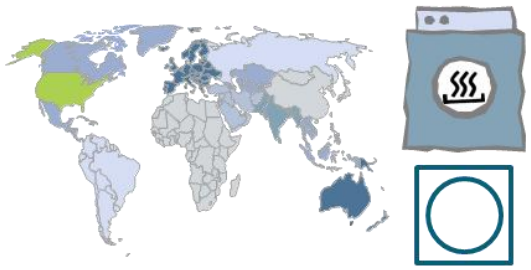


Country:	USA
Technology:	Laundry Dryers
Sub Category:	Vented and condenser electric models

Introduction

The first stage in the Mapping and Benchmarking process is the definition of the products, i.e. clearly setting the boundaries that define the products for use in data collection and analysis. Doing this ensures that comparison between the participating countries is done against a specific and consistent set of products.

The summary definition for this product is:

Laundry Dryers defined as:

'An energy using appliance for use in households designed to remove the moisture of a (given) load of clothing or other textiles.'

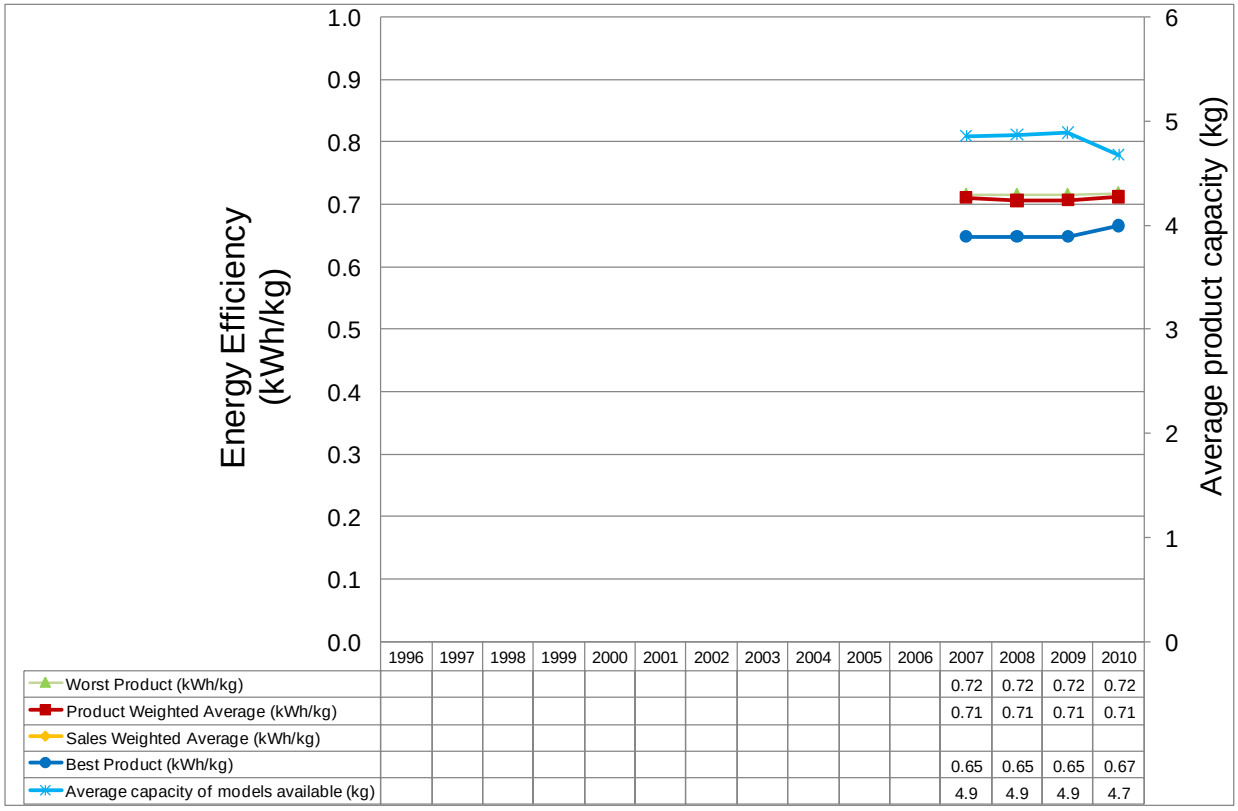
Data will be analysed for the following types of laundry dryer:

Laundry Dryers	Heat source	Electrical	
	Mode of drying	Tumble dryer	
	Air usage	Vented (fresh air is heated, passed through textiles and exhausted from the appliance)	Condenser (noting whether air condenser, or heat pump condenser) (air used for the drying process is dehumidified by cooling and re-circulated)
Functionality	Layout	Noted whether top loader or front loader.	
	Capacity (dry load)	Less than 10 kg. Full analysis only for appliances with capacity between 4 kg and 10 kg.	
	Wash capability	Washer dryers are excluded from the analysis.	
	Automation	To be noted whether the appliance has moisture sensor, load sensor or just timer /manual control.	

The detailed product definitions can be found at the Annex website:

http://mappingandbenchmarking.iea-4e.org/matrix

Energy Efficiency of New Laundry Dryers USA



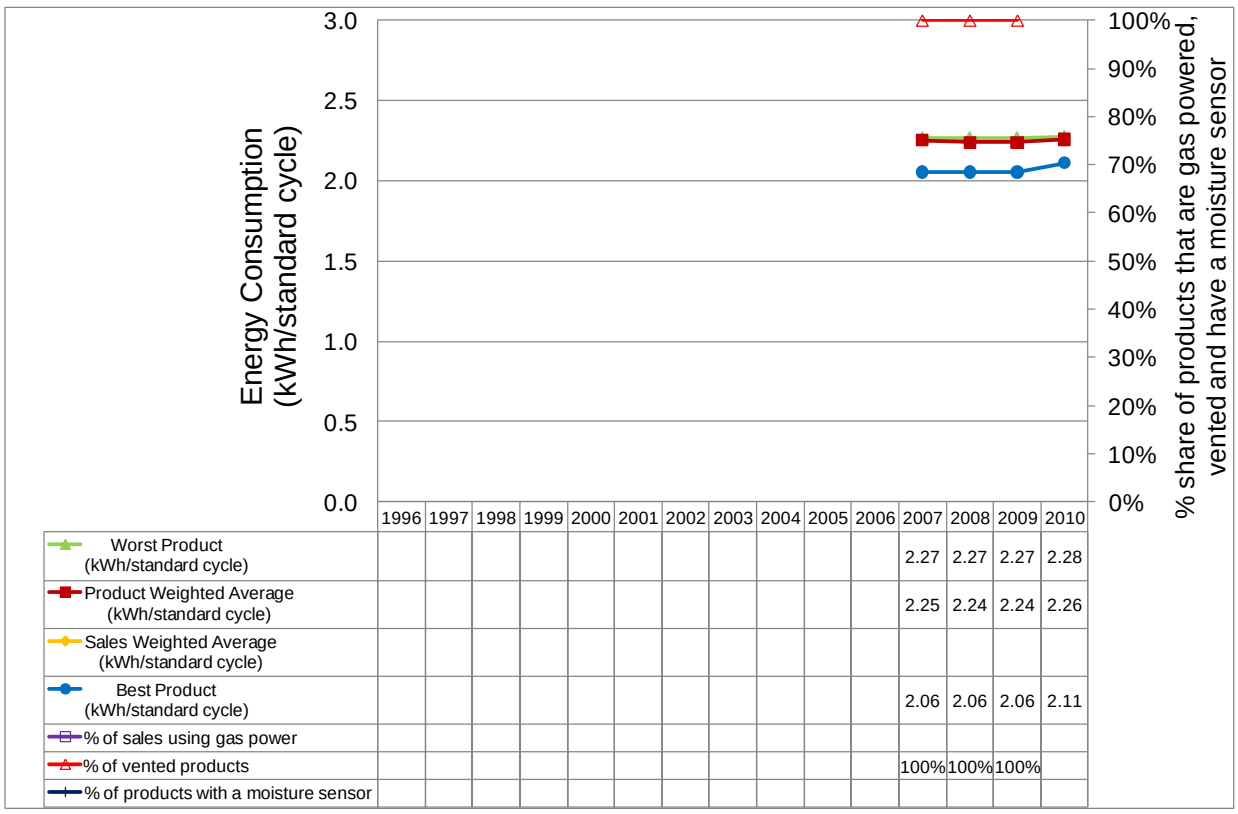
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Worst Product (kWh/kg)												0.72	0.72	0.72	0.72
Product Weighted Average (kWh/kg)												0.71	0.71	0.71	0.71
Sales Weighted Average (kWh/kg)															
Best Product (kWh/kg)												0.65	0.65	0.65	0.67
Average capacity of models available (kg)												4.9	4.9	4.9	4.7

