

# Technology Innovation Project



*Project Brief*

## TIP 323: Affordable Hybrid Heat Pump Clothes Dryer for the U.S. Residential Market

### Context

Approximately 80% of US households have a clothes dryer and approximately 80% of those are electric. In the US, clothes dryers consume about 66 TWh/year which represents about 6% of residential electricity use. The Northwest Power and Conservation Council (NWPCC) is evaluating emerging technologies in their resource acquisition portfolio as part of the development of the Seventh Northwest Power Plan

A heat pump clothes dryer (HPCD) is identified as a residential technology that can contribute to reducing a home's electrical load and thus contribute to the goal of a zero net energy home.

### Description

Pacific Northwest National Laboratory (PNNL) in partnership with Jabil, a US-based global manufacturing services provider, will design, construct, and demonstrate an affordable heat pump clothes dryer (HPCD) suitable for the U.S. Market.

The first year demonstration focuses on demonstrating at least 50% energy savings and less than 5-year payback through analyses, modeling, and testing of a laboratory demonstration system. The demonstration system will integrate a modified commercial clothes dryer with a heat pump system constructed from off-the-shelf components. Two Stage Gates will be based on progress in achieving the goals of 50% energy savings and 5-year payback. The first will be based on calculations and analyses after 3 months, while the second will occur at the end of the first year and be based on test results from the demonstrator using the DOE standard clothes dryer test procedures.

In the second year, a prototype machine will be designed, built, and tested in order to demonstrate a packaged system that is suitable for U.S. residential markets and will attract additional commercialization partners.

### Why It Matters

BPA is committed to acquiring energy savings in the residential sector in the Pacific Northwest region. Heat pump clothes dryers are an important technology given the significant potential energy savings from HPCDs across all climate zones in the Region. The penetration of electric clothes dryers in the Region is greater than 80% and thus there is a potential for large energy savings (yet to be quantified). HPCD technology represents a significant 'leap' in the efficiency of residential appliances, compared to the modest (~25%) efficiency improvements that are effected by federal energy conservation standards; similar to that of heat pump water heaters. A significant improvement in the energy efficiency (up to 50% over today's electric clothes dryers) can only come with a fundamental design change that is offered by a HPCD.

### Goals and Objectives

A novel hybrid HPCD will be developed and demonstrated that saves at least 50% of the energy used by conventional electric dryers and will have a payback of less than 5 years for at least 25% of the BPA residential customers. The scope includes advancing hybrid heat pump clothes dryer technology from TRL 4 to TRL 7/8 through two phases of development and demonstration.

### Deliverables

The deliverables from the project will include: an interim project report documenting simulations and design calculations, payback analysis, equipment designs, test results and a preliminary prototype design.

The Final Project Report provided at the end of the second year will document all calculations, designs, and results from the project. This report will be issued as a PNNL report and made available to the public.

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**Project Start Date:** December 04, 2014

**Project End Date:** November 30, 2016

### Reports & References (Optional)

### Links (Optional)

### Funding

|                     |           |
|---------------------|-----------|
| Total Project Cost: | \$900,893 |
| BPA Share:          | \$400,893 |
| External Share:     | \$500,000 |
| BPA FY2015 Budget:  | \$222,825 |

### For More Information Contact:

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### Participating Organizations

Pacific Northwest National Laboratory (PNNL)  
Jabil, St. Petersburg, FL

