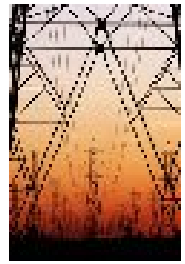

PacNW Energy Pilot

Speaking ['energy'] to an appliance

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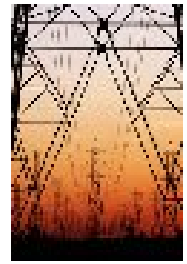
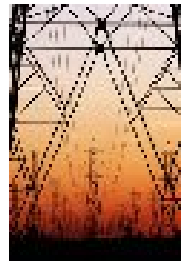


Grid-Friendly Appliances

PacNW Energy Pilot Project

Participants

Portland General, PacifiCorp, Pacific Power, Clallam PUD, Mason County PUD No. 3, Bonneville Power Administration, Pacific NW National Laboratory, GridWise Alliance, Invensys, Whirlpool Corporation, IBM, and Sears.



Two main categories of appliances

Persistent

Single persistent task such as:

- Maintaining room temperature
- Keeping water warm

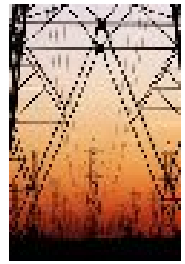
Process-Oriented

Start-to-finish process involving multiple steps, sensors, temperatures and consumables often performing the task upon other consumer products such as food, clothing, and dishes.

--- **Forced power interruption** ---

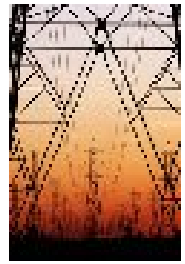
may be acceptable

NOT acceptable



Whirlpool has pioneered the ability to include both Process-Oriented and Persistent appliances in energy management

Persistent	Process-Oriented



An *energy-managed appliance*:

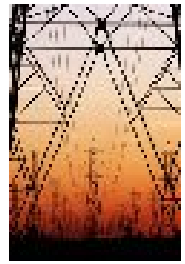
Appliance actions defined as implementing one or more of these characteristics:

PacNW Pilot
- **Grid Friendly** (GFA) - brief instantaneous load shedding

PacNW Phase II
- **Curtailment** - response to external signal requesting a load reduction

PacNW Phase II
- **Critical Peak Pricing** (CPP) – response to external CPP signal indicating a temporary price change

Future Impl.
- **Load / Peak Leveling** - internal, external, or coordinated energy consumption limitation.



An *energy-managed appliance*:

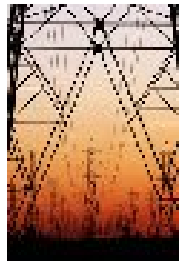
- **Grid Friendly** (GFA) - brief instantaneous load shedding
- **Curtailment** - a load reduction request
- **Critical Peak Pricing** (CPP) - a temporary price change
- **Load / Peak Leveling** - coordinated energy consumption

Key Concept:

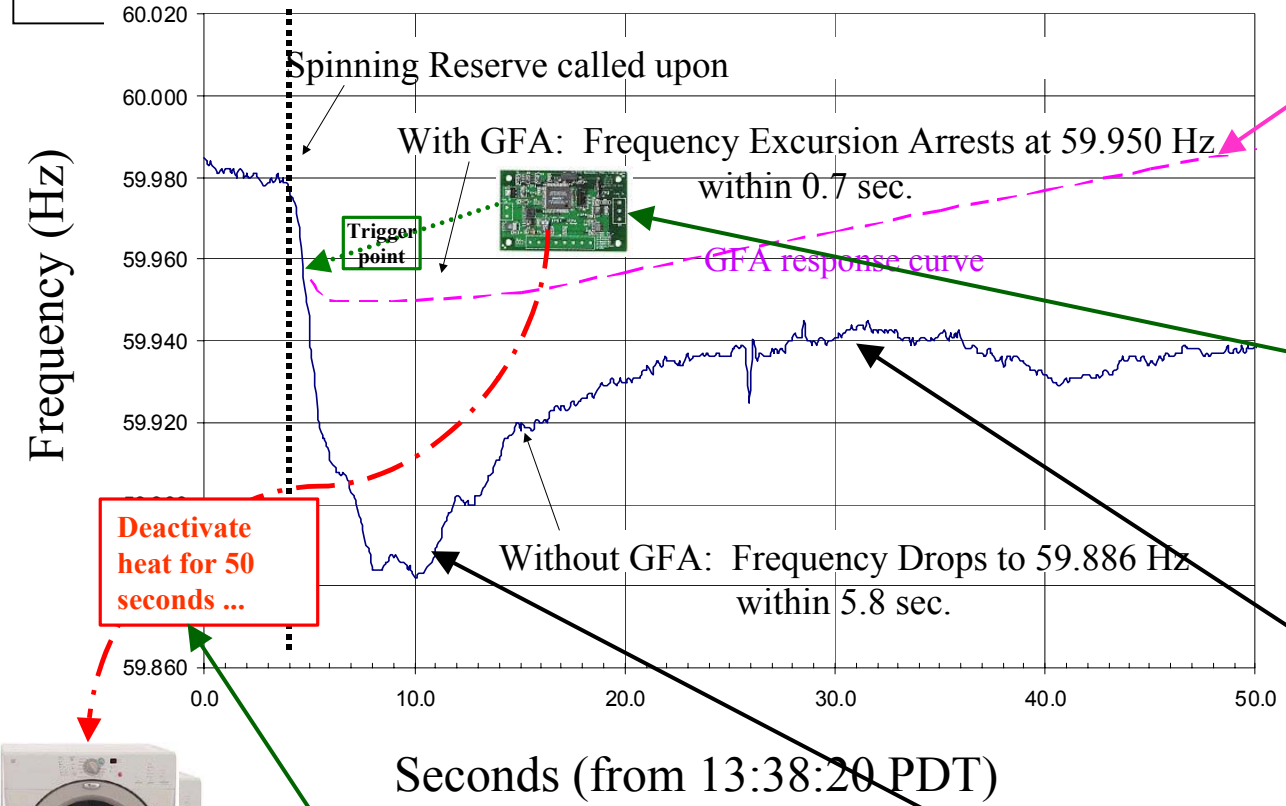
Each appliance model & type may have a different response depending on

- **the capability of the appliance hardware**
- **flexibility of the appliance control system**
- **ability to meet the energy request without objectionable consumer disruption**
- **the general discretion of the designer / manufacturer**

PacNW Project : Whirlpool Appliance Energy Interface



GFA - Grid Stability Sensor Example



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Future System

Grid-Friendly Appliances
Respond faster without cost of running backup generators

Future System

PNNL Sensor
Detects grid frequency & triggers at appropriate time

Current System

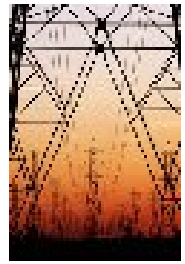
Actual grid event data
Under stress, grid frequency drops

Future System

Appliance Responds
(Average duration of 2 minutes)

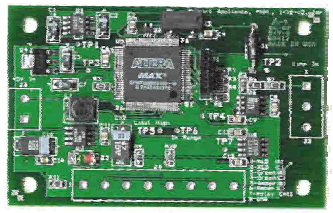
Current System

"Spinning Reserve" power applied
From running backup generators

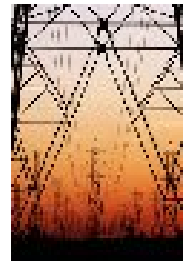


Grid Stability Sensor

(designed by Pacific NW National Labs)



- **Upon sensing a grid instability situation, a signal indicates that a pause in appliance energy consumption is desired.**
- **The appliance responds by reducing power temporarily.**
- **These are infrequent events and are generally a short duration lasting only several minutes.**



Clothes Dryer - Will be used in the PacNW Pilot

Example appliance response:

- turn off the internal heating element
- continue drum rotation
- reduce the heat/temperature
- automatically extend the drying time to compensate for the reduced energy mode
- allow consumer override / continue
  (after specified time interval)

GFA event reduces pilot dryer from approximately 5,700 watts to approximately 280 watts.

