Market Transformation for Clothes Dryers: Lessons Learned from the European Experience

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Abstract

The European residential clothes dryer market is undergoing a transformation driven by highly efficient heat pump dryer technology. In 2012, over 80 residential heat pump dryer models from 18 different manufacturers were available on the European market[1]. Additionally, Switzerland implemented a new minimum energy performance standard (MEPS) that effectively allowed only heat pump dryers to be sold in that country. The Super Efficient Dryer Initiative (SEDI) was formed in the US to support improvements in dryer energy efficiency based on the European experience and to bring together utility energy efficiency programme providers, dryer manufactures, government agencies and other stakeholders to repeat the European success in the US and Canada.

Heat pump dryers have substantial energy saving potential in North America. Recent testing indicates that European heat pump dryers are 50-60% more energy efficient than existing North American conventional electric dryers[2]. In 2012, SEDI supported the US Environmental Protection Agency (EPA) decision to offer an ENERGY STAR Emerging Technology Award (ETA) for efficient dryers. The ETA for Advanced Clothes Dryers is designed to support the introduction of efficient technology through recognition and promotion[3]. Several manufacturers are now ready to introduce a significantly more energy efficient clothes dryer into the North American market, and the announcement of an ETA recipient is expected soon.

This paper describes the actions dryer stakeholders have taken on both sides of the Atlantic to promote efficiency and identifies lessons from the European market transformation experience that can be applied in North America.

Introduction

For over two decades, there has been little improvement in the energy efficiency of North American dryers. Today, there are several new technologies that promise to significantly reduce dryer energy use, including varying heat production and airflow (modulation), appropriately sensing when the clothes are dry, recovering and reusing wasted heat from the drying process, and utilizing heat pumps instead of electric resistance to dry clothing. Manufacturers, governments, utility energy efficiency programmes, and other stakeholders have taken several steps to prepare the North American market for the introduction of more energy efficient dryers.

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[1] http://www.topten.eu/uploads/File/Topten%20Focus%20HP%20dryers%20Apr%2012.pdf
[2] Analysis of Potential Energy Savings from Heat Pump Clothes Dryers in North America. Available at : http://www.clasponline.org/ResourcesTools/Resources/StandardsLabelingResourceLibrary
[3] http://www.energystar.gov/index.cfm?c=pt_awards.pt_clothes_dryers

Europe, on the other hand, is already undergoing market transformation towards greater dryer energy efficiency; primarily through the introduction of clothes dryers with heat pump technology. The European market for heat pump dryers is the most mature globally, with the greatest variation in features and price. The success of heat pump dryers in Europe is the result of efforts by manufacturers, consumers, government agencies and others. There are several lessons from Europe's market transformation experience that could help policymakers and planners in North America transform the North American market.

North American Summary

In North America, dryers have reached market saturation and can be found in over 80% of United States (US) and Canadian homes. Over six million clothes dryers are sold each year, and the installed stock in the US and Canada is close to 100 million[4]. The majority of these dryers are vented conventional tumble dryers that use electricity or gas to dry the clothing. Condensing dryers are sold in North America, but they represent a small fraction of installed dryers. The typical electric conventional dryer consumes between 600 – 1,000 kWh per year[5], making it one of the largest domestic electricity-consuming appliances in North America, after space conditioning and water heating.

Due to the lack of more efficient technology options on the North American clothes dryer market, clothes dryers in the US have never carried energy efficiency labels. The ENERGY STAR programme has not covered clothes dryers, and the US Federal Trade Commission has not implemented an EnergyGuide label for the product group. Canada's similar EnerGuide label does cover clothes dryers, but Canadians have always had essentially the same range of clothes dryer product choices as consumers in the US.

Test Procedure and MEPS

In the US and Canada, the clothes dryer energy efficiency test procedure used for minimum energy performance standards (MEPS), and usually also used by ENERGY STAR, are developed during the MEPS-setting process by the US Department of Energy (DOE)[6]. To be effective for both uses, the test procedure must give a reasonably accurate measurement of dryer energy consumption in the field, and must be able to distinguish differences in energy efficiency between different products.

The current DOE energy efficiency test procedure for dryers[7] was last amended in 2005 and does not accurately measure the energy consumption of dryers capable of automatically terminating the drying cycle based on feedback from moisture or temperature sensors. This automatic termination feature saves energy by reducing the over-drying of laundry that is typical of dryers with simpler, timed drying cycles. Not all North American dryers on the market today are equipped with automatic cycle termination. The dryers that are so equipped also vary significantly in how well they detect the dryness of a load of laundry.

