 3 other criteria pollutants and AQI as an alternative outcome if a city is in non-attainment. |
| • O3 (ozone) concentration (supporting) | • Lumped with 3 other criteria pollutants and AQI as an alternative outcome if a city is in non-attainment. |
| • Also includes:<br>○ NO2 (nitrogen dioxide) concentration (supporting)<br>○ SO2 (sulphur dioxide) concentration (supporting)<br>○ % change in number of native species (supporting) | • Also includes:<br>○ AQI – Air Quality Index<br>○ Light (glare & trespass)<br>○ Light in the Night Sky<br>○ Community Resource Efficiency (GHG intensity measured as GHG/GDP)<br>○ Invasive Species Containment<br>○ Invasive Species Eradication<br>○ Priority Natural System Areas<br>○ Wetlands, Streams, and Shoreline Buffers<br>○ Connectivity<br>○ Restoration<br>○ Land Management |

| In Finance, both systems cover… | |
|---|---|
| • | |
| ISO Standard | STAR Community Rating System |
| • Debt Service Ratio (core) | • None |
| • Capital spending as a percentage of total expenditures (supporting) | • |
| • Own-source revenue as a percentage of total revenues (supporting) | • |
| • Tax collected as a percentage of tax billed | • |

| In Fire and Emergency Response, both systems cover… | |
|---|---|
| • Emergency Response Times | |
| ISO Standard | STAR Community Rating System |
| • Emergency response services from initial call (not fire) (supporting) | • Uses NFPA standards that include EMT and Fire. Measured from time of dispatch, not initial call. Must comply with standards for first arrival and full deployment. |
| • Fire response time from initial call (supporting) | • Uses NFPA standards that include EMT and Fire. Measured from time of dispatch, not initial call. Must comply with standards for first arrival and full deployment. |
| • Also includes:<br>○ Number of firefighters per 100K population (core)<br>○ Number of fire related deaths per 100K population (core)<br>○ Number of natural disaster related deaths per 100K population (core)<br>○ Number of volunteer and part-time firefighters per 100K population (supporting) | • Also includes:<br>○ Superior Fire Protection (Class 4 ISO rating or better)<br>○ Compliance with National Incident Management System (NIMS) |

| In Governance, both systems cover… | |
|---|---|
| • Voter Participation in municipal election<br>• Registered voters as percent of voting age population | |
| ISO Standard | STAR Community Rating System |
| • Voter participation as a percentage of eligible voters (core) | • Asks for increase in percentage of registered voters participating in local elections. Combined with registered voters per eligible population. |
| • Percent of registered voters per voting age population (supporting) | • Similar; Note that STAR identified a challenge in tracking the number of registered voters as Election Commissions may not remove someone from the rolls until they do not participate in 1 or more election. This can artificially inflate the number of registered to population size. |
| • Also includes:<br>○ Women as a percentage of total elected to city-level office (core)<br>○ Percentage of women employed in the city government workforce (supporting)<br>○ Number of convictions for corruption and/or bribery by city officials per 100K population (supporting)<br>○ Citizens' representation: number of local officials elected to office per 100K population (supporting) | • Also includes:<br>○ Diverse Community Representation, measured by racial/ethnic diversity on appointed boards/commissions, not elected officials<br>○ Sense of Empowerment, based on survey of residents on positive impact<br>○ Resolution of Complaints, related to civil and human rights complaints investigated and redressed in a timely manner |

