Commercial Clothes Dryers

Response to California Energy Commission
2013 Pre-Rulemaking Appliance Efficiency
Invitation to Participate

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Summary

The information below is a direct response to the California Energy Commission's (CEC) Invitation to Participate (ITP) for the 2013 Appliance Efficiency Pre-Rulemaking, regarding Commercial Clothes Dryers, including performance data, test procedures, market indicators, and cost data.

There are currently no federal or California energy efficiency testing and minimum energy performance standards for commercial clothes dryers. The United States Department of Energy (U.S. DOE) has established both testing standards and minimum energy performance standards for residential clothes dryers. Commercial clothes dryers have very similar designs and controls as residential clothes dryers. Therefore, the U.S. DOE test standard for residential clothes dryers may be adopted as the Title 20 test standard for commercial dryers with some modifications to accommodate different capacity ranges found in commercial dryers. IOU CASE study team tested commercial dryer models that represent the majority of the commercial dryers in the California market. Energy performance standards for these dryer models can be adopted based on test results.

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1 Basic Information

1.1 Product definition: what differentiates a commercial clothes dryer from a residential dryer?

Commercial and residential dryers have similar designs and controls. They differ in applications and capacities.

Residential dryers are used mostly in single-family residences and some high-end multi-family residences, where space for laundry appliances and gas or electric connections are available for dryer installation. Commercial clothes dryers are used in three types of applications including multi-family laundromats (MFL), coin-operated Laundromats (COL), and on-premise laundromats (OPL). The first two are self-explanatory and serve people who do not have their own laundry equipment. The third one refers to on-site laundry equipment for serving particular types of facilities, such as hospitals, hotels and motels, restaurants, health clubs, fire stations, and law enforcement facilities.

Capacities of residential clothes dryers are specified by drum volume in cubic foot (ft^3). Standard size residential dryers have drum volumes in the range of 6.5 to 9.0 ft^3, and compact size residential dryers have drums less than 4.4 ft^3. MFL dryers represent the smallest class of commercial dryers, and they are mostly used in MFL, as suggested by the name. Capacities of MFL dryers are specified by drum volume and are very similar to those of standard size residential dryers. Capacities of all other commercial dryers are specified by the dryer weight capacity measured in pounds of dry clothes. The available weight capacities are in the range of 18 to 464 lb. Of those dryers, the 30-lb dryers are the most popular model and are widely used in COLs, OPLs, and also some MFLs.

1.2 Test methods used to measure product efficiency and performance?

There are currently no federal or California energy efficiency testing and minimum performance standards for commercial clothes dryers. U.S. DOE has established both testing standards and minimum energy performance standards for residential dryers (CFR Part 430 and Subpart B Appendix D). There are no international standards for commercial clothes dryers, either.

1.3 Are there any existing commercial clothes dryer efficiency specifications or standards?

There are currently no federal or California minimum energy performance standards for commercial clothes dryers. U.S. DOE has established both testing standards and minimum energy performance standards for residential dryers. There are no efficiency specifications in the market for commercial dryers.

1.4 What are the limitations of the test methods? Any improvement needed?

Commercial clothes dryers have very similar designs and controls as residential clothes dryers. The predominant difference between the two types of dryers is capacity in terms of drum volume or weight capacity. The test procedures prescribed in the U.S. DOE residential clothes dryer standards can be used for commercial dryers as well. IOU CASE study team conducted laboratory tests to demonstrate that the test standard established by the U.S. DOE for residential clothes dryers can be effectively used to measure performance of commercial dryers. The only testing parameter needing adjustment for commercial dryers is the test load weight in order to accommodate the large range of capacities of commercial dryers. IOU CASE study team has developed recommendations on test load weights for different classes of commercial clothes dryers.

1.5 Sources of test data

There are no publically available test data for commercial clothes dryers. The IOU CASE study team tested MFL dryers and 30-lb dryers from major commercial dryer manufacturers. Test results were used to develop recommendations on minimum performance standards for these classes of dryers with gas as the main fuel source.

1.6 Energy Use Metrics

The U.S. DOE defines residential dryer energy efficiency using the Energy Factor (EF) and Combined Energy Factor (CEF), in the unit of pounds of dry clothes per kilowatt-hours of energy (lb/kWh). The quantity represents the ratio between the load weight and the associated total dryer energy consumption. The definition of CEF was recently developed and adopted into the latest U.S. DOE residential dryer standards to be effective on January 1, 2015. Compared to EF, CEF also accounts for energy consumed by the dryer during standby and off modes. The U.S. DOE minimum CEF requirements are 3.73 and 3.30 for standard-size residential electric and gas dryers respectively.