In 2010, the DOE initiated a process to revise its dryer test procedure, and on January 2, 2013, they published the draft version of the revision. The proposed procedure contains several modifications, and it allows manufacturers to measure the energy consumption of dryers with the automatic termination feature enabled[8]. If this revision is accepted, the new test procedure will show greater variation in the measured energy consumption of currently-available North American clothes dryers. This improvement will in turn allow ENERGY STAR to recognize more energy efficient products through a dryer label and utility efficiency programmes to promote efficient dryers through financial incentive programmes.

ENERGY STAR

The ENERGY STAR programme for clothes washers has been quite successful at promoting more energy efficient models, particularly front loading designs. There has long been an interest from manufacturers and retailers for a matching programme for dryers, since washers and dryers are normally sold together in the US and Canada, and retailers want to be able to match an ENERGY STAR-qualified dryer with a similarly qualified washer.

In July of 2012, the US Environmental Protection Agency (EPA) announced the launch of an ENERGY STAR programme for dryers. EPA issued a first draft of the ENERGY STAR technical specification for clothes dryers

[4] Based on US EIA Residential Energy Consumption Survey http://www.eia.gov/consumption/residential/data/2009/#undefined and NRCan data.
[5] Estimate for US consumption based on laboratory measurements and observed usage patterns.
[6] Canadian federal clothes dryer energy efficiency regulation is usually based on DOE's lead.
[7] US Federal Code of Regulations 10 CFR 430.23(d)
[8] http://www.gpo.gov/fdsys/pkg/FR-2013-01-02/pdf/2012-30677.pdf

for review in August of 2012. The first draft included a minimum energy efficiency performance level that was about 13% better than the current market baseline. A second draft of the technical specification is currently pending. Publication of a final technical specification is expected after April, 2013. ENERGY STAR-labeled dryers could be available for sale in North America as soon as late 2013.

In addition to an ENERGY STAR labeling programme, EPA announced in 2011 that the ENERGY STAR Emerging Technology Award (ETA) programme would focus on highly efficient electric dryers. Models with a minimum energy efficiency that is roughly 30% better than the market baseline, and which are available on the North American market, are eligible for the award. As of this writing, no dryer models have been submitted for consideration for the award, but announcement of one or more winners may be coming soon.

Energy Efficiency Programmes

North American energy efficiency programmes are usually operated at the state (US) or provincial (Canada) level by electric and natural gas utilities, and sometimes by local governments. These programmes have substantial resources to promote energy efficiency; in 2011, their combined budgets totaled USD $7 billion[9]. There is a wide variation between US state programmes on the level of commitment to energy efficiency, but in general both the number of states with significant energy efficiency programmes and the budgets for those programmes are increasing. There is a similar, though less well-funded, trend across Canada.

To some extent, current North American domestic energy efficiency programmes are victims of their past success. The programmes provide marketing support and price subsidies for targeted energy-using domestic products, and they usually use ENERGY STAR technical criteria to define which products to subsidize. In the past, many programmes invested heavily in subsidies for ENERGY STAR-labeled compact fluorescent lamps and clothes washers. However, as these technologies have obtained large market shares, it has become harder for the programmes to justify continued subsidies for them. At the same time, the budgets of many programmes have been increased, and programme managers are expected to meet higher energy savings goals. As a result, many programmes are actively seeking new, highly efficient domestic technologies to promote. With over six million dryers sold in North America each year, and with heat pump and other technical improvements promising energy savings of up to 50%, many programmes are very interested in supporting their introduction.

Super Efficient Dryer Initiative

For the past four years, the Super Efficient Dryer Initiative (SEDI) has been working to bring new, energy efficient clothes dryers to the US and Canadian markets. In 2012, SEDI found an institutional home at the Vermont Energy Investment Corporation, and evolved from a group of interested parties to a more formal sponsorship organization. For 2013, SEDI has an operating budget of USD $266,000 provided by sponsors representing energy efficiency programmes across the US and Canada. SEDI is run by a core team of experienced consultants (including two of the authors) who provide sponsor services and define SEDI's scope of work. Recently, SEDI created two new working groups intended to help energy efficiency programmes lay the groundwork for new product introductions. The first working group is charged with reviewing technical data on clothes dryers and developing measure characterizations for use in energy efficiency programme cost-effectiveness screenings. The second working group focuses on programme design, specifically creating an approach for the multifamily sector.

One of SEDI's main functions in the near term will be to coordinate existing dryer research and to commission new research as requested by sponsors (including the CLASP testing report referenced above). SEDI also maintains regular communication with laundry industry contacts, particularly those manufacturers and retailers most likely to be involved in bringing energy efficient dryers to the North American market.