| In Health, both systems cover… | |
|---|---|
| • Average Life Expectancy (Mortality) | |
| ISO Standard | STAR Community Rating System |
| • Average life expectancy (core) | • Health Outcomes: STAR bases this on County Health profile, not a specific number. May include factors not specific to life expectancy. Threshold of top 15% of counties in the state. |
| • Also includes:<br>○ Number of in-patient hospital beds per 100K population (core)<br>○ Number of physicians per 100K population (core)<br>○ Under age five mortality per 1000 live births (core)<br>○ Number of nursing and midwifery personnel per 100K population (supporting)<br>○ Number of mental health practitioners per 100K population (supporting)<br>○ Suicide rate per 100K population (supporting) | • Also includes:<br>○ Reduced Risk and Exposure, related to prioritized Environmental Justice sites<br>○ Active Adults, based on leisure time physical activity of aged 20+, as Top 15% of counties in state<br>○ Active Kids, based on 60 minutes per day of physical activity for high schools or requirement for daily physical activity in all public schools.<br>○ Health Behaviors, based on County Health profile, as Top 15% of counties in state<br>○ Clinical Care, based on County Health profile, as Top 15% of counties in state<br>○ Quality of Local Health System, based on recognition by national organization or professional certification |

| In Recreation, both systems cover… | |
|---|---|
| • Public outdoor recreation space/Acreage of parks<br>• Indoor recreation space/Community venues | |
| ISO Standard | STAR Community Rating System |
| • Square meters of public outdoor recreation space per capita (supporting) | • Acreage of parkland with threshold based on population density. These may or may not overlap based on how the city defines "outdoor rec space" versus parks. Outdoor space is also included in STAR's outcomes for Community Venues and Green Infrastructure Distribution. |
| • Square meters of public indoor recreation space per capita (supporting) | • Community Venues. STAR considers both indoor and outdoor venues with programmed activities. Measure is based on proximity (>1mile) of at least 75% of residents. |
| • Also includes:<br>○ None | • Also includes:<br>○ Use and Satisfaction, based on surveys of parks and public space<br>○ Green Infrastructure Distribution, based on proximity (1/2 mile) from green infrastructure features, including recreation through parks and/or greenways |

| In Safety, both systems cover… | |
|---|---|
| • Violent Crime Rate<br>• Number of homicides per 100K population | |
| ISO Standard | STAR Community Rating System |
| • Violent crime rate per 100K population, as an aggregate of homicides, rape/attempted rape, aggravated assault, and robbery. (supporting) | • Violent crime rate per 100K with specific thresholds set for homicide, rape/attempted rape, and aggravated assaults. Does not include robbery. |
| • Number of homicides per 100K population (core) | • Number of homicides is included in STAR's Violent Crime Rate outcome |
| • Also includes:<br>○ Number of police officers per 100K population (core)<br>○ Crimes against property per 100K (supporting)<br>○ Response time for police department from initial call (supporting) | • Also includes:<br>○ Location-specific hazards, property or infrastructure at risk for natural hazard (i.e. flood, avalanche, etc)<br>○ Full Community Hazard<br>○ School violence, incidents per 1000 students in public schools |

| In Shelter, both systems cover… | |
|---|---|
| • Homeless population | |
| ISO Standard | STAR Community Rating System |
| • Number of homeless per 100K population (supporting) | • Human Services Assistance, it may be included (at the community's option) as a priority population. Additional metrics may be reported per priority population, such as trends on healthcare, housing assistance, substance abuse, etc. |
| • Also includes:<br>○ Percentage of city population living in slums (core)<br>○ Percentage of households that exist without registered legal titles (supporting) | • Also includes:<br>○ IAQ Complaints to Enforcement Agency<br>○ Affordable Housing within a Compact and Complete Community<br>○ Affordable Housing Production<br>○ Affordable Housing Preservation |