Key notes on Graph (see notes section 1)

- Data from 2007-9 is taken from the California Energy Commission's appliance efficiency database; 2010 data is taken from a Federal Trade Commission database. Both sources are considered representative of the whole USA market.
- Load capacities have been converted from Container Volumes (ft^3) to loads (kg) using the rule of thumb of 1.34 cubic feet per kg (see Notes on Data, Section 1 Notes on Product Efficiency).
- Analysis excludes compact models defined in this study as less than 4kg capacity[1], with conversions made according to the factor above, rather than excluding compact models as defined by the US test methodology which is less than 4.4 cubic feet volume capacity.
- In order to indicate a 'worst performing' product that reflects the broad market (as opposed to representing perhaps a single unusual or wrongly reported product), the 'energy efficiency of worst product' is in fact the energy efficiency of the product at the 'worst 5%' point of a ranked list in the dataset. The Best performing product is that with the best energy efficiency.

[1] In the USA test methodology, "standard" models are defined as units of 4.4 cubic feet or greater capacity whereas the annex definition is > 4kg dry textile load. The capacity limit adopted for this study equates to around 5.4 cubic feet.

Energy Consumption of New Laundry Dryers USA



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Worst Product (kWh/standard cycle)												2.27	2.27	2.27	2.28
Product Weighted Average (kWh/standard cycle)												2.25	2.24	2.24	2.26
Sales Weighted Average (kWh/standard cycle)															
Best Product (kWh/standard cycle)												2.06	2.06	2.06	2.11
% of sales using gas power															
% of vented products												100%	100%	100%	
% of products with a moisture sensor															

Key notes on Graph (see notes section 2)

- Data for 2007-9 are from the California Energy Commission's appliance efficiency database; 2010 data are from a Federal Trade Commission database. Both are considered representative of the whole market.
- Unit Energy Consumption (UEC) data is derived from the Unit Energy Efficiency and the fixed test load in North America for standard dryers.
- Condensing clothes dryers are not currently regulated in the USA and have not made major inroads into the USA market. Hence it is considered that vented dryers constitute the vast majority of the market in the USA.
- The proportion of gas powered dryers on the market appears to have fallen from 23% in 2000, to 21% in 2005[2] and 19% in 2009[3] (see Cultural Issues section).
- In order to indicate a Worst performing product that reflects the broad market (as opposed to representing perhaps a single unusual or wrongly reported product), the 'energy efficiency of worst product' is in fact the energy efficiency of the product at the 'worst 5%' point of a ranked list in the dataset. The Best performing product is that with the lowest energy consumption.

[2] From the Buildings Energy Data Book, p 5-24, October 2009.
[3] Appliance Magazine .com, *U.S. Appliance Unit Shipments Statistics for the month of August 2009*, published December 2009. Data is for 'year to date' August 2009.

Energy Efficiency in the Installed Laundry Dryers Stock USA

No data on the Unit Energy Efficiency of the typical unit installed in the stock was available to the annex at the time of publication.

Energy Consumption in the Installed Laundry Dryers Stock USA

No data on the Unit Energy Consumption of the typical unit installed in the stock was available to the annex at the time of publication.

