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DOE Rulemaking & EU Update

2014 HI Technical Meeting

Charlotte, NC

June 25, 2014

Speaker Panel

- Mark Handzel, Xylem, Inc.
- Greg Towsley, Grundfos
- Charlie Cappellino, ITT Industrial Process
- Frank Ennenbach, Sulzer Pumps
- Bob Barbour, TACO, Inc.
- Greg Case, TACO, Inc.

Hydraulic Institute – DOE Rulemaking

www.Pumps.org/DOERulemaking

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ASRAC Pumps Working Group

Results Summary






U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

BUILDING TECHNOLOGIES PROGRAM

June 13, 2014

Commercial and Industrial Pumps Background

- The working group voted to define a 'pump' as "a device that moves liquids (which may include entrained gases, free solids, and totally dissolved solids) by physical or mechanical action and includes a bare pump and, if included by the manufacturer, the mechanical equipment, driver, and controls."
  - This rulemaking only includes clean water pumps 1-200 HP limited to certain design parameters

- Equipment classes within the scope of this rulemaking include (1) end suction close coupled (ESCC) 1800, (2) ESCC 3600, (3) end suction frame mounted (ESFM) 1800, (4) ESFM 3600, (5) In-line (IL) 1800, (6) IL 3600, (7) radial split vertical (RS-V) 1800, (8) RS-V 3600, (9) vertical turbine submersible (VT-S) 1800, and (10) VT-S 3600.
  - Analysis was not performed for RS-V 1800, RS-V 3600, or VT-S 1800 due to limited opportunity for energy savings.

- Approximately 420,000 commercial and industrial pumps within the scope of this rulemaking were shipped in 2012. A baseline ESCC 1800 with a shaft HP of 8.0 HP consumes approximately 17,156 kWh/year. A baseline ESCC 3600 with a shaft HP of 13.8 HP consumes approximately 27,096 kWh/year. A baseline ESFM 1800 with a shaft HP of 60.6 HP consumes approximately 112,570 kWh/year. A baseline ESFM 3600 with a shaft HP of 47.8 HP consumes approximately 93,063 kWh/year. A baseline IL 1800 with a shaft HP of 3.9 HP consumes approximately 8,110 kWh/year. A baseline IL 3600 with a shaft HP of 5.7 HP consumes approximately 12,292 kWh/year. A baseline VT-S 3600 with a shaft HP of14.5 HP consumes approximately 30,262 kWh/year.

- The total installed base of commercial and industrial pumps within the scope of this rulemaking accounts for 0.8 quads/year in source energy, which is approximately 2 percent of total annual commercial and industrial energy use.

Trial Standard Levels (TSLs)

- Trial Standard Levels (TSLs) are combinations of efficiency levels
- For this analysis, we assumed that each TSL consists of an identical efficiency level for each equipment class

TSL	Equipment Class						
	ESCC 1800	ESCC 3600	ESFM 1800	ESFM 3600	IL 1800	IL 3600	VT-S 3600
1	PER 10	PER 10	PER 10	PER 10	PER 10	PER 10	PER 10
2	PER 25	PER 25	PER 25	PER 25	PER 25	PER 25	PER 25
3	PER 40	PER 40	PER 40	PER 40	PER 40	PER 40	PER 40
4	PER 55	PER 55	PER 55	PER 55	PER 55	PER 55	PER 55
5	PER 70	PER 70	PER 70	PER 70	PER 70	PER 70	PER 70

NIA and MIA Results

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
National Full-Fuel Cycle Energy Savings (quads, 30 years of shipments)					
	0.09	0.35	0.64	1.02	1.46
NPV of Consumer Benefits (2013$ billion, 30 years of shipments)					
3% discount rate	0.4	1.4	2.6	3.9	5.3
7% discount rate	0.1	0.6	1.0	1.4	1.9
Manufacturer Impacts					
Industry NPV (2013$ million) (Base case = 117.6)	103.6 to 130.9	70.4 to 148.8	6.5 to 133.5	-103.8 to 126.7	-267.9 to 242.8
% Change in Industry NPV	-11.9% to 11.3%	-40.1% to 26.5%	-94.5% to 13.5%	-188.2% to 7.7%	-327.7% to 106.4%

