Guidelines

002
February 2012

Reduce/Eliminate Paper Towel Use by Installing Electric Hand Dryers

Background/Rationale:

Most businesses and public facilities use paper towels for hand drying in restrooms. Any business seeking to make operations more sustainable should consider installing electric hand dryers instead of paper towel dispensers. New technology encourages use of energy efficient hand dryers. Switching to hand dryers will reduce solid waste as well as labor costs related to cleaning and maintaining the area and, despite a slight increase in energy use, will indirectly help reduce greenhouse gas emissions related to paper towel production and any adverse environmental impact associated with excess emissions.

The material contained in these guidelines is intended for use by persons who have a basic level of technical training/competence and familiarity with source reduction concepts and strategies.

Step 1: Assess the Current Situation/Define the Scope of the Situation

1.a. Collect and analyze information about current operations, including but not limited to:

- identify key/relevant sources of information (see Appendix 1, all examples):
  - the environmental cause champion,
  - maintenance, facility, and/or housekeeping supervisor(s),
  - purchasing or accounts payable personnel,
  - key suppliers/vendors
- collect pertinent documents and information (see Appendix 1, all examples):
  - maintenance records, equipment specifications and guides and nameplate information
  - utility bills identifying billing rates and energy usage
  - trash bills/records, purchasing records/invoices,
  - key industry-relevant background information
- keep track of, document and distinguish between key assumptions, known or reported values, and information which is calculated (see Appendix 1, all examples)
- conduct use and cost analyses by observing, interviewing staff, reviewing existing information and developing supplemental data (see Appendix 1, all examples):
  - decide what the best unit is to measure/communicate results depending on the situation: hour/day/year/restroom
    - if you calculate materials, labor and disposal amounts and costs per restroom, these may then be aggregated in different ways to support recommendations for alternatives (e.g., for most frequently used areas, for specific zones/floors/wings, etc.)
  - identify number of restrooms and days/hours used
  - estimate or calculate the number of times and length of time patrons use the facilities for hand drying
  - estimate volume of paper towels used per day/per restroom and calculate purchase costs
  - estimate pounds paper towel solid waste generated/year and calculate disposal/landfill costs

- identify maintenance schedule and estimate time needed for cleaning, refilling dispensers, emptying trash and calculate costs based on average hourly wage for housekeeping/ janitorial staff

- conduct life cycle assessment using reference material cited below to determine global warming potential impact of greenhouse gas emissions associated with paper towel waste based on costs saved or pounds of solid waste eliminated (see Appendix 3):

1.b. Conduct necessary research and calculations using the following references:

The following reference can be used to help convert paper towel volume to weight:

- *Standard Volume-to-Weight Conversion Factors*, a compendium of information from various sources by US EPA, available online at: http://www.epa.gov/epawaste/conserve/tools/recmeas/docs/guide_b.pdf

Use the following reference(s) to calculate life cycle impact on greenhouse gas emissions for the wastes to be reduced as well as for the net impact of implementing alternative practices:

- *Economic Input-Output Life Cycle Assessment (EIO-LCA)*, US 1997 Industry Benchmark model, Green Design Institute, Carnegie Mellon University, 2008, available online at: http://www.eiolca.net

NOTE: In this instance, the EIO-LCA tool was used instead of the U.S. EPA's Waste Reduction Model (WARM) because costs are well documented, which is the basis for EIO-LCA calculations, and because paper towels are not listed as a specific waste type in the WARM model.

Step 2: Identify Feasible P2 Opportunities

2.1. In general:

- research a full range of operational improvements/modifications/suggestions relevant for the situation at hand (several commonly applicable suggestions are listed below)
- keep track of, document and distinguish between key assumptions, known or reported data, and information which is calculated
- include a thorough cost analysis, comparing suggested modifications with current practices, and use a chart to compare current to proposed costs
  - be specific on the "unit" for application, i.e. which restroom(s) to modify and how
  - calculate offsetting amount/cost of electricity associated with operating hand dryers
  - calculate capital costs for installation of hand dryers: equipment and labor
  - calculate pay back periods for return on investment
- research several models of hand dryers and include relevant vendor information (the vendor information included in these guidelines is for example only)
- watch for hidden costs: removal of towel dispensers, peak energy fees, sales tax, expected life of equipment, other installation considerations such as needing extra hand sanitizing equipment
- identify how to monitor/measure impact, e.g. monitor savings, expenditures related to paper towels and electricity usage, follow up survey to determine user satisfaction

2.2. Selected strategies to consider, including techniques and calculations to perform:

- install hand dryers for total paper towel replacement in most utilized restrooms (see Appendix 2, Example 1)
  - acknowledge barriers, highlight benefits to consider
  - research different models; recommended one and provide vendor information
  - detail cost analysis for one high traffic restroom
  - report GHG impact supplied by vendor and calculate net GHG impact and Global Warming Potential (GWP)
- install hand dryers in combination with hand sanitizer dispensers (see Appendix 2, Example 2)
  - suggest a trial/demonstration period: collect feedback and proactively address concerns about hygiene, noise and installation logistics
  - calculate GHG reductions as net of savings from paper towel reduction less the increase in electricity use associated with hand dryers
- install hand dryers to reduce paper towel use by 90% (see Appendix 2, Example 3)
  - present information on different models, leaving decision to client
  - leave paper towel dispensers in place to augment hand dryer use (10%)
  - recommend strategies to facilitate implementation/behavior change
- calculate life cycle impact on greenhouse gas emissions compared to current processes
  - see Appendix 3 for examples

Examples of additional strategies which may require more complex analysis include:

--replace paper towels with partially recycled content paper towels
--replace paper towels with linen roll towel dispensers
--use swinging door which doesn't require touching a handle

Step 3: Identify Barriers to and Benefits of Implementation for Each Opportunity

After analyzing the use of paper towels and identifying feasible opportunities for realizing savings, you will want to make as strong a business case as possible for making changes to include the use of electric hand dryers.

Based on experiences over the past 15 years, the P3 program has found that simple projects with thorough documentation and short pay back periods or projects with compelling cost and environmental savings have a greater likelihood of being implemented. For example, suggestions for installing hand dryers where existing wiring is adequate and/or in the most frequently used/high traffic areas are more likely to be implemented.

On the other hand, suggestions which are high cost, with long payback periods, or which have complex implementation logistics, or are not adequately researched or quantified are typically not implemented. For example, projects which require costly rewiring or for which a cost/benefit analysis has not been fully documented or potential vendors have not been identified are unlikely to be implemented. Interestingly, even though the savings may be well documented, this opportunity involves changing employee behavior and perception of hygiene and may not be implemented due to the employee concerns. Employers are typically sensitive to employees' perceptions.

Specific to hand dryers, benefits are decreased solid waste, decreased maintenance time/costs, and increased aesthetics. Perceived barriers include capital costs, including installation logistics, hygiene concerns, and increased electricity usage. See Appendix 2 for examples of implemented P2 electric hand dryer suggestions from the Nebraska intern program. These are annotated to make it clear what information is needed to perform these calculations for a different facility and to explain why some suggestions were implemented and others were not.

Common Barriers:

Beliefs & Attitudes

- resistance to change—employees set in ways and enjoy convenience of using several paper towels for quick/thorough hand drying and for opening the door without contacting the handle
- fear of risks involved related to hygiene
- other/higher strategic priorities—the company may have other issues is sees as more important to address in the short run
- misinformation or lack of understanding about the full costs related to paper towel use:
  - related labor time/costs for maintenance
  - solid waste impact
  - full costs of production of paper towels and the impact on greenhouse gas emissions

Costs and Investments

- capital investment for purchasing/installing hand dryers
- perception of cheap and available raw materials for paper towels
- concern about increased electricity use

Technical Issues: What to Do and How

- lack of knowledge/skills re: what needs to be done/how to implement the suggestion
- amount of different/conflicting vendor information available can overwhelm
- concern re: managing logistics and process changes, e.g. is there electricity present? proper grounding? will it be noisy?

Common Direct and Indirect Benefits:

Company Image

- improves aesthetics of the working environment by eliminating waste on floors/counters
- demonstrates social responsibility and best management practices; improves/develops a positive public image, sets an example/sets pace for the industry

Cost Savings

- reduces costs and improves efficiency:
  - use fewer paper towels-reduce purchasing costs
  - eliminate waste management and disposal labor and costs
- reduces maintenance required

Education

- educates employees and general public in efficiency and responsibility when information is posted about the change and why it was made

Environmental Impact

- reduces impact of on the environment:
  - reduces amount of harmful wastes generated/expelled
  - reduces use of natural resources/raw materials
  - conserves/preserves/provides clean environment/quality of life for future generations

Step 4: Make the Business Case for Change

4.1. Develop a written report for submission to decision makers.

- include a thorough waste assessment with process descriptions, flow charts and material balance representations.
- outline specific P2 Opportunities/Suggestions with the following information:
  - recommended action
  - brief summary of current operations
  - cost of implementing recommendation: don't forget to consider labor costs and savings in your economic analyses.
  - summary of benefits (acknowledge barriers but discuss how benefits outweigh):
    - potential cost savings ($)
    - waste reduction(s)
    - simple payback
    - indirect benefits: safety, risk/liability reduction, GHG reductions, etc.
- always identify how to monitor/measure impact for future analysis
- incentives to Change: Conclude the report with a summary of the benefits to be realized from implementing the recommendations made. Stress environmental stewardship. Call for action!
  - you may want to reference previous successes in similar businesses as a selling point
  - see Appendix 2 for examples of similar projects which have been implemented

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4.2. Make an oral presentation to summarize your findings and call to action:

- focus on pertinent details of waste assessment and P2 opportunities
- make it interesting yet include sufficient technical detail to be convincing and make the business case for change—include a picture of the product/change in action
- develop a final "impact" slide with table of metrics—call for action/change
- allow time for question/answer period

4.3. Advocate for change based on metrics/facts and environmental ethic:

- use informal interactions to establish trust in your abilities and to build a foundation for change
- use written report and formal presentation to communicate your findings and provide the formal information/rationale for implementing recommendations
- emphasize sustainability (triple bottom line) and preserving resources for future generations—energy use and the relationship to greenhouse gas emissions is important for electrically operated hand dryers, however when compared to the overall Life Cycle Analysis of using paper products there is still a reduction.