IOU CASE study team tested commercial dryers before U.S. DOE adopted the definition of CEF to include dryer standby loss in efficiency measurement. Therefore, test data provided by the IOU CASE study team can only support the performance standard development based on EF.

2 Operations, Functions, and Modes

2.1 Duty cycle and per unit estimated energy consumption per cycle, per volume, per weight of cloth, and per year.

Dryer energy consumption can be measured on a per load (or cycle) basis. Energy consumption for each load is affected by clothes weight, clothes material compositions, moisture contents (both before and after drying), and control settings. These parameters can have large variations depending on dryer applications. The average energy consumptions per load for a dryer may be estimated based on operational and control parameters defined in the test procedure: with a specified test cloth weight and material, with specified initial and final moisture contents. Measured electricity and natural gas consumptions are used to calculate the average energy consumptions per load. Annual energy consumption of a dryer is then calculated by multiplying the average energy consumption per load by the annual load frequency (number of load per year).

Average energy consumption per weight of cloth can be calculated by dividing the average energy consumptions per load by the testing cloth weight. Average energy consumptions per volume are not very meaningful and, therefore, are not provided.

The following table provides average energy consumption estimates for dryer models that were tested by the IOU CASE study team.

Table 1 Estimates of Average Per Unit Energy Consumptions

Dryer Class	MFL Gas dryer	MFL Electric dryer	Size A[1] Gas dryer
Average Load Size (lb/load)	8.45	8.45	20
Average Load Frequency (load/day)	3.5	3.5	5.5
Average Load Frequency (load/Year)	1278	1278	2008
Energy Consumption Per Load/Cycle			
Average Electricity Consumption per Load (kWh/load)	0.27	3.36	0.35
Average Gas Consumption per Load (therm/load)	0.12	0.00	0.36
Energy Consumption Per Weight of Cloth			
Average Electricity Consumption per Load (kWh/lb of Cloth)	0.032	0.398	0.017
Average Gas Consumption per Load (therm/lb of Cloth)	0.014	0.000	0.018
Energy Consumption Per Year			
Average Annual Electricity Consumption (kWh/yr)	350	4300	700
Average Annual Gas Consumption (therm/yr)	147	0	732

3 Energy Saving Technologies, Components, and Features

3.1 Are there new technologies or add-on controllers that offer better efficiency in existing units (retrofits)

All promising efficiency technologies (described in the next section) require substantial changes in dryer internal designs. Therefore, there are no feasible energy efficiency measures for retrofit applications.

3.2 What are the energy efficient technologies in the market to today?

Energy efficiency technologies for commercial dryers may be classified into two categories: optimization of normal dryer designs and utilization of innovative technologies.

[1] Represented by gas dryer with 30-lb weight capacity

The first category of technologies includes optimization of operational parameters and addition of automatic termination controls (ATC). Dryer performance is affected by heat input, tumbler rotation speed, air temperature, air flow rate, and air flow pattern. Optimizing design values and control settings of these parameters is the probably the most cost effective way to improve dryer efficiency, since this approach has minimum impact to dryer designs. Air flow pattern may be most important parameter for optimization, as several manufacturers have been advertising superior efficiency due to better air flow designs. ATC reduce energy waste by automatically stopping heat input when the clothes are sensed to be dry. This control functions also help eliminate over-drying, which may damage clothes fabrics. ATC are widely used in residential dryers and their energy savings are recognized by the U.S. DOE test standards for residential dryers. Implementing ATC in coin-operated dryers requires some changes in common market practices. Coin-operated dryers currently vend a set amount of time for a set price. Implementing ATCs into this market would require the industry to change its focus from dispensing time to delivering dry clothes, so that dryers can be stopped if clothes are detected to be dry.

Innovative technologies for dryer efficiency improvement include gas modulation, air recirculation, condensing, heat pump, mechanical steam compression and microwave dryer technologies. These technologies require major design changes to current commercial dryers in California market and, therefore, they represent long-term efficiency improvement opportunities.