- Main updates from previous numbers:
  - Changed to merged DOE/HI database with new C-values
  - Revised NIA inputs to properly reflect the deltas between the base case and standards case
  - Manufacturer markups in MIA updated to reflect shipment-weighting of models

Updated PER C-Values from Merged DOE/HI Database

Equipment Class		DOE/HI MERGED Database PER C-Values				
		EL 1	EL 2	EL 3	EL 4	EL 5
		PER 10	PER 25	PER 40	PER 55	PER 70
ESCC	1800	131.65	128.23	126.49	125.00	123.57
ESCC	3600	134.58	130.35	128.78	127.28	125.13
ESFM	1800	132.84	128.76	126.95	125.06	123.61
ESFM	3600	134.91	130.86	129.18	127.73	125.98
IL	1800	133.91	129.31	127.25	125.84	124.39
IL	3600	138.85	133.72	130.90	129.30	127.17
RSV	1800	133.70	131.94	129.63	127.88	124.73
RSV	3600	137.44	134.40	133.20	131.90	128.97
VTS	1800	135.78	133.90	130.80	128.67	127.21
VTS	3600	135.78	133.90	130.80	128.67	127.21

Actual Percentage of Merged Database Models Failing at Each Efficiency Level

- In order to determine C-values that cut off a certain percentage of pumps, we had to determine the C-value at which each pump would fail. We did this by ignoring motor losses for three reasons:
  - This is a time-consuming mathematical problem to solve if including motor losses
  - The motor losses to be used in the TP have not yet been finalized
  - Our data likely do not exactly represent the population; therefore the error from ignoring motor losses is likely to be within the noise
- As a result, the efficiency levels each would cut off slightly more pumps than was the design intent:

Equipment Class		Actual % of Models Failing at Each EL				
		EL 1	EL 2	EL 3	EL 4	EL 5
		PER 10	PER 25	PER 40	PER 55	PER 70
ESCC	1800	10.4%	27.4%	43.0%	59.0%	72.6%
ESCC	3600	10.4%	27.3%	43.0%	58.6%	73.1%
ESFM	1800	10.8%	25.9%	41.6%	57.8%	72.1%
ESFM	3600	10.1%	26.7%	40.1%	58.5%	71.4%
IL	1800	11.2%	25.1%	44.2%	57.2%	71.6%
IL	3600	10.4%	26.4%	40.6%	56.6%	71.7%
RSV	1800	Set to harmonize with EU Lot 11 MEI 40				
RSV	3600					
VTS	1800	No data available				
VTS	3600	10.3%	25.9%	43.1%	56.9%	70.7%
Total Industry		**10.6%**	**26.5%**	**42.2%**	**58.1%**	**72.1%**

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US to EU Crosswalk

The C-Values that cause ~10% of US models to fail

Causes ~14% of the ESCC 3600 pumps in the EU to fail (MEI14)

		EL 1	EL 2	EL3	EL 4	EL 5
Equipment Class		PER 10	PER 25	PER 40	PER 55	PER 70
ESCC	1800	11%	35%	51%	69%	>70%
ESCC	3600	14%	39%	53%	67%	>70%
ESFM	1800	10%	28%	44%	62%	>70%
ESFM	3600	11%	31%	44%	57%	>70%
IL	1800	21%	64%	>70%	>70%	>70%
IL	3600	11%	34%	56%	>70%	>70%
RSV	1800	10%	25%	40%	55%	70%
RSV	3600	10%	25%	40%	55%	70%
VTS	1800					
VTS	3600	10%	12%	49%	65%	>70%