4.4. Report potential Greenhouse Gas (GHG) emission reductions as an important indirect benefit:

- include in written report and oral presentation
- include explanation of why GHG emissions are relevant/of concern to all businesses
- calculate potential carbon dioxide equivalent (CO_2e) emission reductions for each recommendation
- include an appendix in written report documenting calculations (see Appendix 3 for details and an example of calculations for electric hand dyers
- explain that even though electricity use may increase, the overall life cycle analysis shows a net GHG reduction
- see Appendix 4 for additional tips for making the business case for change.

Appendix 1
Example Waste Assessments related to Paper Towel Use

Note: *Several examples of waste assessments related to paper towel use are included below. Each of these addresses one or more of the steps needed to accomplish a thorough assessment. In these examples, we have attempted to clarify for the reader what information is known or reported, what is logically assumed, and what has been calculated. This is embodied within the example narrative for easy reference. In an actual report, many of these details would likely be in attached appendices so as not to interrupt the flow of the report.*

Example #1: Waste Assessment: unit of analysis one restroom (adapted from report by Kurtis Palu, 2010)

Multifold paper towels are the current means for drying hands in the public restrooms at the facility. Paper towels are convenient, dry hands relatively quickly, and can also be used to open the door to the restroom, avoiding any bacteria on the door handle. On the other hand, paper towel dispensers need to be refilled and trash cans must be emptied when full. Public restrooms at the facility are checked four times each day for cleaning, refilling paper towel dispensers, and emptying trash cans. According to Housekeeping staff, each restroom uses about three bundles of paper towels per day. Calculations for the waste assessment, including paper towels, labor and landfill disposal costs is included below and is summarized in Table 1. Data was obtained from Housekeeping staff.

Annual Paper Towel Costs / Waste / Restroom

Known values:

$13.02 per case of paper towels (according to invoices)
16 bundles per case
3 bundles used per restroom per day (according to Housekeeping staff)
125 paper towels per bundle
15 lbs. of waste per case
27 public restrooms
average labor wage of $12 per hour
$25 per yard for landfill disposal

Assumptions:

20 minutes per day spent cleaning and changing paper towels (from 4 checks per day)
20 lb/ft^3 density of compacted garbage (estimate used by compactor companies for mixed paper)

Calculations:

Per Restroom Assessment

$$\frac{3\ bundles}{day} \times \frac{365\ days}{year} = \frac{1095\ bundles}{year}$$

$$\frac{1095\ bundles}{year} \times \frac{1\ case}{16\ bundles} = \frac{69\ cases}{year}$$

$$\frac{69\ cases}{year} \times \frac{\$13.02}{case} = \$900/year/restroom$$

$$\$900/year/restroom \times 27\ restrooms = \$24{,}300\ per\ year$$

Labor Cost Per Restroom:

$$\frac{20\ min}{day} \times \frac{\$12}{hour} \times \frac{365\ day}{year} = \$1460/year/restroom$$

Waste:

$$\frac{15\ lbs}{case} \times \frac{69\ cases}{year} = 1{,}025\ lbs/year/restroom$$

$$1{,}025\ lbs/year/restroom \times 27\ restrooms = 27{,}700\ lbs$$

Garbage Service Cost:

$$\frac{20\ lbs}{ft^2} \times \frac{27\ ft^2}{yard} = \frac{540\ lbs}{yard}$$

$$\frac{\$25}{yard} \times \frac{yard}{540\ lbs} \times 1{,}025\ lbs/year/restroom = \$50/year/restroom$$

Total Cost Per Restroom:

$\$900 + \$1{,}460 + \$50 = \$2{,}400$

Table 1. Summary of Annual Paper Towel Cost / Restroom

Cost of Paper Towels / Year	$900
Labor Cost / Year	$1,460
Waste Service Cost / Year	$50
Total / Restroom	**$2,400**

There are 27 public restrooms in the main facility resulting in an annual cost of **$64,800** and **27,700 lbs of solid waste.**

Example #2: Waste Assessment: detailed use/time study (adapted from report by Pierce Rhode, 2008)

Currently, three types of paper towels (#26100 roll, MB550 trifold, and 551130 towels) are used in the restrooms throughout this manufacturing company with multiple buildings. A couple restrooms have BluStorm hand dryers installed. According to a member of the maintenance team at the company, there are 13 additional restrooms that are "high traffic," which might benefit from the installation of hand dryers. Overall using paper towels to dry hands in busy restrooms cost $5475/year and results in 410 pounds of waste paper. Calculations on paper towel use are shown below.

Cost Analysis of Paper Towel Use and Waste

Known values:

Time period for data: January 1 to August 4, 2009 (215 days)

Paper towel information:

Type MB550	**Type 26100**	**Type 551130**
Tri-fold paper towels	Paper towel rolls, 1 ft. per towel	
$34.91 / case	$56.16 / case	$152.99 / case
16 packs per case	1000 ft. per roll	60 boxes per case
250 towels per pack		280 towels per box
15.36 lbs. per case	4 lbs. per roll	67.2 lbs. per case
8 cases used	77 rolls used	3 cases used

Assumptions:

75% of paper towels are used for hand drying
85% of hand drying is done in busy restrooms
2 paper towels used per hand drying
10 seconds spent per hand drying

Calculations:

Paper towel cost for entire facility:

Towel #	**# Cases Used**	**Quantity per Case**	**Towels Used**	**Cost per Case**	**Total Cost**
MB550	8	4000 towels	32000	$34.91	$280
26100	77	1000 ft	77000	$56.16	$4320
551130	3	16800 towels	50400	$152.99	$460

Total towels used over 215 days:

$$32000 + 77000 + 50400 = 159400\ towels$$

Total cost over 215 days:

$$\$280 + \$4320 + \$460 = \$5060$$

Cost attributed to hand drying in busy restrooms per day:

$$\frac{\$5060}{215\ days} \times 75\%\ for\ hand\ drying \times 85\%\ in\ busy\ bathrooms = \frac{\$15}{day}$$

Annual cost of paper towels attributed to hand drying in busy restrooms:

$$\frac{\$15}{day} \times \frac{365\ days}{year} = \$5475$$

Paper towel waste attributed to hand drying in busy restrooms:

Towel #	Hand Drying Towels	Units	Weight per Unit	Total Weight
MB550	20400	5 cases	15.36 lbs	80 lbs
26100	49090	49 rolls	4 lbs	200 lbs
551130	32130	2 cases	67.2 lbs	130 lbs

Total weight of paper towel waste over 215 days:

$$80 + 200 + 130 = 410\ lbs$$

Towel use attributed to busy restrooms over 215 days:

$$159400\ towels \times 75\%\ for\ hand\ drying \times 85\%\ in\ busy\ bathrooms = 101600\ towels$$

Time spent drying hands annually in busy restooms:

$$\frac{101600\ towels}{215\ days} \times \frac{hand\ drying}{2\ towels} \times \frac{10\ seconds}{hand\ drying} \times \frac{hour}{3600\ seconds} \times \frac{365\ days}{year} = 240 \frac{hours}{year}$$

Example #3: **Waste Assessment: all restrooms included in analysis** (adapted from report by John Ward, 2010)

The Partners in Pollution Prevention (P3) intern visited the company's headquarters in Lincoln, Nebraska and met with the Records and Safety Coordinator to discuss the use of paper hand towel in restrooms. The company has 31 pairs of men's and women's restrooms. All restrooms use paper towels for hand drying, using over **11,000 lbs** of paper towels per year, costing almost **$19,400 per year**. Calculations are shown below.

Annual Paper Towel Waste

Known values:

$47.24 per case of paper towel rolls
242 cases purchased per year
26.09 lbs. of waste per case
$31.25 per case of tri-fold paper towels
252 cases purchased per year
19.24 lbs. of waste per case

Calculations:

Cost of paper towels:

$$\frac{\$47.24}{case\ of\ rolls} \times 242\ cases + \frac{\$31.25}{case\ of\ tri-fold} \times 252\ cases = \$19,400$$

Solid waste produced:

$$\frac{26.09\ lbs}{case\ of\ rolls} \times 242\ cases + \frac{19.24\ lbs}{case\ of\ tri-fold} \times 252\ cases = 11,200\ lbs$$

According to Carnegie Mellon University Green Design Institute's Economic Input-Output Life Cycle Assessment (EIO-LCA) US 2002 (428) model (2012) available from http://www.eiolca.net/ , $19,400/year spent on paper towels means that 29.5 tons of CO2E is produced each year associated with the production of those paper towels (see more information about GHG in Appendix 3).

Appendix 2
Example P2 Opportunities for Reducing Paper Towel Waste

Note: *Several examples opportunities for reducing paper towel waste are included below. Each of these addresses a different way to improve practices and achieve direct and/or indirect savings and each uses different techniques for encouraging implementation (highlighted at the beginning of each example). In these examples, calculations are embodied within the narrative for easy reference, although in an actual report, these would likely be in appendices at the end so as not to interrupt the flow of the report.*

Example #1: Install hand dryers for total paper towel replacement in most utilized restrooms
(adapted from report by Scott Barker, 2009)

Due to the hospital's strict health requirements, hygiene was considered when researching hand dryers. Two conflicting reports about this issue were found. The hospital should conduct further research, including consulting with the CDC, prior to proceeding.

By installing hand dryers the hospital will decrease their operating costs, reduce unrecyclable waste, and conserve natural resources. Hand dryers are better for the environment despite using electricity, producing fewer greenhouse gas emissions and conserving trees. Utilizing hand dryers will also reduce labor costs related to janitors refilling the dispensers and cleaning paper towel waste. Studies have also shown that hand dryers are better for elderly patients because they are touch-less and gentle on sensitive hands.

Three different hand dryers were investigated and information on these is included in report appendices. The recommended brand is the Dyson AirBlade, which has similar drying times and energy savings as the other two brands, but which is the only hand dryer to be National Sanitation Foundation (NSF) certified. Even with a high initial cost, Dyson Airblade is the best dryer for hygiene and environmental concerns. All hand dryers that were considered are Leadership in Energy and Environmental Design (LEED) certified which will help improve the hospital's image. A quote for a Dyson Airblade, with equipment information is included below.

Sample Dyson Airblade Quote

Thank you for contacting us regarding your interest in the Dyson Airblade™ hand dryer. In response to your recent inquiry, I have put together some information you might find useful in learning more about this new innovation from Dyson.
The documents I have attached to this email are as follows:

- Sales brochure
- Spec sheets
- Mounting templates
- NSF protocol 335 (commercial hand dryers)
- Health care installations slide

Pricing:
The Dyson Airblade™ hand dryer lists at $1,199.00/unit for AB04 (polycarbonate ABS cover) and $1,399/unit for AB02 (die-cast aluminum cover). Please contact me directly for further details.

