Transforming Industrial Markets

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British Columbia Hydro

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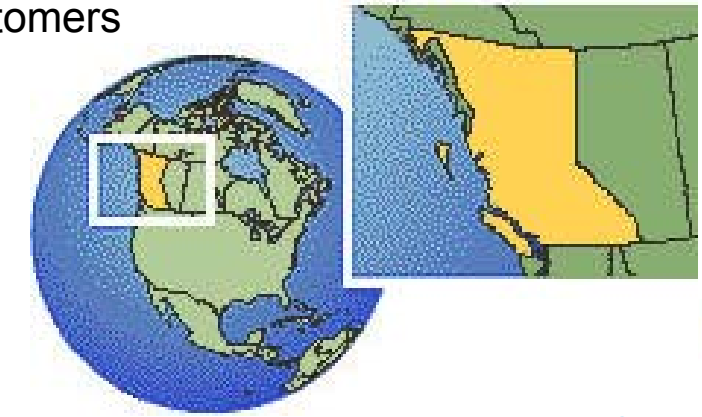
BC hydro powersmart

British Columbia

British Columbia Hydro

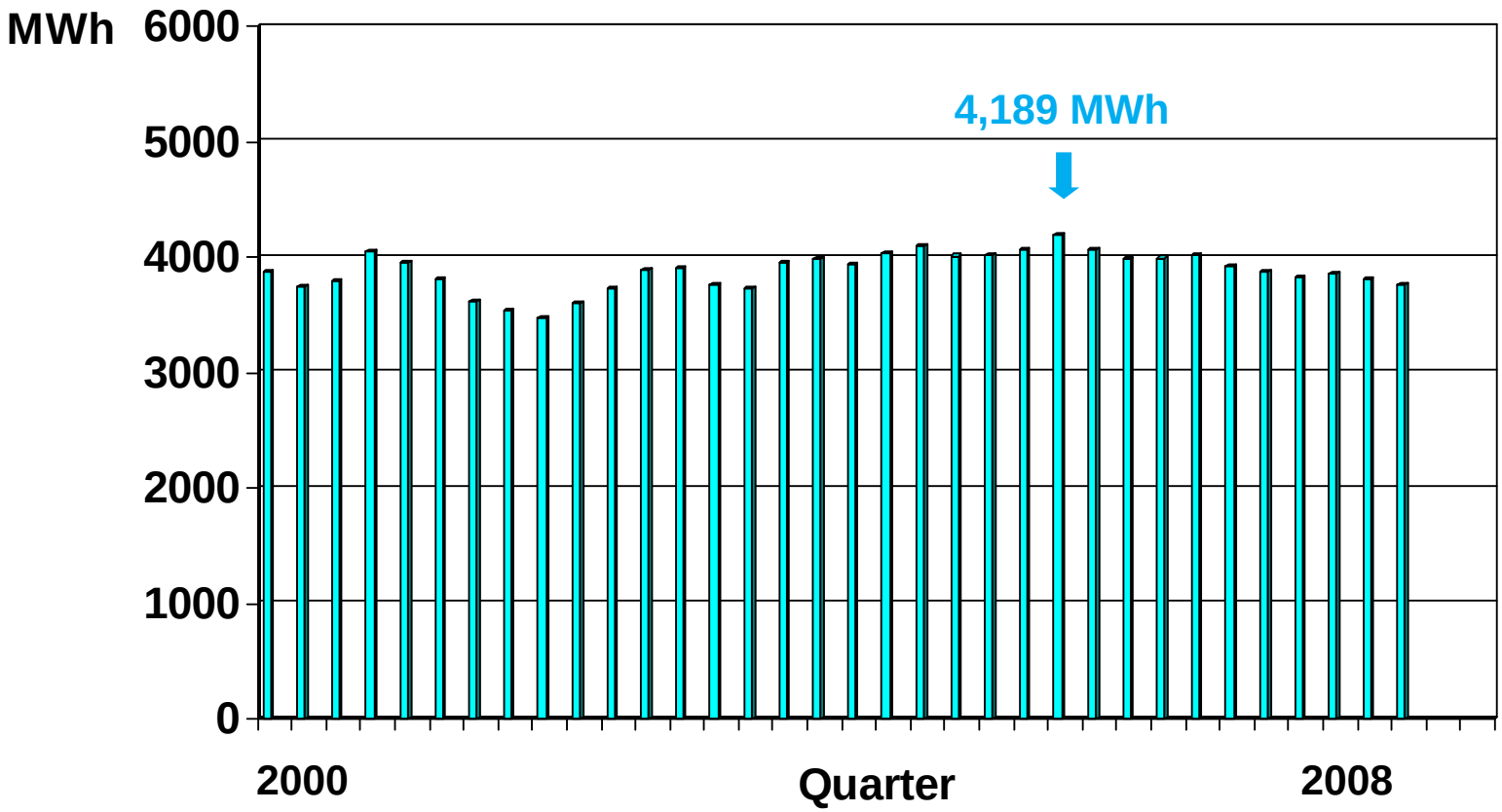
- 54,000 gigawatt hours of electricity annually
  - ▶2,500 GWh Power Smart annually
  - ▶About 40% is purchased by the industrial sector
  - ▶Key sectors are pulp & paper, forestry, mining
- 18,400 kilometres of transmission lines
- 55,700 kilometres of distribution line
- 95% of the province's population
  - ▶ 1.7 million customers