DOE ASRAC "Term Sheet"

Appliance Standards and Rulemaking Federal Advisory Committee

Commercial and Industrial Pumps Working Group

Term Sheet

June 19, 2014

Background

On July 23, 2013, DOE issued a Notice of Intent to Establish the Commercial/Industrial Pumps Working Group To Negotiate a Notice of Proposed Rulemaking (NOPR) for Energy Conservation Standards for Commercial/Industrial Pumps. 78 FR 44036. This working group is established under the Appliance Standards and Rulemaking Federal Advisory Committee (ASRAC) in accordance with the Federal Advisory Committee Act (FACA) and the Negotiated Rulemaking Act (NRA). The purpose of the working group was to discuss and, if possible, reach consensus on a proposed rule for the energy efficiency of commercial/industrial pumps, as authorized by the Energy Policy and Conservation Act (EPCA) of 1975, as amended. The working group was to consist of representatives of parties having a defined stake in the outcome of the proposed standards, and will consult as appropriate with a range of experts on technical issues.

DOE received 19 nominations for membership. Ultimately, the working group consisted of 16 members, including one member from ASRAC and one DOE representative (see Appendix A). The working group met in-person during 7 sets of meetings held December 18-19, 2013 and January 30 – 31, March 4 – 5, March 26 – 27, April 29 – 30, May 28 – 29, and June 17– 19, 2014. The working group successfully reached consensus on proposed energy conservation standards for a specific set of pumps. This document includes the working group's recommendations to ASRAC on determining scope of this rulemaking as well as energy conservation standards. The group also chose to provide test procedure and metric-related recommendations to the committee.

Definition of Covered Product

Recommendation #1. The covered product, a 'pump,' will be defined as below subject to potential edits necessary to accomplish the same intent:

- '**Pump**' is a device that moves liquids (which may include entrained gases, free solids, and totally dissolved solids) by physical or mechanical action and includes a bare pump and, if included by the manufacturer, the mechanical equipment, driver, and controls.

Vote results: Consensus[1] (15 yes -1 no) on 3/4/2014

Recommendation #2. The components of a 'pump' will be defined as below:

- '**Bare pump**' is a 'pump' excluding mechanical equipment, driver, and controls.
- '**Mechanical equipment**' is any component that transfers energy from the driver to the bare pump.
- '**Driver**' is the machine providing mechanical input to drive the bare pump directly or through the mechanical equipment, and may include an electric motor, internal combustion engine, or gas/steam turbine.
- '**Controls**' means any device that can be used to control the driver.

Vote results: Consensus (15 yes - 1 absent) on 3/4/2014

[1] There are 16 members of the working group. Consensus has been defined as no more than 2 no votes.

Key Term Sheet Additions from last week

Energy Conservation Standards

Recommendation #9. For ESCC, ESFM, IL, and VT-S pumps in both 1800 and 3600 rpm speeds, the energy conservation standards will be set at PEI 25 (with C-values iterated to cut off as near to 25% of the pumps [in the DOE analytical team's merged database] as possible). For RS-V pumps, energy conservation standards will be set to harmonize with the European Union No 547/2012 MEI 40 level, [with the intent that no models known to pass the EU standard would fail the US standard.] The compliance date for all equipment classes will be 4 years from the publication of the Final Rule.

Vote results: Consensus (15 yes – 1 absent) on 6/17/14

Test Procedure and Metric

Recommendation #10. Pump test procedure should be in accordance with HI 40.6 for determining bare pump performance.

Vote results: Consensus (13 yes – 2 abstain – 1 absent) on 6/18/14

Key Term Sheet Additions from last week

Recommendation #11. [The metric for assessing compliance with the standard should be PEI, which is constructed based on values of PER.]