3.3 How much energy do they save? How commonly are they implemented?

Research literature indicates that up to 20% savings can be achieved through heat input, drum rotation speed, and air flow optimization. Performance test conducted by IOU CASE study team indicated that 2.5% and 8% efficiency differences for tested MFL and 30-lb gas dryers, respectively. These performance differences are mostly due to differences in operational and control settings and, therefore, represent optimization opportunities.

U.S. DOE residential dryer standards currently recognize ATC by giving dryers with ATC features a field use factor adjustment (around 13% credit for having temperature or moisture ATC as opposed to timer control only) in efficiency rating. More test studies are needed to further assess energy savings achieved by different ATC technologies under field operation conditions. While ATC is relatively common for residential dryers, it does not have the same high penetration in commercial dryers.

Most of the innovative technologies listed in the prior section are in the development stage and are not commercially available. They provide different levels of energy savings for future efficiency improvements.

3.4 Design life cycle and incremental cost of energy efficiency improvement

Based on interviews with stakeholders, commercial clothes dryer expected useful life (EUL) is expected to be between 13 and 15 years. In contrast, The California Database for Energy Efficient Resources (DEER) sets the residential dryer EUL at 15 years. The IOU CASE study assumes commercial dryers to have an average EUL of 14 years for performing lifecycle cost analysis.

Costs of commercial clothes dryers are not correlated with dryer efficiencies. The dryers that performed better based on the laboratory tests did not cost more than those that were tested to be less efficient. Dryers with higher heat input ratings (kBTU/hr for gas and kW for electric dryers) tend to have higher prices, even though higher heat inputs may lead to lower efficiencies.

4 Market Characteristics

4.1 California sales by model and estimated retail price. What proportion use natural gas as a fuel source?

Multifamily commercial dryers cost between $500-1,000 per unit, and size A (30-lb capacity) gas dryers cost $3,000-4,000 per unit.

There is no definitive data source for the market share between gas vs. electric commercial clothes dryers. Market study and conversations with product distributors indicate that the majority (more than 90%) of commercial dryers used in California use gas as a fuel source.

4.2 How many commercial clothes dryers are there currently in operation in California?

The estimated commercial dryer stock in California is as follows:

Table 2 Estimated Commercial Dryer Stock in California

Applications	Estimated Current Stock
MFL Dryers	268,000
Gas	255,000 (95%)
Electric	13,000 (5%)
COL Dryers*	40,000
OPL Dryers*	40,000 – 72,000
Total	348,000 – 380,000

*They are all gas models and are represented by 30-lb dryers.

5 Market Competition for Efficient Products

5.1 Product Development Trends

There have been no obvious improvements in commercial clothes dryer efficiencies in the past. Lack of an energy efficiency test standard is one of the major reasons for such a stagnating improvement because dryer efficiencies are unknown to end users. While some manufacturers may try to promote efficient products, others may try to compete with products with faster drying speeds. Without a standardized efficiency rating system, there is no efficiency performance data to effectively drive efficiency improvement.

5.2 Market barriers to Energy Efficiency

IOU CASE study demonstrated with dryer test results that efficiency improvements can be achieved through operational parameter optimizations. These optimizations are based on existing dryer designs and controls and, therefore, are expected to face little market barriers.

As explained in a prior section, possible penetration barriers to applying ATC technologies in commercial dryers are mainly due to the common practices of the market. Laundromats with coin operated dryers currently vend a set amount of time for a set price. Implementing sensors into the market would require the industry to change its focus from dispensing time to completing the drying cycle.

5.3 How do businesses identify efficient products on the market?

Because there are currently no energy efficiency test standards nor efficiency requirements established for commercial dryers, products do not display any quantitative efficiency-related information. As a result, businesses do not have a way to clearly identify efficient products besides any voluntary info or sales pitch provided by the product manufacturers.

5.4 Is there any survey done to gauge consumers' acceptance and performance of the new units?

No.

5.5 How many small businesses are involved in the manufacture, sale, or installation of these products?

There are very few small businesses involved in the manufacture of commercial dryers. A few large manufacturers account for the majority of the market are:

Table 3 Commercial Dryer Manufacturers

Manufacturer
Alliance Laundry Systems (Includes Cisell, Huebsch, IPSO, SpeedQueen, Unimac)
American Dryer Corporation
Continental Girbau
Dexter
General Electric (GE)
Maytag (Include brand names of Maytag and Whirlpool)
Wascomat

Small businesses may be involved in the sale and installation of these products, though there are no market study data to describe the market make up.