Shipping & handling:
S&H is free on any order of 13 units or more. On orders of 12 units or less, Dyson ships UPS Ground and freight will be prepaid & added. Please contact me directly for further details.

Cost Savings Calculator:
The following link is a very useful tool in helping determine how much you can expect to save by installing Dyson Airblade™ hand dryers: http://www.dysonairblade.com/specification/calculator.asp

Availability:
The Dyson Airblade™ hand dryer is currently in stock and orders are usually processed and shipped within 1-5 business days.

After looking over this information, please do not hesitate to let me know if you have any additional questions.

Kind regards,

Business Development Executive
Dyson B2B Inc.
Phone 773-510-3501
www.dysonairblade.com

These Hospitals are currently using the Dyson Airblade:

dyson airblade

TECHNICAL SPECIFICATION

AB 04

120V

Electrical
Electrical supply: 110-120 V AC, single phase 60 Hz
Rated power: 1400 W
Motor type: Dyson digital motor. Switched reluctance brushless
Motor speed: 81,000 rpm
Heater type: None
Standby power consumption: 1 W
Energy consumption per dry: 0.00468 kWh

Construction
Polycarbonate-ABS casing with homogenous anti-microbial additive
Color finish: Metallic steel finish PC-ABS
Anti-microbially integrated external plastics, seals and air ducts
Galvanized steel back plate / mounting bracket
Tamper-proof T30 type exterior screws
Water ingress protection to IPX5

Filtration
HEPA filter with anti-microbial coating
99.97% particulate efficiency < 99.9% bacterial removal

Operation
Touch-free infra-red activation
Hand dry time: 12 seconds (measured to method defined by National Sanitation Foundation protocol P335)
Airspeed output: 400 mph
Operating airflow: 68 CFM
Rated operating noise power: 85 dB(A)

Logistics
Serial number prefix: A04-US
Single unit order code: 14225-01
Unit weight: 22 lb
Packaged weight: 28.7 lb
Packaged dimensions: 29.1" × 14.2" × 12.2"
Pallet count: 13
Pallet type: US
Unit barcode: 879957002210

Standard warranty
5 year parts, 1 year labor limited

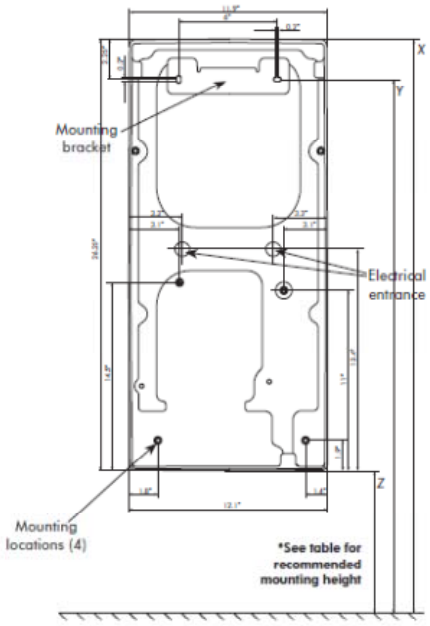
Product Certification
ETL listed in accordance with UL 507
ADA Compliant

*Recommended installation heights measured from floor	Male	Female	Child or Disabled
x To top of machine	41.25"	38.25"	34.25"
y To mounting bracket screw	39.0"	36.0"	32.0"
z To bottom of machine	15.0"	12.0"	8.0"

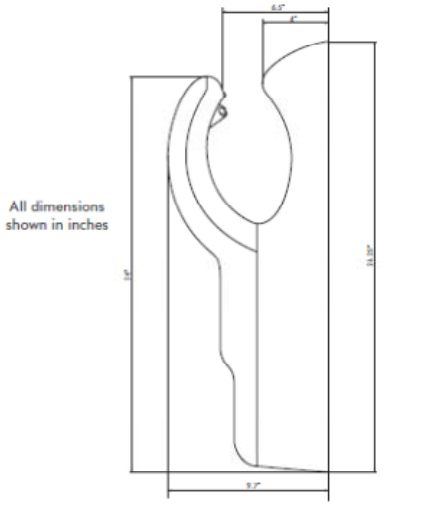
Manufactured materials
Plastic: ABS, PC/ABS, PC, PP (+ PPGF and PPTF), PET-TS
Thermoset (BMC/DMC), PEEK
Rubber: Styrene, butadiene, EPDM
Metal: Stainless steel, galvanized steel, zinc diecast alloy brass

For further information please contact Dyson at
1-888-DYSON-AB or email any questions to
airbladeinfo@dyson.com

REAR VIEW



SIDE VIEW



GreenSpec® LISTED
www.GreenSpec.com

dyson airblade

AB04 (120V)

Dyson Airblade™ hand dryer wall mounting instructions

⚠Important safety information – Read before proceeding further.

Installation work and electrical wiring must be done by qualified person(s) in accordance with all applicable codes and standards, including fire-rated construction.

⚠⚠WARNING: **Before beginning any installation work you must confirm the following:**
Make sure that the electrical supply has been disconnected or switched off before attempting installation to avoid the risk of electrical shock or electrocution.
Ensure no pipe work (gas, water, air) or electrical cables, wires or ductwork are located directly behind the drilling area.

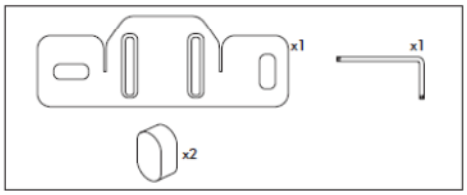
⚠WARNING: **Risk of electric shock! If casing is removed or handled improperly the internal components of the Dyson Airblade™ hand dryer may cause harm or become permanently damaged.**

⚠CAUTION: **To reduce the risk of electric shock, do not expose the internal mechanism/components of this unit to rain or moisture.**

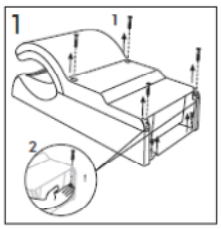
Check that the electrical supply will correspond with the rating plate located on the bottom of the unit.
If the unit is connected to any electrical supply other than that stated on the rating plate of the unit, permanent damage or improper/unsafe operation of the Dyson Airblade™ hand dryer may result.
All wiring and electrical work must be done by a qualified electrician in accordance with all federal, state and local applicable codes and standards, including fire-rated construction.
A means for all pole disconnection must be incorporated in the fixed wiring to the appliance in accordance with local wiring regulations.
The Dyson Airblade™ hand dryer must be grounded properly.
The instructions herein must be read carefully before attempting to install the Dyson Airblade™ hand dryer. Read and retain for future reference.
Failure to accurately follow the instructions may result in the incorrect operation of the Dyson Airblade™ hand dryer, damage to property and/or personal injury.
Dyson will not be held liable for any damages to property or personal injury as a result of failure to comply with the instructions contained herein.
Failure to follow these instructions will invalidate the warranty of this product. Please refer to the Owner's Manual for details of the warranty.

The Dyson Airblade™ hand dryer requires a 15 amp circuit breaker on a dedicated line.

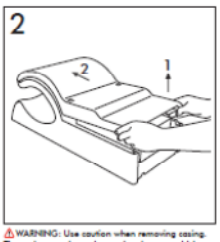
If you have any questions on the installation please call our Dyson Helpline toll free at 1-888-DYSON-AB (1-888-39766-22)



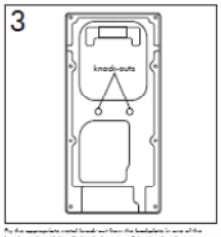
Supplied hardware



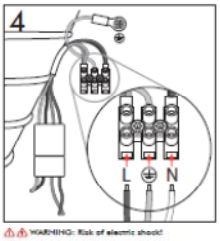
Remove the (2) tamperproof screws from the unit as illustrated with the tamper proof service tool provided. Make sure to retain the (2) screw inserts from the front fascia cover/hinge.



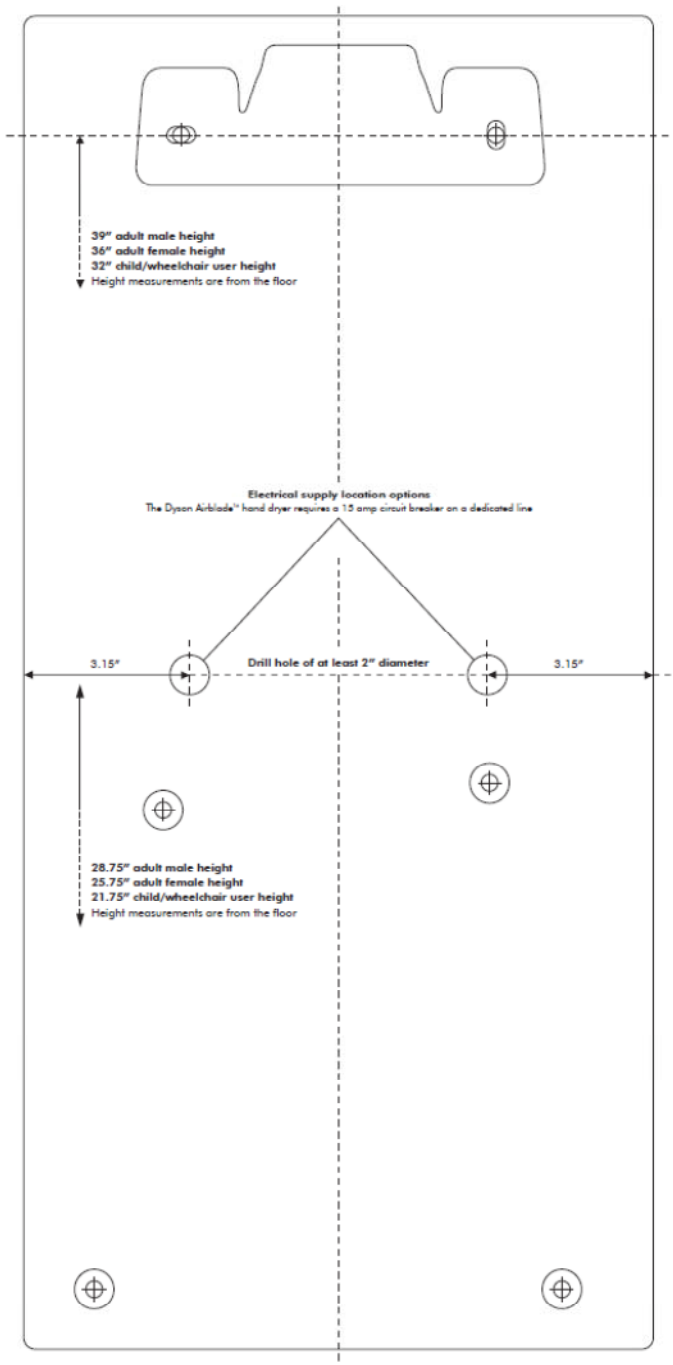
⚠WARNING: Use caution when removing casing. The casing may have sharp edges/corners which may cut or cause harm.
Remove fascia as illustrated.