Pump Energy Index (PEI) CL and VL: PER_{CL} and PER_{VL}, for a given pump model (at full impeller diameter), over the PER_{CL} for a minimally compliant pump (PER_{STD}) serving the same hydraulic load:

$$PEI_{CL} = \left[\frac{PER_{CL}}{PER_{STD}}\right]$$

$$PEI_{VL} = \left[\frac{PER_{VL}}{PER_{STD}}\right]$$

Pump Energy Rating (PER) CL and VL: equally weighted average electric input power to the 'pump' measured (or calculated) at the driver input or, when present, controls input, over a specified load profile:

$$PER_{CL} = \sum_i \omega_i \left(P^{in}{}_i\right)$$

$$PER_{VL} = \sum_i \omega_i \left(P^{in}{}_i\right)$$

Key Term Sheet Additions from last week

Labeling Requirements

Recommendation #12. Pumps are labeled based on the configuration in which they are sold. The following information would be required to be included on a pump nameplate:

Bare Pump	Bare Pump + Motor	Bare Pump + Motor + Controls
PEI_{CL}	PEI_{CL}	PEI_{VL}
Model number	Model number	Model number
Impeller diameter for each unit	Impeller diameter for each unit	Impeller diameter for each unit

Vote results: Consensus (14 yes – 1 abstain – 1 absent) on 6/18/14

Key Term Sheet Additions from last week

Certification Reporting Requirements

Recommendation #13. Recommended data to be included in certification reports/database:

- Manufacturer name
- Model number(s)
- Equipment class
- PEI_{CL} or PEI_{VL} as applicable
- BEP flow rate and head
- Rated speed
- Number of stages tested
- Full impeller diameter (in.)
- Whether the PEI_{CL} or PEI_{VL} is calculated or tested
- Input power to the pump at each load point *i* (P^{in}_i)

Vote results: Consensus (14 yes – 1 abstain – 1 absent) on 6/18/14

Recommendation #14. Certification for RS-V and VT-S pumps shall be based on testing with the following number of stages:

- RS-V: 3 stages
- VT-S: 9 stages
- If a model is not available with that specific number of stages in the given scope, the model will be tested and certified with the next closest[1] number of stages offered for sale by the manufacturer.

Vote results: Consensus (15yes– 1 absent) on 6/18/14

What's Next?

- The DOE ASRAC Pump Working Group has now completed their assigned tasks. The scheduled July meeting is cancelled.
- The Term Sheet summarizing the results will be presented at the next meeting of the Appliance Standards and Rulemaking Federal Advisory Committee (ASRAC) meeting. Date: tbd
- DOE will spend the rest of the year doing further in depth studies of the recommendation, vetting the impacts with other federal departments who have to approve and developing the Notice of Proposed Rulemaking (NOPR)
- There will be some communication with HI during this time period.