Quarterly Transmission Load

- Transmission load has shown no particular pattern of growth over the period First Quarter 2000 through Second Quarter 2008
- Load peaked in 2005:Q2 at 4,189 MWh per quarter and appears to have declined fairly steadily for 10 quarters
- Factors driving decline in purchased electricity include
  - Long term reduction in pulp and paper output
  - Drop in basic chemicals production to supply the pulp and paper industry
  - Increased self generation at pulp and paper facilities
  - Energy efficiency improvements financed and supported by Power Smart

Quarterly Transmission Load 2000:Q1 to 2008:Q2



Power Smart Partners Program: Customer Responsibilities

1. Commitment to improve the overall energy efficiency at their facilities
2. Signing a Power Smart Partner agreement outlining their energy efficiency target and the Energy Champion responsible for carrying out the energy efficiency plan
3. Commitment to provide matching funds to identify and implement energy savings opportunities
4. Assisting with monitoring, verification, evaluation activities

Power Smart Partners Program: BC Hydro Responsibilities

1. Providing education and training for business partner staff, including provision of energy managers
2. Providing funding for energy savings opportunities including a fixed incentive program and a large project program
   - **Fixed Incentive Fund**, provided project incentives of 1.5 cents per kWh saved
   - **Large Project Incentive Program**, competitively bid projects requiring an incentive of $1 million or more

Study Approach

Evaluation Issue	Data Sources	Method
Estimate demand equations	Electricity billing data Sector GDP	Regression analysis
Compare participant and non-participant market penetration	On-site visits - 59 participants & - 65 non-participants	T-tests
Estimate gross and net energy and peak savings	Participant customer survey (n = 42) On-site visits Metering	Engineering algorithms

Approach:
On-site Data Collection

- The on-site visits were used to:
  - verify installation of rebated measures
  - determine any changes in operating procedures since the measures were installed
  - undertake metering of energy use for selected measures, &
  - collect information on saturation of energy efficient measures
- Estimates of **saturation rates** for energy efficient measures were developed for the main types of end uses in industrial facilities including:
  - lighting
  - fans & blowers
  - pumps
  - compressors, &
  - process equipment

Approach:
Gross Savings Analysis

- Analysis began with a review of the program's calculated savings to determine whether the methodology, assumptions and calculations were appropriate
- For lighting measures, data was collected on types and numbers of lighting fixtures, luminaires and ballasts
- For fans & blowers, pumps and compressors information on efficiency was obtained from name plates, and clamp on voltage meters were used to measure the variation in the voltage
- For process measures, installation of any process equipment, removal of process equipment and any pre-post load monitoring infromation was used