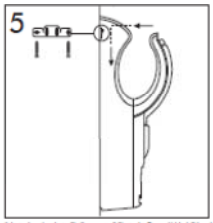


Fix the supplied metal knock-out from the backplate in one of the locations pictured. Install electrical extension fitting into knockout. Connect the electrical supply using approved flexible or solid conduit and electrical fittings. Ensure that the flexible or solid conduit and wires are of sufficient length to make the necessary connection to the backplate and the terminal block.

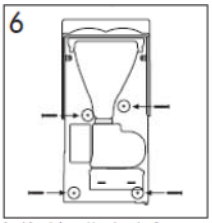


⚠⚠WARNING: Risk of electric shock!
Secure the Line, Ground and Neutral wires into the proper terminal block locations. Verify connections are correct before proceeding.

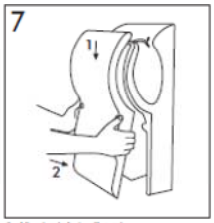




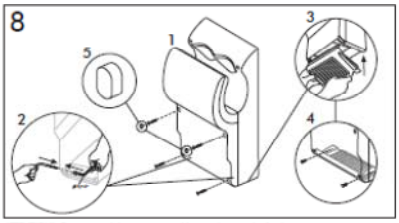
Select a location that will allow accessibility to the Dyson Airblade™ hand dryer and proper clearance from surroundings and floor. Make sure that the unit is installed in compliance with all building codes and/or regulations. Position the mounting template provided on the wall where the Dyson Airblade™ hand dryer is to be installed. Recommended heights are shown, but may need to be adjusted for each individual installation. Securely fasten the mounting bracket to the wall with a minimum anchor size of 0.25". Hang the unit on the secured mounting bracket as illustrated.



Securely fasten the four remaining anchors to the wall. Recommended minimum anchor size of 0.25".



Carefully mate the fascia as illustrated.



ATTENTION!: Do not overtighten screws as this may damage the fascia.
Make sure that the clips on the top of the front fascia are seated correctly and that the fascia is mounted flush before tightening screws.
1. Insert and tighten the (2) anti-tamper screws into the middle of front fascia as illustrated.
2. Place a mounting nut insert underneath the lower fascia and slide into mounting hole with a 5/16" allen key, then insert and hand tighten the anti-tamper screw. Finish tightening with the supplied tamper proof service tool. Repeat process for the opposite lower side.
3 & 4. Insert the (2) screw inserts and then (2) anti-tamper screws. Tighten with supplied tool.
5. Test unit for correct operation before inserting the (2) screw covers.

dyson airblade

AB04 (120V)

Instrucciones para la instalación en pared de la secadora de manos Dyson Airblade™

⚠Información importante de seguridad. Lea antes de avanzar.

El trabajo de instalación y cableado eléctrico debe ser realizado por una persona o personas calificadas, de acuerdo con todos los códigos y normas vigentes, incluso la construcción evaluada contra incendios.

⚠⚠ADVERTENCIA: Antes de comenzar con cualquier trabajo de instalación, debe confirmar lo siguiente:

Asegúrese de que el suministro eléctrico ha sido desconectado o apagado antes de comenzar con la instalación, a fin de evitar el riesgo de electrocución o descarga eléctrica.

Asegúrese de que ninguna cañería (gas, agua, aire) o cables eléctricos, alambres o canalización se encuentra directamente detrás de las áreas de perforación.

⚠ADVERTENCIA: ¡Riesgo de descarga eléctrica! Si se quita el revestimiento o se maneja de manera inapropiada, los elementos internos de la secadora de manos Dyson Airblade™ pueden ocasionar daño o estropearse de manera permanente.

⚠ADVERTENCIA: A fin de reducir el riesgo de descarga eléctrica, no exponga los elementos y mecanismos internos de esta unidad a la lluvia o humedad.

Verifique que el suministro eléctrico corresponda con la placa de especificaciones ubicada en la parte inferior de la unidad.

Si esta unidad se conecta a cualquier suministro eléctrico no establecido en la placa de especificaciones de la unidad puede dar como resultado daño permanente o funcionamiento inseguro o inadecuado de la secadora de manos Dyson Airblade™.

Todos los cableados y trabajos eléctricos deben ser realizados por un electricista calificado, de acuerdo con todas las normas y códigos federales, estatales y locales aplicables, incluso la construcción evaluada contra incendios.

Se debe incorporar un medio para todas las desconexiones de polos en el cableado fijo al dispositivo, conforme a las regulaciones de cableado local.

La secadora de manos Dyson Airblade™ debe estar conectada a tierra de manera adecuada.

La instrucción aquí presente debe leerse con detenimiento antes de intentar instalar la secadora de manos Dyson Airblade™. Lea y retenga para referencia futura.

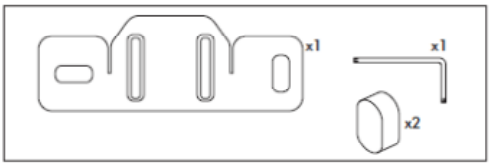
El no cumplir con las instrucciones exactas puede resultar en el mal funcionamiento de la secadora de manos Dyson Airblade™, puede dañar la propiedad y ocasionar lesiones personales.

Dyson no será responsable de los daños o la propiedad o lesión personal, que sean resultado de no cumplir con la instrucción incluida en el presente.

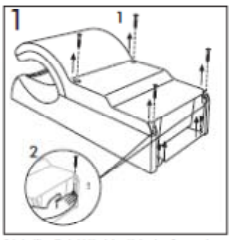
El no seguir estas instrucciones anulará la garantía de este producto. Consulte el Manual del propietario para los detalles de la garantía.

La secadora de manos Dyson Airblade™ requiere de un disyuntor de un mínimo de 15 amperios en una línea dedicada.

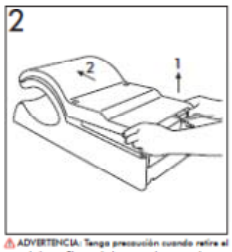
Si tiene dudas sobre la instalación, comuníquese con nuestra línea de ayuda gratuita Dyson al 1-888-DYSON-AB (1-888-39766-22)



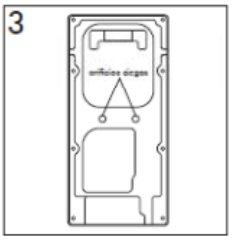
Piezas proporcionadas



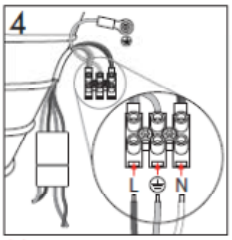
Quite los (4) tornillos invisibles de la unidad según se ilustra, use la herramienta para tornillos invisibles que viene incluida. Conserve de retener los (2) inserto de tornillo en los orificios de la tapa inferior.



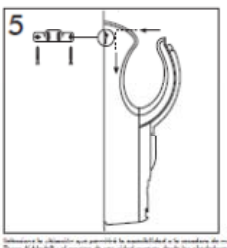
⚠ADVERTENCIA: Tenga precaución cuando retire el revestimiento. El revestimiento puede tener aristas y esquinas filosas que pueden cortar u ocasionar daños. Retire la lámina, como se muestra en la ilustración.



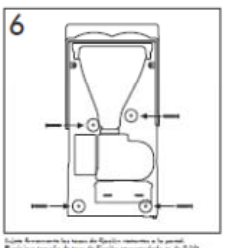
Deslice los orificios largos adecuados desde la placa posterior en uno de los ubicaciones de la imagen. Instale el montaje de ingreso eléctrico en el orificio elegido. Conecte el suministro eléctrico utilizando montajes eléctricos y conductos sólidos o flexibles aprobados. Asegúrese de que los conductores y cables sólidos o flexibles tienen el largo suficiente para realizar la conexión necesaria a la placa posterior y al bloque de terminales.



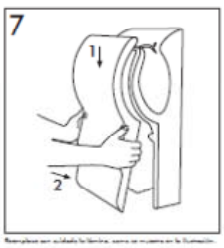
⚠⚠ADVERTENCIA: ¡Riesgo de descarga eléctrica! Asegure los cables de línea, de tierra, y neutrales en las ubicaciones adecuadas de bloques de terminales. Verifique que las conexiones estén sentadas antes de proceder.



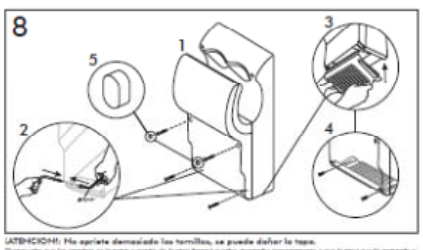
Seleccione la ubicación que permitirá la accesibilidad a la secadora de manos Dyson Airblade™ y el margen de seguridad correcto desde los alrededores y el piso. Asegúrese de que la unidad esté instalada de acuerdo con todos los códigos y normas de construcción. Coloque la plantilla de soporte proporcionada en la pared donde debe instalarse la secadora de manos Dyson Airblade™. Se muestran las alturas recomendadas, pero pueden necesitar un ajuste para cada instalación individual. Sujete firmemente el soporte de montaje a la pared con un tasa de fijación con un tamaño mínimo de 0.25". Cuelgue la unidad en el soporte de montaje asegurado, como se ilustra.