| In Solid Waste, both systems cover… | |
|---|---|
| • Total Solid Waste | |
| ISO Standard | STAR Community Rating System |
| • Total collected municipal solid waste per capita (core)<br>• Percentage of the city's solid waste that is disposed of in a sanitary landfill (supporting)<br>• Percentage of the city's solid waste that is disposed of in an incinerator (supporting) | • Total Solid Waste; STAR considers the total solid waste generated within the jurisdiction, not a measurement of per capita. Threshold set as achieving 100% reduction by 2050. ISO excludes C&D waste. STAR also specifies waste disposed of by landfill or incinerator (not WTE). |
| • Also includes:<br>○ Percentage of city population with regular solid waste collection (residential) (core)<br>○ Percentage of the city's solid waste that is recycled (core)<br>○ Percentage of the city's solid waste that is burned openly (supporting)<br>○ Percentage of the city's solid waste that is disposed of in an open dump (supporting)<br>○ Percentage of the city's solid waste that is disposed of by other means (supporting)<br>○ Hazardous Waste Generation per capita (tonnes) (supporting)<br>○ Percentage of the city's hazardous waste that is recycled (supporting) | • Also includes:<br>○ None |

| In Telecommunications and Innovation, both systems cover… | |
|---|---|
| • None | |
| ISO Standard | STAR Community Rating System |
| • Number of internet connections per 100K population (core)<br>• Number of cell phone connections per 100K population (core)<br>• Number of landline phone connections per 100K (supporting) | • None |

| In Transportation, both systems cover… | |
|---|---|
| • Bike paths and lanes<br>• Commuters/Mode Split<br>• Fatalities<br>• Personal autos per capita | |
| ISO Standard | STAR Community Rating System |
| • Kilometers of bicycle paths and lanes per 100K population (supporting) | • Not a STAR outcome, but an action with a threshold of 10% increase in the past 3 years. Measured in miles, not kilometers. Both exclude routes that only include signage. STAR action available in BE-7 and NS-4. STAR measures two sides of road separately (i.e. 1 linear mile of street with bike lanes on both sides equals 2 miles). ISO does not specify. |
| • Percentage of commuters using a travel mode to work other than a personal vehicle; personal vehicle defined as single occupancy vehicle (supporting) | • Mode Split, sets maximum for drive alone and minimums for Bike+Walk+Transit and Bike+Walk. Does not include carpool or motorcycle trips. |
| • Transportation fatalities per 100K population; all modes of travel (supporting) | • Transportation Safety, with a focus on pedestrian and bicyclist fatalities |
| • Number of personal automobiles per capita; excludes commercial vehicles (core) | • Green vehicles, STAR asks for increased green vehicle ownership in the community; as part of this, the community would need to identify total vehicles. Measure is in total, not per capita. STAR does not specify regarding commercial vehicles. |
| • Also includes:<br>○ Kilometres of high capacity public transport system per 100 000 population (core)<br>○ Kilometres of light passenger public transport system per 100 000 population (core)<br>○ Annual number of public transport trips per capita (core)<br>○ Number of two-wheel motorized vehicles per capita (supporting)<br>○ Commercial air connectivity (supporting) | • Also includes:<br>○ Walkability, within a Compact and Complete Community area<br>○ Transportation Affordability<br>○ Green Vehicles, increased ownership of alternative fuel and fuel efficient vehicles. |

| In Urban Planning, both systems cover… | |
|---|---|
| • Green area | |
| ISO Standard | STAR Community Rating System |
| • Green area (hectares) per 100K population; must be publicly accessible (core) | • Designated Green Infrastructure, including a variety of green spaces and vegetated surfaces (tree canopy, green roof, wetlands) Also links with Public Spaces outcome. |
| • Also includes:<br>○ Annual number of trees planted per 100K population (supporting)<br>○ Areal size of informal settlements as a percentage of city area (supporting)<br>○ Jobs/housing ratio (supporting) | • Also includes:<br>○ Density, Destinations, and Transit, in a Compact and Complete Community area<br>○ Design, in a Compact and Complete Community area<br>○ Infill Development<br>○ Existing Infrastructure, or a measure of new development use of pre-existing infrastructure<br>○ Accessibility, walk distance to public space or park<br>○ Connectivity, within 3 miles of off-road trail<br>○ Neighborhood Cohesion, survey of positive affiliation<br>○ Local Historic District(s)<br>○ Preserved structures and sites, designated historic<br>○ Equitable Access and Proximity to community services, facilities, and infrastructure<br>○ Access to Healthful Food, and Food Desert area |