In Summary

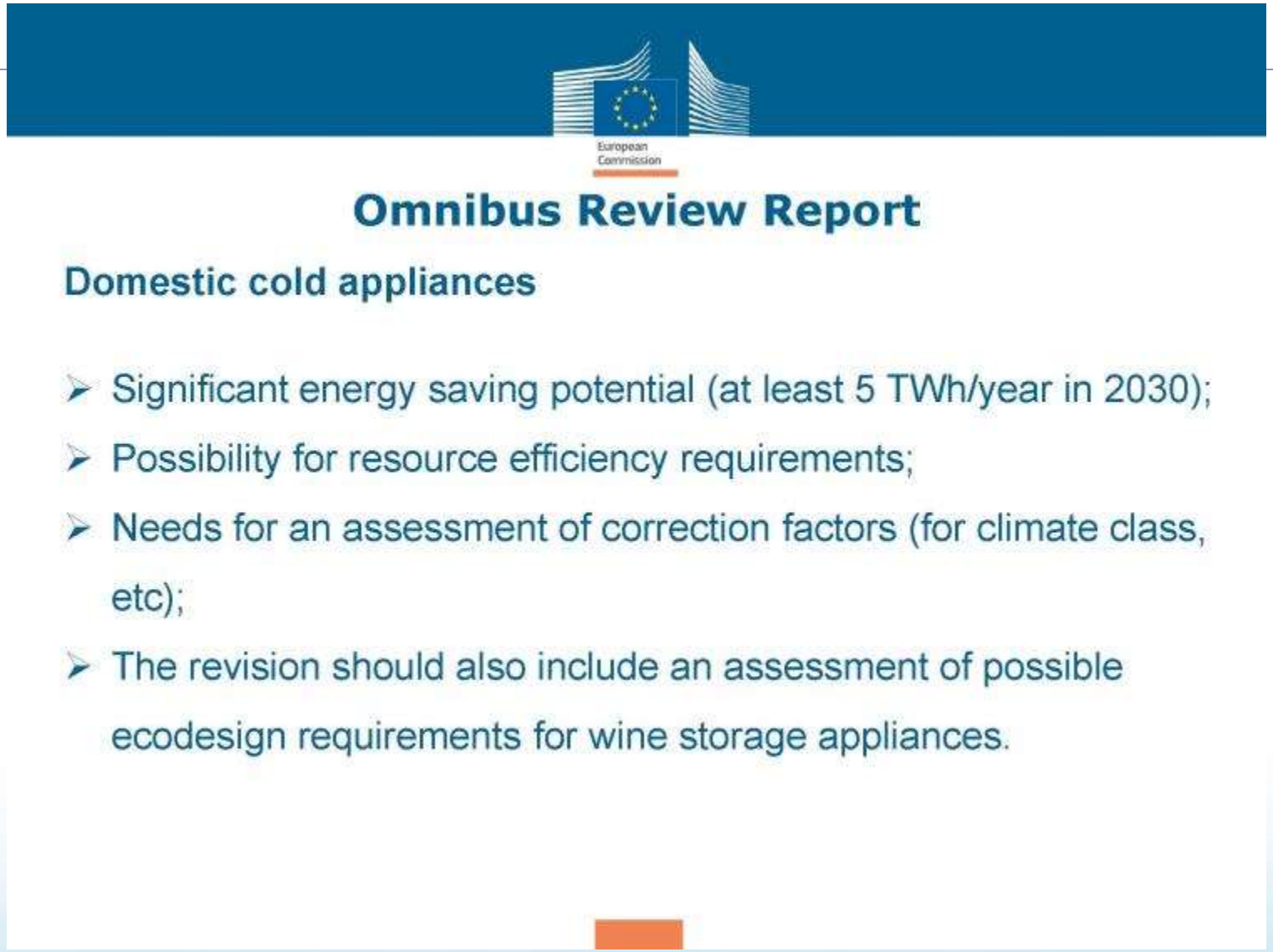
HI representatives on the DOE ASRAC Working Groups accomplished their goals:

- Recommendation agreed upon with energy advocates is in near alignment with EU regulations for covered products and efficiency standards and also includes a metric for "extended products."
- The recommended four year time period for implementation allows adequate time for the industry to get in compliance.
- The DOE ASRAC Term Sheet includes recommendations on Labeling, Certification Reporting and Testing that align with HI's objectives.

Last remaining step will be to review the actual NOPR issued by the DOE to insure alignment with the Working Groups' recommendation.

EU Update

ErP Directive 2009/125/EC – Horizontal Consultation Forum



ErP Directive 2009/125/EC – Horizontal Consultation Forum

ErP Directive 2009/125/EC – Horizontal Consultation Forum

European Commission

Lot 28 - Waste water pumps
Lot 29 – Other pumps

Conclusions of the studies:

In the case of waste water pumps around 0.4 TWh could realistically be saved per year in 2030, for the pumps covered under Lot 29 this calculated energy saving potential would be 0.5 TWh.

If an Extended Product Approach (EPA) would be applied, the energy saving potential could be increased up to 1 TWh and 3 TWh respectively.