Research

Several research projects have recently concluded in North America, and their results will be published soon. A laboratory research report to be released in first quarter of 2013 (commissioned by SEDI sponsor CLASP)[10] confirms that European heat pump dryers consistently use only about 50% as much energy as North American conventional dryers across a range of test procedures[11]. Similarly, the report highlights the large impact of laundry load composition on dryer energy consumption. Less complicated clothing with a higher proportion of synthetic textiles requires less energy to dry than heavier clothing made primarily of cotton. In other words,

[9] Blog post, Steve Nadel ACEEE http://aceee.org/blog/2013/01/ring-out-old-ring-new-energy-efficien
[10] Analysis of Potential Energy Savings from Heat Pump Clothes Dryers in North America. Available at : http://www.clasponline.org/ResourcesTools/Resources/StandardsLabelingResourceLibrary
[11] See footnote 2 above.

regional differences in the types of clothes people wear, and in the load compositions stipulated by applicable dryer test procedures, can drive both real and laboratory-derived differences in dryer energy consumption.

The Northwest Energy Efficiency Alliance (NEEA) also plans to release extensive laundry energy use and owner behaviour data from 49 homes in the Northwester part of the US[12]. The NEEA study found that, at least for this sample, participants had a higher number of dryer cycles per year than is assumed in the current DOE dryer test procedure. These results should help North American utility energy efficiency programmes better quantify the energy efficiency savings from new, more efficient dryer technologies.

European Summary

The market penetration of residential dryers in Europe has been lower than in North America but is steadily on the rise. Four million tumble dryers were sold for residential use in Europe in 2010[13], and annual sales are increasing as the installed stock of 54 million dryers increases. The level of market penetration is uneven across European countries. For example, more than 60% of Dutch homes have dryers, while they appear in less than 20% of Italian homes[14]. The dominant dryer technology in Europe is non-vented condensing, but heat pump clothes dryers, which are significantly more energy efficient, are steadily gaining market share.

EU Energy Label

In 1995, the European Commission implemented a measure to require the labeling of electric dryers with the European Union (EU) Energy Label. The EU Energy Label is a categorical label that ranges from "A" through "G," with the "A" class representing the most energy efficient dryers on the European market[15]. When the label was introduced, heat pump dryers were not yet available, and no other dryers on the European market were capable of achieving the "A" class energy efficiency level. This meant that there were three years during which no dryer qualified for the "A" class energy efficiency level.

Introduction of heat pump dryers

The first "A" level heat pump dryer on the market was offered by AEG in 1998, followed by the first effort by energy activists to promote the new technology in 2001. The City of Zurich owned about 10,000 residential flats, for which it purchased large numbers of domestic appliances. Zurich took an early interest in heat pump dryers as a way to save energy in their residential properties. During the summer of 2003, Zurich initiated a pilot energy efficiency programme in which 30 heat pump dryers were installed in multi-family residences, a nursing home, an indoor swimming pool, and a hairdressers,' followed by a satisfaction survey. User satisfaction with heat pump dryers was examined a second time beginning in 2005. The surveys revealed that facilities owners or managers responsible for multi-family residences were content with the heat pump dryers. Based on first study, in 2003 the City of Zurich implemented a policy officially favoring the procurement of heat pump dryers for its properties, and in 2005 it initiated a rebate programme to promote heat pump dryer purchases.

Switzerland's Efficiency Standard

In 2012, Switzerland's government established an efficiency standard requiring that all electric dryers sold in Switzerland meet the class "A" energy efficiency level. By 2011, heat pump dryers had reached a market share of 47% in Switzerland. Currently, after the standard's implementation,100% of dryers sold in Switzerland are heat pump dryers.

TopTen

TopTen[16] was launched in Switzerland in 2000 and has been instrumental in all phases of Europe's dryer market evolution from 2006 through today. The success in transforming the European dryer market is largely due to the continuity of TopTen's advocacy efforts and their ability to work effectively with a network of stakeholders – including manufacturers, government officials, utilities, NGOs and energy agencies on both the national and EU levels. TopTen also provided public visibility for the new heat pump dryers through its European and national websites, as well as technical expertise to stakeholders in order to promote standards, subsidies, and procurement schemes.