Major Policy Interventions (See notes Section 5)

Manufacturers must declare the Energy Factor, expressed in lb/kWh and meet a prescriptive standard based on capacity of the dryer. The current standards came into force in 1994. A proposed a new standard is scheduled to be published in June 2011.

There is no EnergyGuide label applicable to clothes dryers.

Brief History: The current final rule for gas and electric clothes dryers (10 CFR 430.32(h)) was published in May 1991 and prescribed Federal energy conservation standards effective from 1994. The standards consist of four minimum Energy Factors (EF), expressed in pounds of clothing load (lb) per kilowatt-hour (kWh), one for gas dryers and one each for three different types of electric dryers as per the table below.

Residential Clothes Dryer Current US Energy Conservation Standards

Product Class	**EF lb/kWh**	**Equivalent efficiency kWh/kg**
Electric, Standard (4.4 cubic feet (ft^3) or greater capacity)	3.01	0.733
Electric, Compact (120 V) (less than 4.4 ft^3 capacity)	3.13	0.704
Electric, Compact (240 V) (less than 4.4 ft^3 capacity)	2.90	0.760
Gas	2.67	0.826

Update of the 1994 standards began in 2007 with DOE lead consultation on the "Energy Conservation Standards Rulemaking Framework Document for Residential Clothes Dryers and Room Air Conditioners"[4]. This was followed by the preliminary technical support document (preliminary TSD[5]) which included: A market and technology assessment to define scope and classes for clothes dryers; reviewed technology options to improve efficiency; engineering analysis of price impacts; annual energy use; life-cycle costs and pay-back periods for individual consumers; product shipments, national impact and manufacturer impact analysis. Associated consultation, a public meeting in March 2010 and a "Joint Petition"[6] from manufacturers, NGOs and consumer groups contributed to DOE's proposed resolution of the issues in the proposed final rule to be published in June 2011.

[4] See http://www1.eere.energy.gov/buildings/appliance_standards/
[5] See http://www1.eere.energy.gov/buildings/appliance_standards/residential/preliminary_analysis_tsd.html.
[6] "Agreement on Minimum Federal Efficiency Standards, Smart Appliances, Federal Incentives and Related Matters for Specified Appliances". See http://www.aham.org/ht/a/GetDocumentAction/i/49956. This paper submitted by groups representing manufacturers, energy and environmental advocates and consumer groups recommends specific energy conservation standards for residential clothes dryers and other products.

Cultural Issues (See Notes Section 6)

The total number of USA households with a dryer has grown from 76% in 2002 to 81% in 2005[6].

The proportion of the market accounted for by gas powered dryers appears to have fallen slightly from 23% in 2000, to 21% in 2005[7]. The fall appears to have continued, as a different data set[8] indicates that 19% of sales for year to date August 2009 were gas powered.

Note that the products in the 2010 dataset used for this analysis that are gas powered (product weighted) is 37%, indicating that a good variety of gas powered appliances is available but sales are not as strong as for electric appliances.

The average useful life of a domestic dryer is 12 years.

[7] From the Buildings Energy Data Book, p 5-24, October 2009.
[8] Appliance Magazine .com, U.S. Appliance Unit Shipments Statistics for the month of August 2009, published December 2009. Data is for 'year to date' August 2009.

Notes on data

Section 1: Notes on Product Efficiency

The test methodology used in the USA is ANSI/AHAM HLD-1-2010 and energy performance levels and test procedures for residential electric clothes dryer are harmonized with the Canadian regulations.

The principal issues to note in the context of comparison with other countries are:

Test methodology	ANSI/AHAM HLD-1-2010
Capacity metric	Volume of drum, cubic feet
Ambient temperature for test	24°C±2°C
Ambient relative humidity for test	50%±10%
Test cloths	50% of cloths cotton; 50% of cloths easy care fabrics
Load during test	3.17 kg (7lb) dry weight cloths
Initial moisture content	70%±3.5% of bone dry
Final moisture content	3.75%±1.25% of bone dry
Metric for efficiency arising from local test	Energy Factor (EF) kg/kWh

- The average capacity of the appliances is measured in kg for this analysis. This is converted from cubic feet to kg based upon the assumption that there is a ratio of 2.5[9] between the load capacity in kg of a clothes washer and a clothes dryer with the same volumetric capacity. The table which defines test loads in the North American **washing machine** test methodology is used to estimate the washing machine load in kg for the given volume. This equates to around 0.54 cubic feet per kg for a washing machine and so 1.34 cubic feet per kg for a dryer.