Energy Management System

Load Control Meter

Electric Water Heater

Load Control Meter

Always On Network

Secure Network

Gateway

Thermostat

Electric Meter

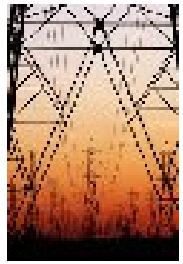
Back End Server

Internet

UTILITY

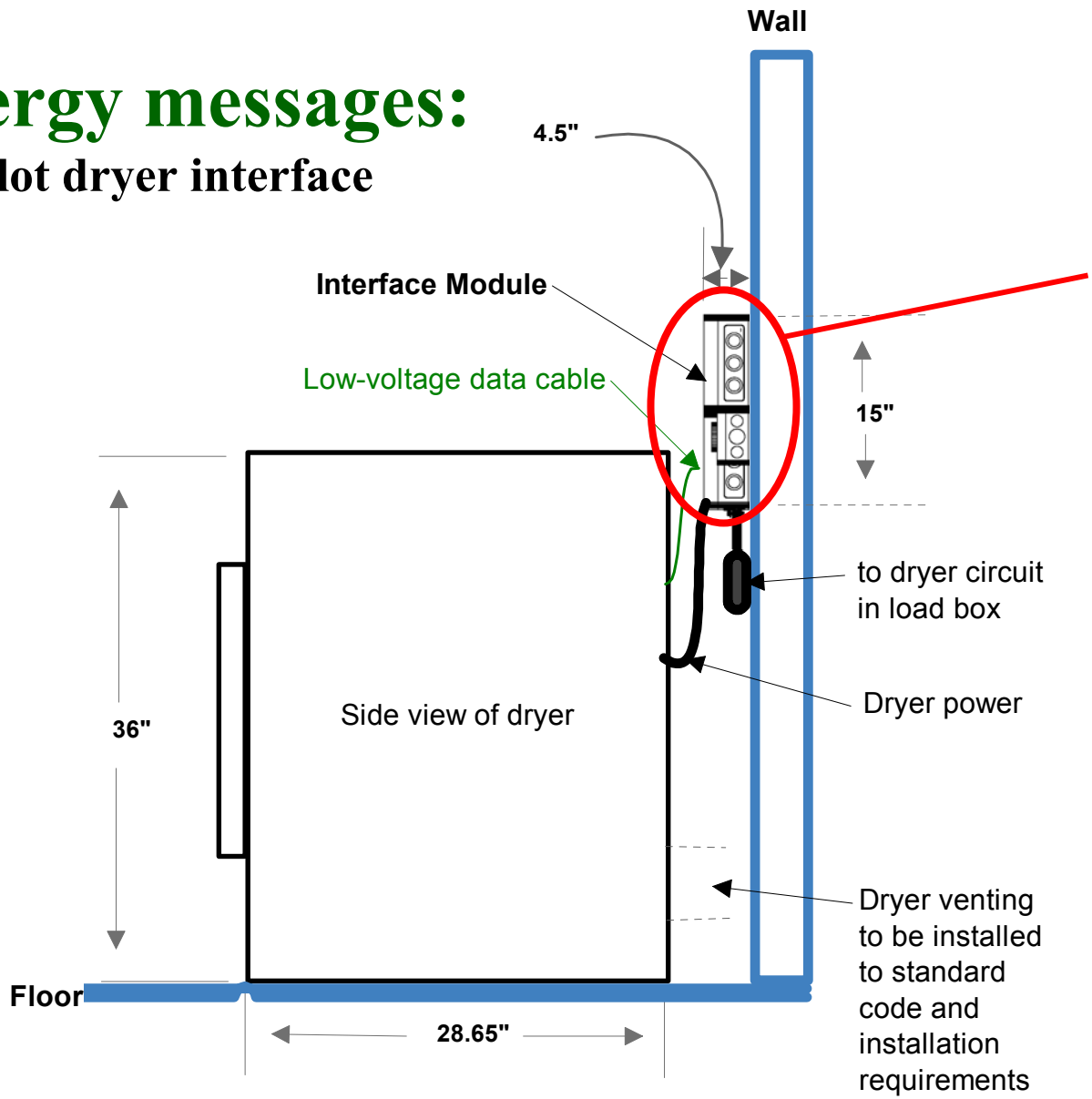
HOME

PacNW Testbed Project



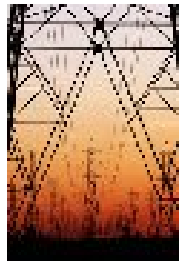
Energy messages:

via pilot dryer interface



Interface includes communications and power metering for program pilot validation only.

PacNW Project : Whirlpool Appliance Energy Interface



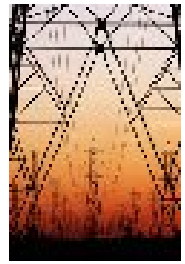
Consumer requested to delay use of energy

En ergy – The dryer has received a energy curtailment request.

Consumer notified of a temporary energy price increase.

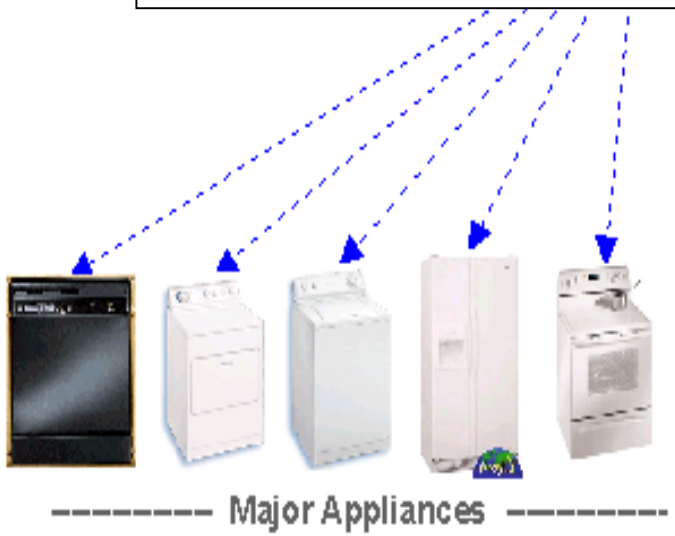
Pr ice – The dryer has received a critical peak pricing indicator.

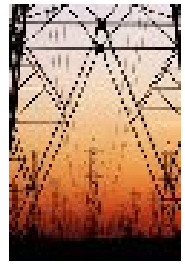
PacNW Project : Whirlpool Appliance Energy Interface



Whirlpool Appliance Energy Interface enables:

- Tailoring to any appliance type or model
- Scaleable to handle a variety of control structures
- Accessible via any infrastructure, simple or complex





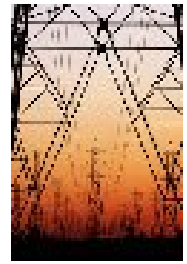
Additional considerations or issues:

Research and Engineering costs are:

- higher for process-oriented white goods
- invested up front far ahead of any measurable ROI
- difficult to justify or quantify results

Requires value proposition and cooperation

- the appliance manufacturer
- the consumer
- the energy industry
- residential building industry
- managed home technology firms
- government incentives or regulations



Questions & Comments?

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