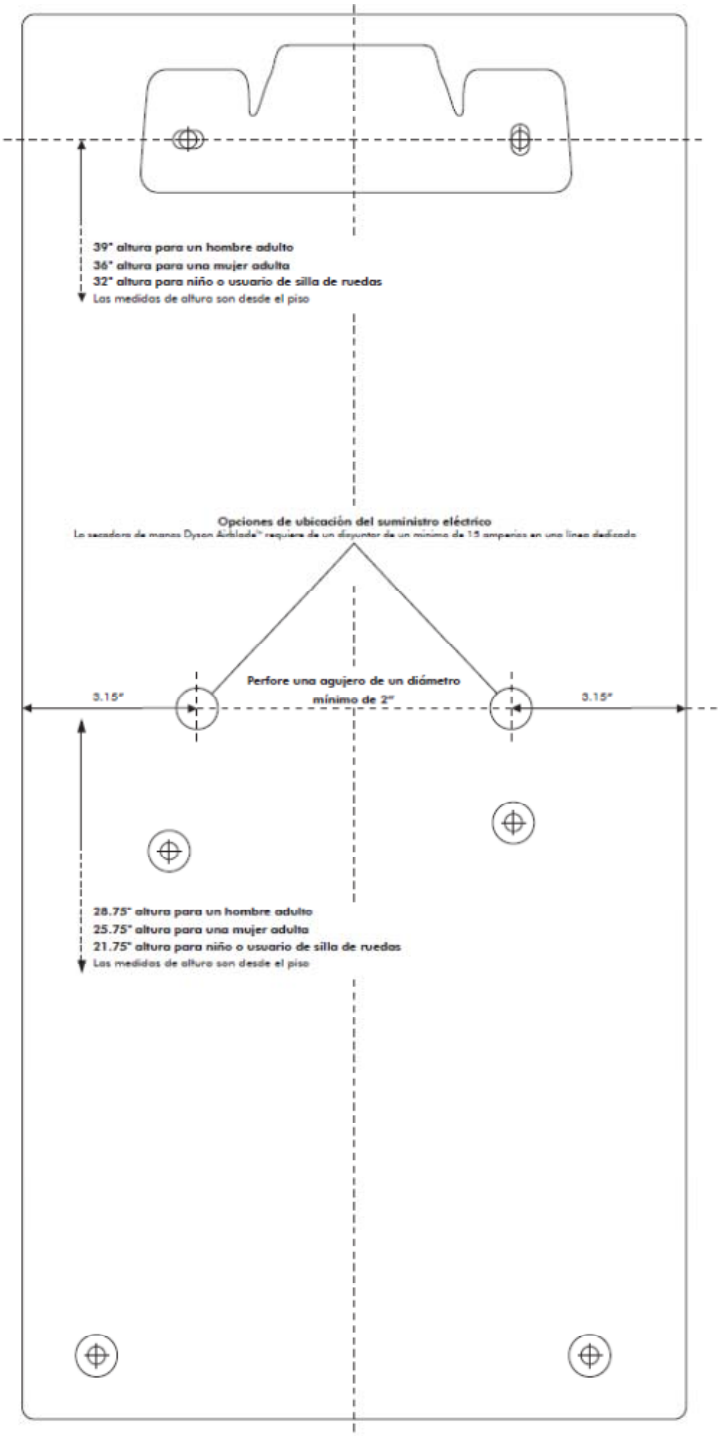
Sujete firmemente las tasas de fijación restantes a la pared. El mínimo tamaño de tasa de fijación recomendado es de 0.25".



Reemplace con cuidado la lámina, como se muestra en la ilustración.



¡ATENCIÓN!: No apriete demasiado los tornillos, se puede dañar la tapa.
Compruebe que los ganchos en la parte superior de la tapa frontal queden asentados correctamente y que la tapa quede montada a ras antes de apretar los tornillos.
1. Inserte y apriete los (2) tornillos invisibles en la parte inferior de la tapa frontal según se ilustra.
2. Coloque una cuerda de montaje debajo de la tapa inferior y deslícela dentro del orificio de montaje con una llave Allen de 5/16", después inserte y apriete con la mano el tornillo invisible. Termine de apretar con la herramienta que viene incluida. Repita el proceso en el lado inferior opuesto.
3 y 4. Inserte el panel de la cubierta del filtro, después los (2) tornillos invisibles. Apriete con la herramienta que viene incluida.
5. Compruebe que la unidad funciona correctamente antes de insertar los (2) cubiertas de los tornillos.



The best location for installation of a hand dryer on a trial basis is in the Women's restroom in the North Corridor near the large conference room. By purchasing one Dyson Airblade for $1200, the facility will save $1800 in operating costs. A cost analysis for the Dyson Airblade in this location is included below.

Dyson Airblade Cost Analysis, North Corridor Women's Restroom

Paper Towels

Known or calculated values:

Annual cost of paper towels=$1200/year

Annual weight of paper towel waste=1500 lbs/year

Labor cost for restroom maintenance and disposal of waste paper towels =$730/year

Total cost for paper towels in restrooms=$1930/year

Dyson Airblade

Known values:

$0.08 per kWh

786.94 kWh electrical demand per year based on Dyson Airblade website

Calculations:

Operating costs:

$$786.94\ kWh * \frac{\$0.08}{kWh} = \$63 \text{ per year}$$

Annual Savings:

$$\$1930 - \$63 = \$1870 \text{ per year}$$

Payback Period: cost of hand dryer/annual savings = 1200/1800 = .666 yr. or **8 months**

A life cycle analysis was conducted to compare the environmental effects for both paper towels and hand dryers. The ten year useful life of the hand dryer compared to ten years use of the single use of the paper towels was considered and evaluated in the life cycle analysis. One Dyson Airblade hand dryer has a Global Warming Potential (GWP) of 0.6 $MTCO_2E$. Installing this hand dryer in one restroom will eliminate 1,500 lbs/year of paper towels, which life cycle analysis has determined has a GWP of 9.8 $MTCO_2E$. Using just one Dyson Airblade saves 9.2 $MTCO_2E$. (see Appendix 3, Example 2 for full documentation).

Implementation Status: Implemented (adapted from report by Kurtis Palu, 2010)
While this recommendation was not immediately implemented, the facility was interested enough that they requested additional information and agreed to host a demonstration of an Airblade at the main facility. A re-evaluation of potential savings was performed which substantiated the accuracy of the initial assessment. Based on a follow-up contact, the facility will install two units in January, 2012.

Key Barriers/Benefits: The implementation cost was high yet benefits to be realized spurred serious consideration. The company would save on operating costs, and reduce its indirect impact on greenhouse gas emissions and related environmental issues on an ongoing basis. The company wanted

verification of the original analysis before proceeding, which was provided. Initial concerns about hygiene needed to be further researched and a user satisfaction survey was conducted during the trial demonstration period. Employee concerns about hygiene were addressed.

Related Opportunities: The Infection Control Manager stated that if the facility were to install hand dryers, it is encouraged by the Centers for Disease Control (CDC) to take additional steps to provide the cleanest and healthiest hospital possible (e.g., install touch-less faucets and soap dispensers, install alcohol sanitizer dispensers outside each restroom).

Example #2: Install Dyson Airblade hand dryers in combination with Purell dispensers for sanitation

As pointed out previously, a possible way to eliminate the use of paper towels is to install hand dryers. Traditional hand dryers use electric coils to heat the air and blow air at low velocities making them less efficient, consuming higher amounts of electricity. The Dyson Airblade expels air through a small opening at 400 mph. It is also the only hand dryer certified to be hygienic by NSF International. A brochure on the Airblade can be found at www.dysonairblade.com .

A demonstration of an Airblade was held at the facility in both the women's and men's restrooms that are primarily used by employees rather than patients or visitors. During the demo period, users were asked to provide feedback on the Dyson Airblade via email. The main concern expressed was that many liked using a paper towel to open the door when exiting the restroom. Purell dispensers could be installed outside of restrooms as an alternative, similar to the Purell NXT dispensers already in use in certain areas of the hospital. Cost for dispenser refills were obtained from Housekeeping and are included in the cost analysis. The noise of the machine was also mentioned. Dyson rates the dryer at 85 dBA, which according to OSHA is a permissible level of noise for up to eight hours per day.

Electrical requirements were also obtained from the demonstration. Dyson Airblades pull 12 amps when operating. Public restrooms already contain GFI outlets on undedicated 15 amp breakers which makes installing the Airblades easy, as additional breakers are not needed. The hand dryers can be mounted to most flat surfaces. Dyson quotes an installation time of one hour per unit. Installation details and specs can be found in report appendices. There are two Airblade models offered by Dyson: AB02 and AB04 that could be used. Basic information on both models can be found below:

- AB02
  - Die Cast Aluminum Casing
  - Dimensions (HxWxD): 29.1" x 14.3" x 12.2"
  - Weight: 32lb
  - Available Colors: Silver
  - Suggested Retail: $1,399.00
- AB04
  - Polycarbonate-ABS Casing
  - Dimensions (HxWxD): 26.25" x 12.1" x 9.7"
  - Weight: 22lb
  - Available Colors: White or Grey
  - Suggested Retail: $1,199.00

- White Electric in Lincoln, Nebraska offers a price break of $50 / unit if 13 or more units are purchased
- Data obtained from www.dysonairblade.com and White Electric in Lincoln, Nebraska

Dyson recommends the AB02 in high use/high abuse applications like airports, nightclubs and sports stadiums. Both models have the same electrical requirements and performance and either would be acceptable for the facility's application. Illustration 1 found below shows the colors available for both models.

AB02 Silver

AB04 Grey

AB04 White

Illustration 1. Color Options for Dyson Airblade

Capital and annual costs for both models plus the Purell hand sanitizer dispensers were calculated. Dyson states the Airblade consumes 5.33 Watt*hrs / use and data from the demo confirmed the consumption rate. From the amount of paper towels used per day it was estimated the restrooms will have 200 uses of the hand dryer/day; resulting in energy usage of 390 kWh /yr. It was assumed that ½ of restroom users would also use the Purell dispenser when exiting the restroom. Cost for Purell refills was obtained from Housekeeping and uses / refill was obtained from Purell. Results of the calculations are summarized below in Table 1. Details are included in the calculations box below.

Table 1. Capital Cost for Airblade and Purell

Model	Capital Costs/Restroom	Annual Costs/Restroom
Dyson AB02	$1,370	$30
Dyson AB04	$1,170	$30
Purell NXT	$5.60	$370

An assessment of current paper towel use indicated that materials and labor for maintenance cost more than $2,000 per year, per restoom. A simple payback period was calculated for the total cost (capital plus annual operating costs) of the hand dryers. Results are summarized in Table 2 below. Details are included in the calculations box below.

Table 2. Total Cost Analysis for Dyson Airblade Models

Model	Total Capital+ Operating Cost/Restroom	Net Annual Savings/Restroom	Simple Payback Period
Dyson AB02 w/ Purell NXT	$1,400	$2,000	0.7 years ≈ **9 months**
Dyson AB04 w/ Purell NXT	$1,200	$2,000	0.6 years ≈ **7 months**

If the Dyson Airblade / Purell NXT combination is installed in all 27 public restrooms it will **save $54,000 annually** with total project cost being **$32,400 or $37,800** depending on which model is chosen. Even if the paper towel dispensers were left in restrooms, in which case the Purell dispensers would not be necessary, and the facility reduced paper towel costs by 50% ($1,200 / Restroom); the Dyson Airblade still has a payback period of 1 year.