| In Wastewater, both systems cover… | |
|---|---|
| • None | |
| ISO Standard | STAR Community Rating System |
| • Percentage of city population served by wastewater collection (core)<br>• Percentage of city's wastewater that has received no treatment (core)<br>• Percentage of city's wastewater receiving primary treatment (core)<br>• Percentage of city's wastewater receiving secondary treatment (core)<br>• Percentage of city's wastewater receiving tertiary treatement (core) | • Safe Wastewater Management, as measured by compliance of POTW and industrial dischargers with EPA effluent permits |

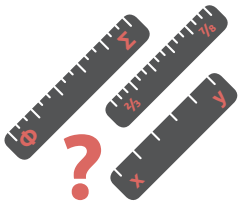
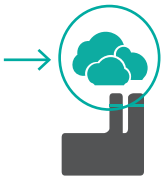
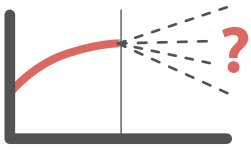
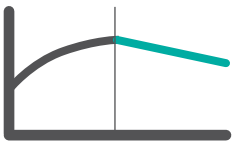
| In Water and Sanitation, both systems cover… | |
|---|---|
| • Water Quality<br>• Domestic Water Consumption<br>• Total Water Consumption | |
| ISO Standard | STAR Community Rating System |
| • Percentage of city population with sustainable access to an improved water source (core) | • Drinking Water Quality, based on meeting EPA standards for coliform bacteria, turbidity, and water pathogens |
| • Total domestic water consumption per capita. ISO excludes commercial/industrial uses. (core) | • Secure Water Supply that includes projections of a city's demands. It is assumed that such demand would be based on consumption per capita. Both measures are specific to potable water supply. STAR does not specify domestic versus commercial/industrial use, but does indicate "drinking water supply". |
| • Total water consumption per capita, including commercial, industrial, and agricultural uses (supporting) | • Similar to domestic water, STAR measures secure water supply, with projections of a city's demands. |
| • Also includes:<br>  ○ Percentage of city population with potable water supply service (core)<br>  ○ Percentage of population with access to improved sanitation (core)<br>  ○ Average annual hours of water service interruption per household (supporting)<br>  ○ Percentage of water loss (unaccounted for water) (supporting) | • Also includes:<br>  ○ Safe Stormwater Management<br>  ○ Water Efficiency (3 outcomes: Industrial, Buildings, and Public Infrastructure)<br>  ○ Hydrologic Integrity<br>  ○ Biologic Integrity<br>  ○ Chemical Integrity – Pollutants<br>  ○ Chemical Integrity – Usability |

| Finally: In STAR, but not addressed in ISO Standard… |
|---|
| • Vulnerability Reduction<br>• Creative Industries<br>• Attendance and Participation<br>• Social and Cultural Events<br>• Volunteerism<br>• Local Fresh Foods<br>• School Nutrition<br>• Certified Sustainable Harvests |

GREENHOUSE GAS PROTOCOL

# Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC)

**GPC, the world's most widely-endorsed GHG accounting and reporting standard for cities, enables local leaders to build more effective climate strategies and track the performance of actions already underway.**

| WITHOUT **GPC** | | WITH **GPC** | |
|---|---|---|---|
| Different types of measurements |  |  | One measurement |
| Account for only a portion of emissions |  |  | Consistently account for all emissions |
| Unclear if climate targets will be met |  |  | Emissions trajectory well understood |
| Incomplete data limits investment |  |  | Good data drives investment |
| Unable to relate to national climate action |  |  | Can measure city's contribution to national climate efforts |

**LEARN MORE:** Access GPC online at
**http://www.ghgprotocol.org/city-accounting**

WORLD RESOURCES INSTITUTE

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ICLEI Local Governments for Sustainability