- Only appliances with capacities between 4kg and 10kg are within scope of this analysis and so the capacity conversion described above was used to convert capacity in cubic feet to an equivalent kg for each US appliance. The 4kg and 10kg limits were then applied to define the products considered in scope. This equates to a capacity scope of 5.4 to 13.4 cubic feet.
  Note that the US test methodology defines a 'compact dryer' as one with less than 4.4 ft^3 (125 litres) capacity, and so is smaller than the adopted 'compact dryer' definition for this analysis.

- Energy efficiency and MEPS levels are measured as an energy factor (EF) kg/kWh (compared kWh/kg under the European system). EF it is therefore simply the inverse of efficiency in kWh/kg.

[9] http://www.laundry-and-dishwasher-info.com/Tumble-Dryers.html

- Appliances are tested with a test load of 3.17 kg of fabric (dry weight) regardless of the capacity of the dryer (compact dryers, less than 4.4 ft^3 capacity, are tested with a lower weight of fabric).

1.1 Product Efficiency Graphic

1.1.1 Data Source:

All product data is taken from a mix of sources:

- Data from 2007-9 is taken from the California Energy Commission - appliance efficiency database.
- Data from 2010 is from a Federal Trade Commission database.

1.1.2 Data Clarifications

Whilst the 2007-9 data is not for the whole USA, it is believed that the US marketplace is relatively homogenous and therefore, that this data can be considered representative of that market.

1.1.3 Glossary of energy metrics for laundry dryers:

The key metrics for laundry dryers and the key calculations undertaken in the wider Annex analysis are described below. Some metrics and/or calculations are not relevant to all data sets due to absence of data or for other reasons.

Declared Unit Load Capacity: Unit load capacity in kg is defined by local regulations and declared by manufacturers. Unit kg. Capacity for US appliances is declared in cubic feet. This is converted based on 1kg for every 38 litres (see Section 1.1).

(Note: This capacity is defined using the mixture of materials defined in the local regulations which is not necessarily in line with the mixture of material used elsewhere (for local load mix, refer to Section 1.1 on “Notes on Data”)).

Unit Energy Consumption (UEC): Unit Energy Consumption is the energy consumed by the unit to complete one drying cycle as defined by local test conditions (Unit: kWh/cycle).

Sales Weighted UEC of New Models: Value calculated by [Sum of (UEC multiplied by sales volume of Model in year) for all Models] divided by [Sum of (sales volume of all Models in year)]. Unit kWh/cycle.

Product Weighted UEC of New Models: Value calculated by [Sum of (Model UEC for all models sold in year)] divided by [Sum of (Number of Models sold in year)]. Unit kWh/cycle.

Unit Energy Efficiency (UEE): Value calculated by dividing UEC by Declared Unit Load Capacity (kWh/Kg/cycle).

Sales Weighted UEE of New Models: Value calculated by [Sum of (UEE multiplied by sales volume of Model in year) for all Models] divided by [Sum of sales volume of all Models in year]. Unit kWh/kg/cycle.

Product Weighted UEE of New Models: Value calculated by [Sum of UEE for all models sold in year] divided by [Number of Models sold in year]. Unit kWh/Kg/cycle.

Section 2: Notes on Product Consumption

2.1 Test methodologies, Performance Standards and Labelling Requirements

No further information.

2.2 Product Consumption Graphic

See section 1.2

Section 3: Notes on Efficiency of Stock

No further information.

Section 4: Notes on Consumption of Stock

No further information.

Section 5: Notes on Policy Interventions

No further information.

Section 6: Notes on Cultural Issues

No further information.