Cost Analysis – Dyson Airblade

Determination of Energy Consumption and Operating Cost for Dyson Airblade:

Known values:

5.33 W-hours per use (from Dyson literature)

$0.07 per kWh

Assumptions:

1 W stand-by consumption (assume stand-by energy use and cost are negligible)

200 uses per day

Calculations:

Energy consumption:

$$\frac{200\ uses}{day} \times \frac{5.33\ W-hour}{use} \times \frac{365\ days}{year} = 390\ kWh/_{year}$$

Energy cost:

$$\frac{390\ kWh}{year} \times \frac{\$0.07}{kWh} = \frac{\$27}{year}$$

Determination of Capital and Installation Cost for Dyson Airblade:

Known values:

$1399 per unit for AB 02 Die Cast Aluminum (silver) (per quote from White Electric)

$1199 per unit for AB 04 PC-ABS (grey or white) (per quote from White Electric)

Prices discounted by $50 per unit if more than 13 are purchased

27 units to be purchased

Assumptions:

45 minutes of installation time (per estimate by White Electric)

1 hour of installation time assumed

Maintenance technician wage of $19 per hour

Calculations:

Capital costs for AB 02 units:

$$\frac{\$1349}{unit} + \frac{\$19}{hour} \times 1\ hour = \frac{\$1370}{unit}$$

Capital costs for AB 04 units:

$$\frac{\$1149}{units} + \frac{\$19}{hour} \times 1\ hour = \frac{\$1170}{unit}$$

Determination of Operating and Installation Costs of Hand Sanitizer Dispensers:

Known values:

$10.49 per dispenser (per quote from Staples)
$30.57 per case of NXT Purell refills (per quote from Madonna Housekeeping)
8 refills per case
14 dispensers to be purchased
Housekeeping wage of $12 per hour

Assumptions:

Installation cost is negligible
667 uses per refill
50% of users will use hand sanitizer
200 restrooms uses per day
Dispensers refilled every 3 days
10 minutes spent per refill

Calculations:

Capital cost:

$$\frac{\$10.49}{unit} \times 14\ units + 27\ restrooms = \frac{\$5.60}{restroom}$$

Annual cost of refills:

$$\frac{\$30.57}{case} \times \frac{case}{8\ refills} \times \frac{refill}{667\ uses} \times \frac{100\ uses}{day/restroom} \times \frac{365\ days}{year} = \frac{\$220}{restroom}$$

Annual cost of labor:

$$\frac{10\ min}{refill/dispenser} \times \frac{3\ refills}{week} \times \frac{52\ weeks}{year} \times \frac{hour}{60\ min} \times \frac{\$12}{hour} + \frac{2\ restrooms}{dispenser} = \frac{\$150}{restroom}$$

Total annual cost per restroom: $\$5.60 + \$220 + \$150 = \frac{\$370}{restroom}$

Project Cost Analysis:

Known values:

Annual paper towel savings of $2,400
Annual per restroom values for Dyson Airblades taken from previous calculations

Assumptions:
Units (along with Purell dispensers) installed in all 27 restrooms:

Calculations:
Total capital costs:

$$\frac{\$1370}{AB\ 02} + \frac{\$5.60}{dispenser} \sim \frac{\$1400}{restroom}\ for\ AB02\ units$$

$$\frac{\$1170}{AB\ 04} + \frac{\$5.60}{dispenser} \sim \frac{\$1200}{restroom}\ for\ AB04\ units$$

Total annual operating costs: $\$27 + \$370 = \frac{\$400}{restroom}$

Net annual savings:

Simple Payback Period (θ):

$$\theta = \frac{Total\ Capital\ Costs}{Net\ Annual\ Savings}$$

For the Model AB-02:

$$\theta = \frac{\$1400}{\frac{\$2000}{year}} = 0.7\ years \sim 9\ months$$

For the Model AB-04:

$$\theta = \frac{\$1200}{\frac{\$2000}{year}} = 0.6\ years \sim 7\ months$$

Implementation Status: **Implemented**
The facility was interested enough in an initial assessment that they requested additional information and agreed to host a demonstration of an Airblade at the main facility. A re-evaluation of potential savings was performed which substantiated the accuracy of the initial assessment. Based on a follow-up contact, the facility will install two units in January, 2012.

Key Barriers/Benefits: The implementation cost was high yet the calculated return on investment and the short payback period spurred serious consideration. The company would save on operating costs, and reduce its indirect impact on greenhouse gas emissions and related environmental issues on an ongoing basis. Initial concerns about hygiene needed to be further researched and a user satisfaction survey was conducted during the trial demonstration period. Employee concerns about hygiene and noise were addressed, as well as logistics related to installation.

Another company which received a similar suggestion had some restrooms that were not built to allow the proper power for the hand dryers. In addition, many of the employees wanted to keep the paper towels. The extra work involved in rewiring certain areas, coupled with employee resistance to change outweighed the calculated benefits of solid waste reduction and the indirect benefit of helping reduce greenhouse gas emissions. The company had other strategic priorities for waste reduction and despite the amount of solid waste they could save, the company has not installed additional hand dryers.

Example #3: Install electric hand dyers to reduce paper towel use by 90% (but not totally eliminate paper towels) (adapted from report by John Ward, 2010)

Calculations have shown that installing hand dryers to replace the majority of paper towel use in the office building could save ~**$17,000/yr** and reduce solid waste by ~**10,000 lbs/yr** as shown in Table 1 below. (Note to user: Detailed calculations for waste and cost savings are not shown since the principles involved have been demonstrated elsewhere.) Since it is not realistic to assume that all use of paper towels will be eliminated by the addition of hand dryers, the table shows the savings with a more reasonable 90% reduction in paper towel use. Key information of example products including cost calculations and payback information, and information on reducing greenhouse gas emissions below.

Table 1: Annual Cost Savings and Waste Minimization

Hand Drying Method	Capital Cost	Total Operating Cost $/yr	Solid Waste generated lbs/yr	Solid Waste Reduction lbs/year	Cost Savings $/year
100% Paper Towels (current)		~$19,000/yr	~11,100 lbs/yr		
10% Paper Towels, 90% Hand Drying (proposed)	$50,800	~$2,000/yr	~1100 lbs/yr	**10,000 lbs/yr**	**~$17,000/yr**

There are several steps the company can take to help assure support for change. Some ideas to facilitate implementation:

- Encourage employee participation through environmental education. Post signs next to the units informing the associates of the environmental impact of paper towels and the benefit of using the hand dryers.
- Strategically place hand dryers and paper towel dispensers so that it is more convenient for associates to use the hand dryers. It is recommended that the hand dryers are placed next to the sinks and the paper towel dispensers are located closer to the exit.
- Start by installing hand dryers in high traffic restrooms as a pilot program to test the system before purchasing hand dryers in all the restrooms.

Calculations for Model Comparison

Example 1: AIRFORCE Hand Dryer

Manufacturer known values:

$319 per unit

13 second dry time (includes run-on-time)

0 W stand-by power consumption

1.1 kW consumption per use

Calculations:

Annual hand dryer uses:

$$\frac{562{,}500\ uses}{year} - \frac{562{,}000\ uses}{year} \times 10\% = 506{,}250\ uses$$

Annual cost of hand dryer operation:

$$\frac{506{,}250\ uses}{year} \times \frac{1.1\ kW}{use} \times 13\ seconds \times \frac{hour}{3600\ seconds} \times \frac{\$0.05}{kWh} = \$100$$

Total annual cost of operation (including paper towel costs):

$$\$100 + \$19{,}300 \times 10\% = \$2{,}030$$

Capital cost: $\left(\frac{\$319}{unit} + \$500\right) \times 62\ units = \$50{,}800$

Annual savings: $\$19{,}300 - \$2{,}030 = \$17{,}270$

Payback period: ———

Annual solid waste reduction: $11{,}200\ lbs \times 90\% = 10{,}080\ lbs$

Note: the deciding factor in annual savings is not how often the unit is run, but how many paper towels are used. Ten percent of the current volume is $1,900/yr while the cost to run the unit is only $100/yr.

Example 2: Dyson Airblade

Manufacturer known values:

$1200 per unit
15 second dry time (includes run-on-time)
1 W stand-by power consumption
0.005 kWh consumption per use

Calculations:

Annual hand dryer uses:

$$\frac{562{,}500\ uses}{year} - \frac{562{,}500\ uses}{year} \times 10\% = 506{,}250\ uses$$

Annual cost of hand dryer operation:

$$\frac{506{,}250\ uses}{year} \times \frac{0.005\ kWh}{use} \times \frac{\$0.05}{kWh} = \$130$$

Annual time spent on stand-by:

$$\frac{24\ hours}{day} \times \frac{365\ days}{year} - \frac{506{,}250\ uses}{year} \times \frac{15\ seconds}{use} \times \frac{hour}{3600\ seconds} = 6650\ hours$$

Annual cost of stand-by time:

$$\frac{6650\ hours}{year} \times 62\ units \times \frac{1\ W}{unit} \times \frac{1\ kW}{1000\ W} \times \frac{\$0.05}{kWh} = \$20$$

Total annual cost of operation (including paper towel costs):
$\$130 + \$19{,}300 \times 10\% + \$20 = \$2{,}080$

Capital cost: $\left(\frac{\$1200}{unit} + \$500\right) \times 62\ units = \$105{,}400$

Annual savings: $\$19{,}300 - \$2{,}080 = \$17{,}220$

Payback period: ———

Annual solid waste reduction: $11{,}200\ lbs \times 90\% = 10{,}080\ lbs$

According to Carnegie Mellon University Green Design Institute's Economic Input-Output Life Cycle Assessment (EIO-LCA) US 2002 (428) model (2012) available from http://www.eiolca.net/ , $17,220 net/year saved on paper towels means that 16.8 tons of CO2E is reduced each year associated with the reduction in production of those paper towels (see more information about GHG in Appendix 3).

Sample product information is shown below.