[12] Northeast Energy Efficiency Alliance report to be released July, 2013 www.neea.org
[13] TopTen focus on dryers http://www.topten.info/uploads/File/Topten%20Focus%20Sept2010%20Tumbler.pdf
[14] See footnote 6 above
[15] http://www.eceee.org/Eco_design/Energy_labelling_directive
[16] www.topten.info

The Swiss market has undergone a complete market transformation, but success in Europe has so far only been partial. In November 2013, a new EU MEPS will exclude the least efficient dryers from the market, but it is not stringent enough such that only "A" class dryers would be sold in Europe. Under the previous EU energy label, all heat pump dryers were simply class "A". The updated label recognizes that there is now a wide range of efficiency within the European heat pump category, and it will distinguishes between more and less efficient class "A" dryers with the designations "A+", "A++" and "A+++". The best dryers on the European market may already reach the "A++" class. The "A+++" class sets a future target for manufacturers. TopTen recommended that letter classes be realigned so that the least efficient heat pump dryers would no longer receive the "A" class, but this recommendation was not followed.

The European Commission declined to make the new EU MEPS as ambitious as Switzerland's due to general concern (particularly from consumer associations) that this action would drive up dryer purchase prices. The laundry appliance industry was strongly opposed to any revision to the EU energy label for dryers that would result in downgrading the energy class of any products. The implementation of the "A+" through "A+++" levels are an attempt to provide some useful information to customers, while responding to industry demands. However, this set of designations may result in consumers perceiving that the majority of dryers on the market are above average efficiency, which would reduce the informational value of the label.

Lessons Learned

Regulatory policy is important.

Europe has had an effective test procedure and an appliance labeling programme for dryers in place for some time. Additionally, the EU appliance labeling programme was able to promote a new, higher level of clothes dryer technology before it was actually present in the market. Recent improvements to the test procedure and implementation of an ENERGY STAR labeling programme for dryers should help create the necessary conditions for market transformation in North America.

An achievable target is needed to drive market transformation.

A modified electric resistance, vented, conventional dryer may be capable of reaching both the ENERGY STAR dryer efficiency level (expected to be about a 13% improvement) and the ENERGY STAR Emerging Technology Award efficiency level (about a 30% improvement). Without a new target, it may be difficult for manufacturers of more efficient technologies – such as heat pumps, which offer a 50% improvement – to successfully enter the North American market in the short term.

When the EU energy label class "A" designation was initially set at a level the technology available at the time could not reach, it established a target that contributed to the introduction of the first heat pump dryer in 1998. The challenge for SEDI over the next two years will be to work with manufacturers, government, energy efficiency programmes, and others to set this higher efficiency target for North America.

Good technology requires policy sponsors to succeed.

The commitment of manufacturers, government, consumers (represented by the City of Zurich), and TopTen were key to the success of heat pump dryers in Europe – first in Switzerland and now in the wider region. TopTen played an integral role by promoting heat pump dryers and coordinating European stakeholders. They followed the development of the technology and the associated political process through many stages on a long-term basis in Europe. The same type of coordinator will be needed in North America, and SEDI appears to be well-positioned to fulfill this role.

Energy labeling schemes differ between regions, but industry interests do not.

The EU energy label and the ENERGY STAR label both strongly influence consumer choice, making them an important part of a manufacturer's marketing strategy. As a result, manufactures will invest in efficiency in order to obtain the EU energy label class "A" designation or the ENERGY STAR label. When efficiency labels work well, they pull the market towards greater energy efficiency. However, efficiency labels can also hinder market transformation if their requirements are too easily met and if they do not effectively differentiate between the most efficient dryers and the rest of the market. Manufacturers want their products to qualify for labels with the least amount of investment, and once the label is obtained, manufacturers want their products to retain it. In Europe, manufacturers opposed a realignment of the EU energy label to match greater efficiency in the dryer market. The results is the potentially confusing "A+" "A++" and "A+++" subcategories for dryers described above. In North America, similar industry pressure could result in an initial ENERGY STAR label for dryers with an efficiency level that manufacturers could easily and quickly meet. If this were to occur, it could inhibit further efficiency gains.

Conclusion

After decades without significant improvement in dryer efficiency, North America has a significant opportunity to transform the dryer market towards greater energy efficiency. Looking forward, 2013 will stand out as a particularly important year in this process. Several developments are expected, including:

- Introduction of more energy efficient dryers into the North American market, including a dryer capable of qualifying for the ENERGY STAR Emerging Technology Award;
- Finalization of the revised clothes dryer energy efficiency test procedure;
- Completion of the ENERGY STAR label for dryers; and,
- Publication of important dryer research (including the CLASP laboratory testing and NEEA field data).

Successful market transformation in Europe has inspired these developments.

Over time, we can expect that domestic clothes dryers will follow the penetration curve of domestic clothes washers in developed countries, becoming a common domestic appliance and adding to domestic energy consumption around the world. More efficient dryers will mitigate, but not remove, this challenge. The US and Canada should continue to study the lessons from Europe's experience, and apply them in North America. All parties should share research results and work towards the harmonization of standards that will allow a better understanding of the energy impacts.

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