To apply the EPA further work is needed (specific load patterns and distribution of the efficiency of the pumps currently on the market according to this methodology).

ErP Directive 2009/125/EC – Horizontal Consultation Forum

- **Keep Dialog open**
- **Common Understanding of EPA**
  - **eg. not all need VFD**

ErP Directive 2009/125/EC – Horizontal Consultation Forum

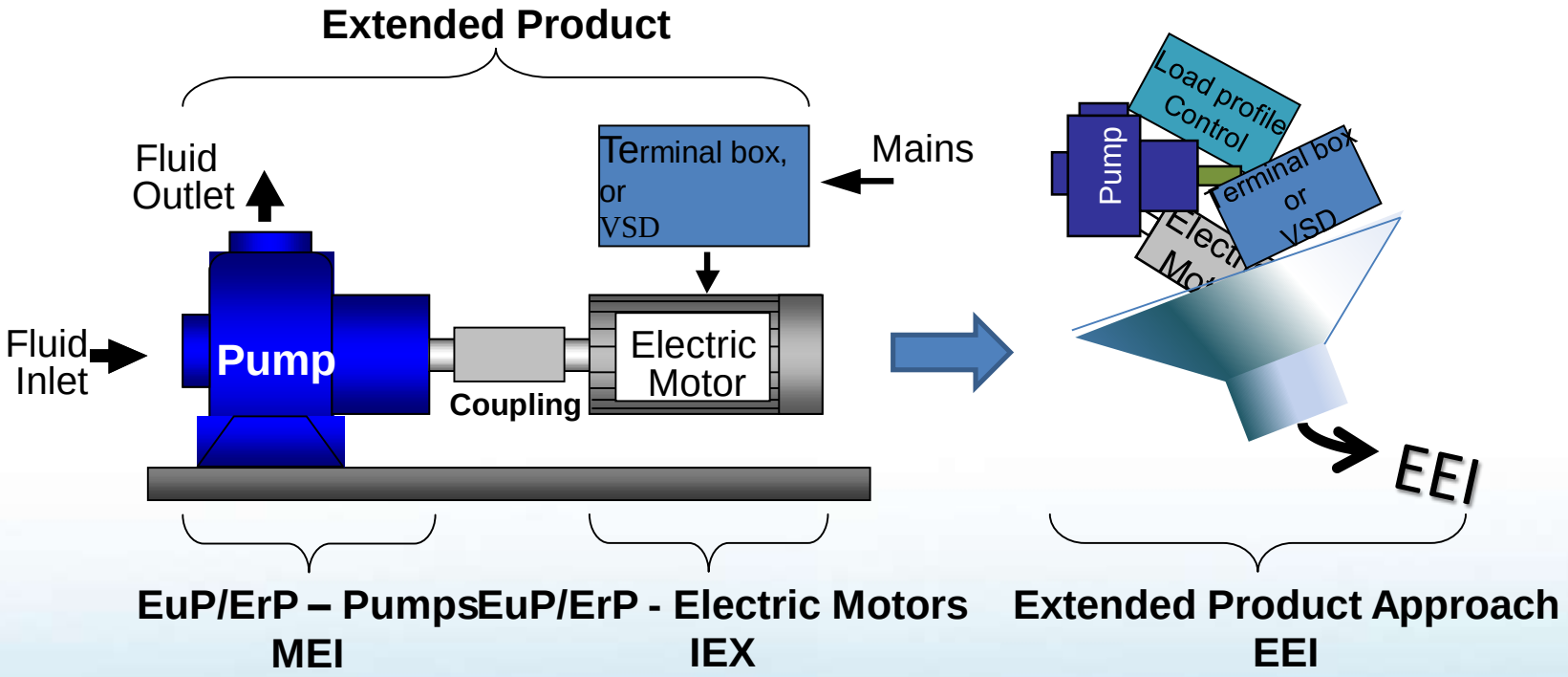
ErP Directive 2009/125/EC - Regulations

- Extended Product Approach
  - Regulation EU/547/2012 specifies in
    - Article 7 “Revision”