Implementation Status: Not yet reassessed to determine impact

Sample Product Information for Hand Dryers

AIRFORCE Hand Dryer, CHROME, Fast Drying, SteriTouch® antimicrobial, World Dryer

Manufacturer: **World Dryer**
SKU: **WD-J970**
Price: $319.00
This item is in stock
add
106
Please select options:
Select Voltage
120V
208/230V
Quantity: 1 Add To Cart

Don't forget, FREE Shipping to lower 48 states on all of our products at ProDryers.com

Another innovative breakthrough from World Dryer, high speed dry time while using a low amount of energy... introducing the Airforce hand dryer.

Features

- High Speed, Fast 12 Second Dry Time
- Air velocity: 53 CFM (10,500 LFM)
- Extremely Low Power Consumption at 1100 Watts
- Automatic infrared activation ensuring optimum hygiene levels
- Compact and Sleek Design
- Drastically Reduces the Spread of Harmful Bacteria
- Sound Level of 83dB
- 5 Year limite warranty

Environmental Certification

Products selected for the GreenSpec directory are considered to be the top of their class and environmentally preferable, base on BuildingGreen's criteria. The Airforce™ can help a building earn LEED credits based on EA Credit 1 optimized energy performance. for

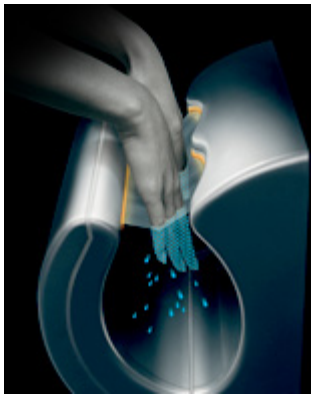
http://www.prodryers.com/servlet/the-106/AIRFORCE-Hand-Dryer--dsh-/Detail

For more information World Dryer can be contacted at: 866-322-8739

Dyson Airblade

The fastest, most hygenic hand dryer.

- **AB02 Airblade**
- **AB04 Airblade**



12 second dry time
Sheets of air travelling at over 400mph scrape water from hands like a windshield wiper.
Costs less to run
Uses up to 80% less energy than warm air hand dryers
The only hand dryer certified by NSF as hygienic
Touch-free operation
Easy clean
Tough and durable
5 year warranty
Dyson Airblade™ AB04 hand dryer

Please call 1-888-DYSON-AB to purchase.

TWO MACHINES TO CHOOSE FROM
AB02 has a casing made from robust, impact-resistant aluminum for tolerating high levels of use and abuse at places such as airports, nightclubs and sports stadiums.
AB04 is designed for regular washrooms. It has the same patented technology as AB02 but it's made from PC-ABS – a lightweight yet durable compound. Its manufacturing process is over 50% less carbon intensive than AB02.

QUICK SPEC	AB02	AB04
Colour(s) available	Silver	White Grey
Casing construction	Die-cast aluminum	Polycarbonate - ABS
Unit dimensions (HxWxD)	29.1" x 14.3" x 12.2"	26.25" x 12.1" x 9.7"
Unit weight	32lb	22lb
Airspeed at hands	400mph	400mph
Operating power consumption	1400W	1400W
Energy consumption per dry	0.00468kWh	0.00468kWh

Full technical specification
http://www.dysonairblade.com/store/product.asp?product=AB04-WHITE

Appendix 3
Greenhouse Gas Reductions Explanation and Calculations

Relevance of Greenhouse Gas Emission Estimates
This issue is an increasingly important one for business decision makers as it relates to regulations, stakeholder interests and day-to-day business operations and energy use.

There are several important dimensions of analysis for any pollution prevention opportunity. One is certainly direct environmental impact (e.g. reductions in solid or hazardous waste, water use, air pollution, or energy use). Another important dimension is cost. Yet another is the intangible (not quantifiable) impact, such as reduced liability, increased worker safety/satisfaction, or improved corporate image. A final important dimension is indirectly estimating the impact on greenhouse gas (GHG) emissions that can be achieved by implementing any given pollution prevention opportunity.

GHGs include a number of different gases such as carbon dioxide, methane, nitrous oxide, ozone, chlorofluorocarbons and water vapor. These gases contribute to the "greenhouse effect" in the Earth's atmosphere. While GHGs make the planet warm enough to be habitable, an excessive amount of these gases is believed to be building up in the atmosphere and causing the average global temperature to rise, leading to climate change and instability. A significant spike in GHG concentrations in the atmosphere has occurred since the industrial revolution, pointing to the man-made nature of this change. This is why a new emphasis, and discussion of possible regulations, has been placed on reducing GHG emissions in all parts of our society, including government, business and industry.

The most widely recognized unit for measuring GHG emissions is carbon dioxide equivalent (CO2e). Each of the GHGs has a different capacity to heat the earth's atmosphere, called its global warming potential (GWP). Carbon dioxide (CO2) has a GWP of 1, so in order to standardize reporting, when GHG emissions are calculated, they are reported as equivalent to a given volume of CO2.

Reductions in GHG emissions can be estimated using a variety of calculation tools and computer models. The direct environmental/cost benefits estimated or realized are used as quantified input for these calculations, therefore the resulting GHG emission reduction estimates are considered indirect benefits. Some commonly used tools are listed below:

--Nationally recognized conversion factors from the U.S. Department of Energy and the American Water Works Association are used to estimate GHG emissions for electricity, natural gas, and water use. For example, kilowatt-hours (kWh) of electricity used can be converted to GHG emissions using a factor of 1.404 pounds CO2 e per kWh.

--Another tool to determine GHG emissions related to solid waste, is the EPA's WAste Reduction Model (WARM). This online calculator uses a life-cycle approach to determine the change in GHG emissions caused by alternative end-of-life waste management decisions or disposal methods for a number of different kinds of wastes. For example, using the weight of a solid waste diverted from a landfill and recycled, an approximate reduction in GHG can be calculated. WARM is periodically updated and new material types are added by the EPA as new information from climate change research becomes available.

--Another model used to estimate GHG reductions is the Economic Input Output Life Cycle Assessment (EIO-LCA) developed by researchers at Carnegie Mellon University. This model provides a useful approximation of GHG reductions through the full life-cycle production of a material or

chemical, based on the cost savings from reductions in use. For example, if a business reduces its lubricating oil purchases by $50,000, the EIO-LCA estimates the GHG emissions to produce that oil through the mining, extracting, refining, packaging and delivery (to list a few) steps in the process of getting that oil to the end user.

--Recycled Content (ReCon) Tool: EPA created the ReCon Tool to help companies and individuals estimate life-cycle greenhouse gas (GHG) emissions and energy impacts from purchasing and/or manufacturing materials with varying degrees of post-consumer recycled content.

When using one of these models to estimate GHG emission reductions for a client, always provide a summary sentence stating the amount of GHG reduction associated with each recommendation, e.g. "Using electric hand dryers will reduce solid waste by 10,000 lbs/year, save $17,000/year, and reduce GHG by over 16TCO_2e/year. Also provide an explanation of which model was used, why, what assumptions were applied, and the importance of reducing GHG emissions as a business and global sustainability strategy. Two example Appendices documenting GHG impact of implementing suggestions are found below. The first example shows the net reduction in CO_2e production per year from using hand dryers vs. paper towels and the second compares the life cycle effects of paper towels and hand dryers.

Example 1: Greenhouse Gas Calculations for Use of Dyson Airblade Hand Dryer

Opportunity: Replace paper towels in restrooms with Dyson Airblade hand dryer

Reduced cost of paper towels **$24,300**

Increased electricity usage by **390 kWh / yr**

Elimination of Paper Towels

Using the EIO-LCA model the elimination of paper towels results in the reduction of **21.5 MTCO$_2$E.** The effect of waste disposal is assumed to be minimal. Specific details are shown below.

Sector #322291: Sanitary paper product manufacturing
Economic Activity: $24.3 Thousand Dollars
Displaying: Greenhouse Gases
Number of Sectors: Top 10

Documentation:
The environmental, energy, and other data used ar
Frequently asked questions about EIO-LCA.

Change Inputs (Click here to view greenhouse gases, air pollutants, etc...)

This sector list was contributed by Green Design In

	Sector	Total t CO2e	CO2 Fossil t CO2e	CO2 Process t CO2e	CH4 t CO2e	N2O t CO2e	HFC/PFCs t CO2e
	Total for all sectors	*23.7*	*20.9*	*0.605*	*1.42*	*0.500*	*0.219*
322120	Paper mills	7.17	7.17	0	0	0	0
221100	Power generation and supply	6.90	6.80	0	0.019	0.042	0.044
322110	Pulp mills	1.05	1.05	0	0	0	0
211000	Oil and gas extraction	0.970	0.273	0.178	0.519	0	0
322291	Sanitary paper product manufacturing	0.727	0.727	0	0	0	0
325190	Other basic organic chemical manufacturing	0.616	0.553	0	0	0.063	0
484000	Truck transportation	0.600	0.600	0	0	0	0
324110	Petroleum refineries	0.498	0.496	0	0.002	0	0
325211	Plastics material and resin manufacturing	0.369	0.369	0	0	0	0
212100	Coal mining	0.363	0.041	0	0.322	0	0

www.eiolca.net
US 2002 Benchmark
Industry: Wood, Paper and Printing
Sector: Sanitary Paper Product Manufacturing (#322291)
Greenhouse Gases
$24,300 input → 23.7 tCO$_2$E * 2000 lb / ton ÷ 2204.6 lb / metric ton = **21.5 MTCO$_2$E**

Use of Dyson Airblade

Using the sources identified below an additional **0.4 MTCO2E** is produced from the electricity use.

Calculations

390 kWH/yr * 2.104 lbCO2E/kWH * 1 MTCO2E / 2,204.6 lbCO2E = **0.4 MTCO2E**

Sources

Electricity

U.S. EPA, Clean Energy. "eGRID 2007 Version 1.1." February 2009. Dowloadable ZIP file: eGRID20071_1year05_aggregation.xls, tab NRL05 and US05. (http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html#download)

US EPA, Downloadable Document: "Unit Conversions, Emissions Factors, and Other Reference Data, 2004." Table I, Page 1. (http://www.epa.gov/climatechange/emissions/downloads/emissionsfactorsbrochure2004.pdf)

Total Net MTCO2E Reduction

21.5 MTCO2E – 0.4 MTCO2E = **21.1 MTCO2E**

Incentives to Change

By installing Dyson hand dryers the facility would reduce the amount of solid waste produced by **27,700 lbs** annually. This reduction in paper towel use has a green house gas (GHG) reduction of **21.5 MTCO$_2$E**, GHG calculations are one way to see the impact a project has on the environment. With the Dyson Airblade, the facility has a great opportunity to both reduce annual costs and lessen their impact on the environment.