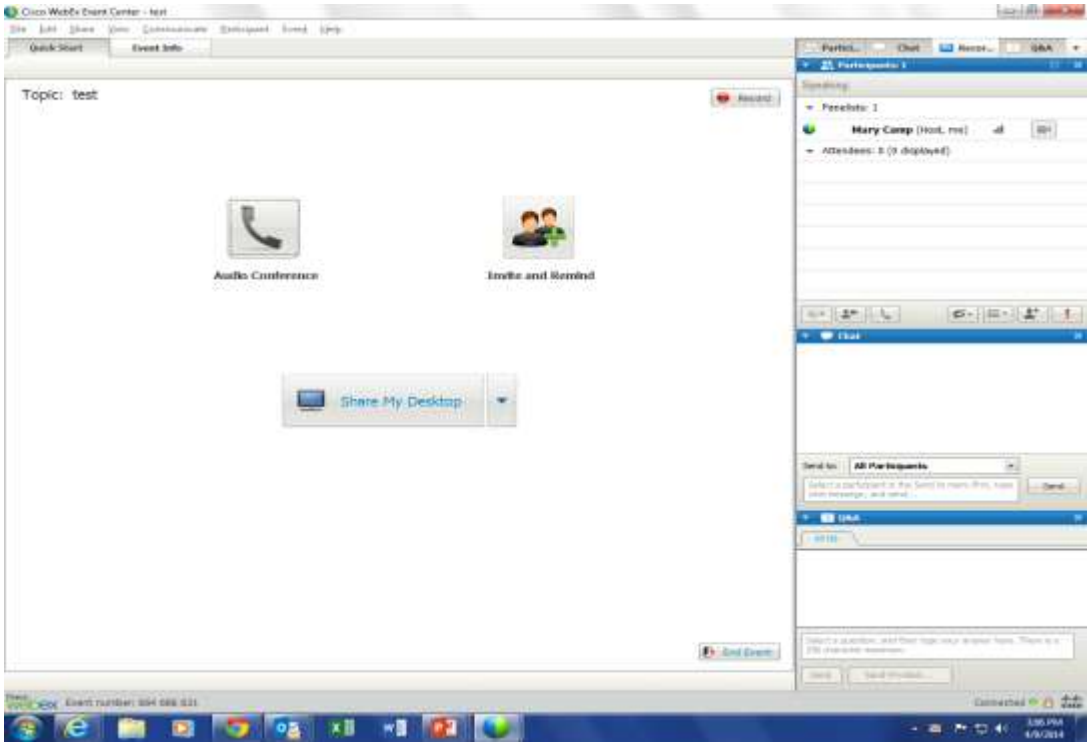
      The Commission shall review this Regulation in the light of technological progress and shall present the result of this review to the Consultation Forum no later than four years after its entry into force. The review shall aim at adopting an **extended product approach**. …….
  - Extended Product Approach discussed between Hydraulic Institute and EUROPUMP
    - Objective is to align the USA and EU legislation as much as possible

ErP Directive 2009/125/EC - Extended Product Approach

- Extended Product Approach (EPA) vs. Extended Products (EP)
  - Extended Product Approach is a methodology to calculate the energy efficiency Index (EEI) of an Extended Product (EP), which incorporates load profiles and control method.
  - Extended Products (EP) consists of physical components



Questions?



Please type your question in the dialogue box in the lower right box of your WebEx Screen

- **We will answer questions in the order in which they are received**

Upcoming HI Meetings:

Hydraulic Institute's Market Outlook Workshop
August 14-15, 2014
Boston, MA

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Upcoming HI Meetings:

Hydraulic Institute's Fall Meeting
October 8 – 10, 2014
St. Louis, MO