Example 2: Greenhouse Gas Calculations for Paper Towels & Electric Hand Dryer

Life Cycle Analysis – Below are two tables depicting the life cycle effects of paper towels and hand dryers. Each table highlights the top ten contributors for conventional air pollutants and green house gases. It is important to note that these are based on the price of one Dyson Airblade and the equivalent consumption of paper towels. Life cycle assessments can be found at: http://www.eiolca.net

Paper Towels

Sector #322291: Sanitary paper product manufacturing (*View Description*)
Economic Activity: $11 Thousand Dollars
Displaying: Conventional Air Pollutants, Greenhouse Gases
Number of Sectors: Top 10

Documentation:
The sectors of the economy used in this model.
The environmental, energy, and other data used and their sources.
Frequently asked questions about EIO-LCA.

This sector list was contributed by Green Design Institute.

Change Inputs (Click here to view greenhouse gases, air pollutants, etc...)

	Sector	SO2 mt	CO mt	NOx mt	VOC mt	Lead mt	PM10 mt	GWP MTCO2E	CO2 MTCO2E	CH4 MTCO2E	N2O MTCO2E	CFCs MTCO2E
	Total for all sectors	*0.024*	*0.121*	*0.024*	*0.019*	*0.000*	*0.009*	*9.81*	*8.65*	*0.752*	*0.274*	*0.138*
221100	Power generation and supply	0.014	0.000	0.006	0.000	0	0.000	2.56	2.53	0	0	0.031
322291	Sanitary paper product manufacturing	0.004	0	0.000	0.000	0	0.000	0.897	0.897	0	0	0
325520	Adhesive manufacturing	0.001	0.000	0.000	0.000	0	0.000	0.038	0.038	0	0	0
3221A0	Paper and paperboard mills	0.000	0.004	0.000	0.000	0	0.000	1.43	1.43	0	0	0
325110	Petrochemical manufacturing	0.000	0.000	0.000	0.000	0	0.000	0.070	0.070	0	0	0
324110	Petroleum refineries	0.000	0.000	0.000	0.000	0	0.000	0.158	0.157	0.000	0	0
325130	Synthetic dye and pigment manufacturing	0.000	0.000	0.000	0.000	0.000	0.000	0.097	0.097	0	0	0
211000	Oil and gas extraction	0.000	0.000	0.000	0.000	0	0.000	0.231	0.039	0.192	0	0
325180	Other basic inorganic chemical manufacturing	0.000	0.000	0.000	0.000	0	0.000	0.104	0.104	0	0	0
484000	Truck transportation	0.000	0.066	0.005	0.005	0	0.000	0.937	0.923	0.001	0.013	0

Download

Hand Dryers

Sector #333319: Other commercial and service industry machinery manufacturing (*View Description*)
Economic Activity: $1 Thousand Dollars
Displaying: Conventional Air Pollutants, Greenhouse Gases
Number of Sectors: Top 10

Documentation:
The sectors of the economy used in this model.
The environmental, energy, and other data used and their sources.
Frequently asked questions about EIO-LCA.

This sector list was contributed by Green Design Institute.

Change Inputs (Click here to view greenhouse gases, air pollutants, etc...)

	Sector	SO2 mt	CO mt	NOx mt	VOC mt	Lead mt	PM10 mt	GWP MTCO2E	CO2 MTCO2E	CH4 MTCO2E	N2O MTCO2E	CFCs MTCO2E
	Total for all sectors	*0.002*	*0.006*	*0.001*	*0.000*	*0.000*	*0.000*	*0.596*	*0.507*	*0.054*	*0.008*	*0.026*
221100	Power generation and supply	0.001	0.000	0.000	0.000	0	0.000	0.176	0.174	0	0	0.002
333319	Other commercial and service industry machinery manufacturing	0.000	0.000	0.000	0.000	0	0.000	0.042	0.042	0	0	0
331111	Iron and steel mills	0.000	0.000	0.000	0.000	0	0.000	0.072	0.072	0	0	0
331411	Primary smelting and refining of copper	0.000	0.000	0	0.000	0	0.000	0.000	0.000	0	0	0
331312	Primary aluminum production	0.000	0.000	0	0.000	0	0.000	0.011	0.004	0	0	0.007
331311	Alumina refining	0.000	0	0.000	0.000	0	0.000	0.002	0.002	0	0	0
324110	Petroleum refineries	0.000	0.000	0.000	0.000	0	0.000	0.013	0.012	0.000	0	0
211000	Oil and gas extraction	0.000	0.000	0.000	0.000	0	0.000	0.017	0.003	0.014	0	0
325110	Petrochemical manufacturing	0.000	0.000	0.000	0.000	0	0.000	0.004	0.004	0	0	0
33361A	Speed changers and mechanical power transmission equipment	0.000	0.000	0.000	0	0	0.000	0.000	0.000	0	0	0

Download

Important conclusions from the life cycle assessment:

--This analysis if for only one hand dryer. There are opportunities to multiply these benefits.

--Hand dryers save:

--Global Warming Potential (GWP) - **9.214 $MTCO_2E$**

--Carbon Dioxide Equivalent – **8.143 $MTCO_2E$**

--Improve air quality in every category.

Appendix 4
Tips for Making the Business Case for Change

Tip # 1: Writing an Executive Summary

An executive summary is a brief overview of a report designed to give readers a quick preview of its contents. Its purpose is to consolidate the principal points of a document in one place. After reading the summary, your audience should understand the main points you are making and your evidence for those points without having to read every part of your report in full. It is called an executive summary because the audience is usually someone who makes funding, personnel, or policy decisions and needs information quickly and efficiently in order to make decisions and respond appropriately.

Guidelines:

An executive summary should communicate independently of the report. It should stand on its own as a complete document.

It should explain why you wrote the report, emphasize your conclusions or recommendations, and include only the essential or most significant information to support those conclusions.

Use subtitles, bullets, tables, selective bolding or other types of organizational structure to add clarity to your summary

It should be concise—about 10% of the length of the full report.

It should be organized according to the sequence of information presented in the full report. Don't introduce any new information that is not in your report.

To help with organizing the executive summary, after you have written the full report, find key words; words that enumerate (first, next, finally); words that express causation (therefore, consequently); words that signal essentials (basically, central, leading, principal, major); and contrast (however, similarly, less likely).

Read the completed summary with fresh eyes. Check spelling, grammar, punctuation, details, and content. Ask someone else to read it.

Tip #2: Technical Writing Tips

Use these tips as a **checklist** as you prepare your report.

- **Proof reading.** Write your report, let it sit, then proof read it for grammar, jargon, clarity, multiple meanings, and technical correctness before submittal. Re-read the report from the recipient's point of view. Reading the report aloud may help.
- **Figures and tables.** Refer to each figure and table in the text prior to inserting it. Always place the figure or table in the report soon after you have referred to it. Include a title and number for all figures and tables, capitalizing the title when referring to a specific table or figure, e.g., "All of the wastes generated by the shop are listed in Table 1
- **Transitions.** Provide brief transition sentences between sections of the report and before a bulleted list to explain what the list consists of and how it is organized.
- **Parallel construction.** Use parallel construction in all numbered or bulleted lists. For example, all items should be a complete sentence or none should be; or all items might begin with an active verb, e.g., "use," "change," "remove" or a noun, like this list.
- **Format.** A general format/outline has been suggested, although this may need to be modified to address a client's requests. Generally you should:
  - Move from generalities to specifics, in each section and across the report as a whole.
  - Use page numbers.
  - Keep section headings with the narrative that follows at page breaks.
  - Rarely split a table across two pages.
- **Abbreviations.** On first use, spell the term out completely, followed by the abbreviation in parentheses. For example, "Volatile Organic Compounds (VOCs) are another waste that could be minimized." Subsequently, just the abbreviation is sufficient unless it is used at the beginning of a sentence. Never start a sentence with an abbreviation or a numeral.
- **Professional tone.**
  - Avoid slang, informal terminology (inexpensive vs. cheap), or imprecise (there, that, it) language.
  - Be careful how you word suggestions. Avoid making recommendations outside of your area and level of expertise in source reduction and waste minimization.
  - Use tact and be positive in your conclusions. Remember a reader likes to be complimented, but can see through phoniness.
  - Be careful to confirm your information if you state it as a fact; or cite your source, e.g., "According to Mr. Jones, Plant Engineer, . ." or state that the information is a potential based on xyz assumptions.
- **Common errors.**
  - i.e. vs. e.g.: i.e. means "that is" or "in other words," and e.g. means "for example."
  - compliment vs. complement: a compliment is a nice comment, and a complement is a part of a whole
  - how many vs. how much: how many can be counted, and how much is uncountable, e.g., how many bottles of water vs. how much water.
  - policies vs. procedures vs. practices: policies are formal written positions or statements about some issue; procedures are written directives aimed at accomplishing a task or complying with a policy; practices are typically informal steps people take, which may or may not follow written policies and procedures

Tip #3: General Recommendations

General recommendations are made to help a company establish the culture and infrastructure needed to establish and sustain a commitment to source reduction and sustainability. Examples of commonly made general recommendations include:

1. A pollution prevention policy statement should be generated and periodically updated by management to formally reflect management's commitment to incorporating pollution prevention in the company's operations. Some examples of formal policy statements follow:

> *This company is committed to continued excellence, leadership, and stewardship in protecting the environment. Environmental policy is a primary management responsibility, as well as the responsibility of every employee.*
>
> *The corporate objective is to reduce waste and achieve minimal adverse impact on the air, water, and land through excellence in environmental control.*
>
> *Minimizing or eliminating the generation of hazardous waste is a prime consideration in process design and plant operations and is viewed by management as having a priority as high as safety, yield, and loss prevention.*

2. To further implement the corporate pollution prevention policy, one or more "cause champions" should be selected to lead the pollution prevention program and overcome the resistance present when changes are made to existing operations. These "cause champions" may include a project manager, an environmental coordinator, or anyone else dedicated to implementing the pollution prevention ideal and company policy. These individuals must be given authority by management to carry out the policy.

3. Input from employees should be considered, encouraged, and valued. Since the employees must deal with the waste, they may have insight into how a specific pollution prevention opportunity may be implemented. Many companies offer incentives to employees who suggest innovations to minimize or reduce waste generation.

4. Goals should be established to help implement and track the progress of the corporate pollution prevention policy. Specific, quantitative goals should be set that are acceptable to those willing to work to achieve them, flexible to changing requirements, and achievable with a practical level of effort. To document the progress of the pollution prevention goals, a waste accounting system should be used.