Approach:
Net Savings Analysis

- Several criteria were used to determine what proportion of a given project should be attributed to free ridership
  - customers' pre-program installation of the technology
  - customers' plans to install the technology without the program, &
  - customers' views of the importance of the program in making the install decision
- Several criteria were also used to determine spill over
  - installation of similar measures without an incentive, &
  - likelihood of undertaking another energy efficiency project at the site without an incentive
- The net effect of the free rider and spill over analysis was used to calculate the **net to gross ratio** for each segment

Results:
Electricity Demand Equations

- To understand the market we estimated demand equations for electricity for the five main industrial sectors
- Log of electrify purchases was modeled as function a constant term, the log of sector GDP, a trend term and the log of marginal price
- Since the model is estimated in logs, the regression coefficients give the relevant elasticities
- Elasticity of X with respect to Y is the percentage change in X divided by the percentage change in Y
- Price elasticities are all about -0.10 or smaller so a 10% increase in price leads to a 1% reduction in demand

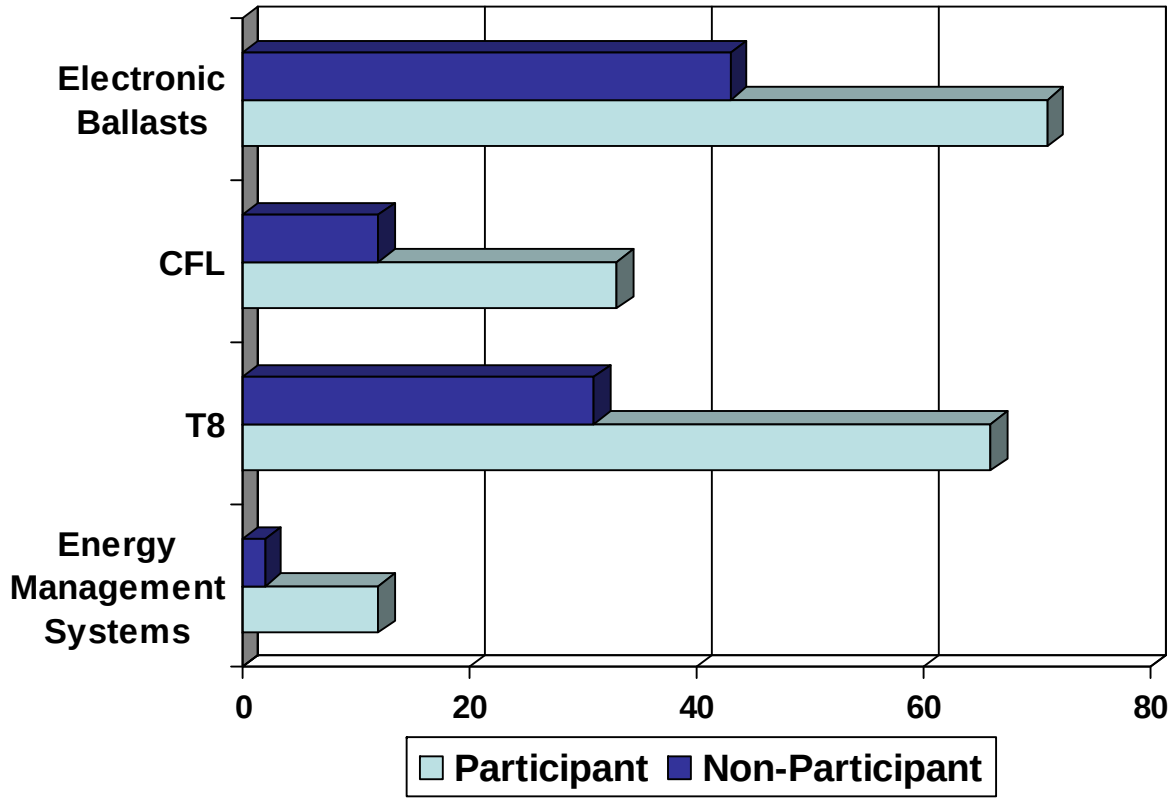
Results:
Electricity Demand

Segment	Metal Mining	Wood Products	Pulp and Paper	Chemicals	Coal Mining
Constant	5.10 * (0.34)	2.37 * (0.62)	2.49 * (0.75)	2.86 * (0.63)	0.54 (1.62)
Log sector GDP	0.39 * (0.052)	0.50 * (0.081)	0.89 * (0.10)	0.67 * (0.093)	0.87 * (0.23)
Trend	-0.0067 * (0.0025)	0.026 * (0.0057)	0.0057 * (0.0018)	-0.0056 * (0.0029)	-0.025 * (0.0032)
Log marginal electricity price	-0.086 * (0.041)	-0.10 * (0.048)	-0.10 * (0.031)	-0.082 * (0.050)	-0.065 * (0.040)
Adjusted R^2	0.65	0.98	0.88	0.79	0.81
F test	12.6 (0.00)	377.5 (0.00)	39.3 (0.00)	24.6 (0.00)	27.7 (0.00)

(standard errors in parentheses)

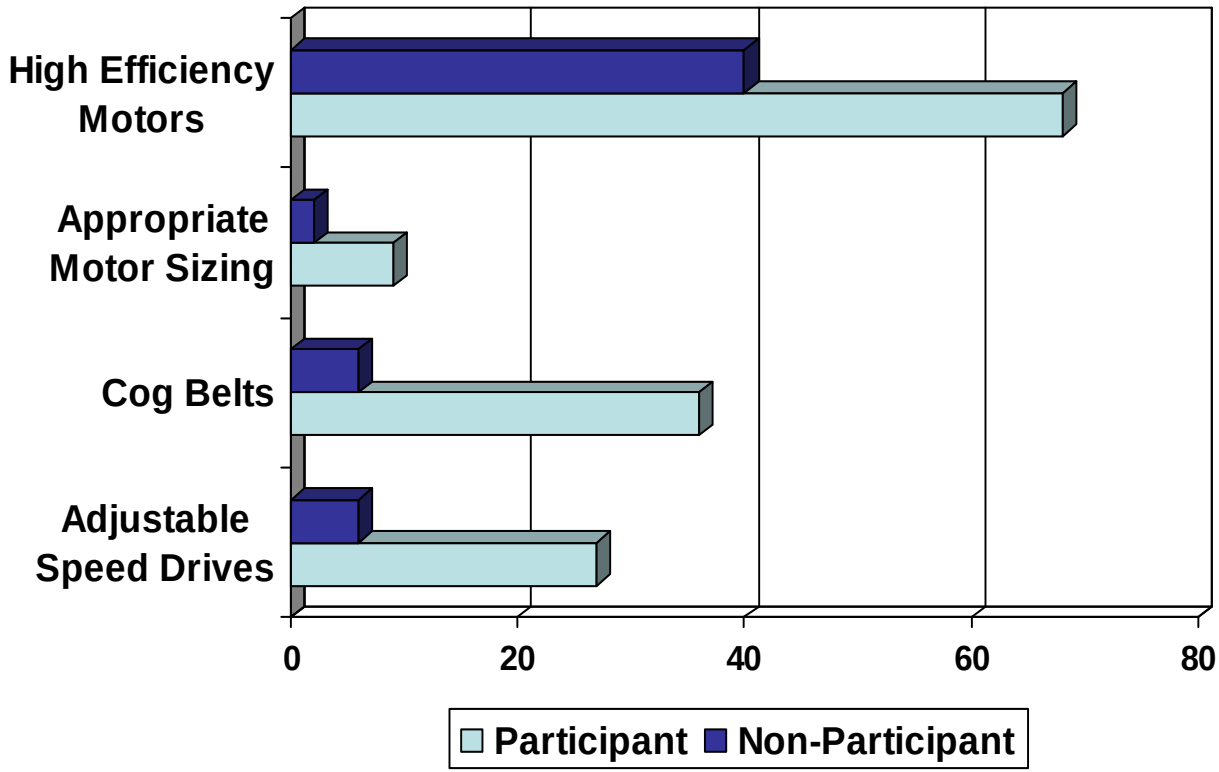
asterisk - significant at 10% level

Results: Selected Lighting Technologies Saturations



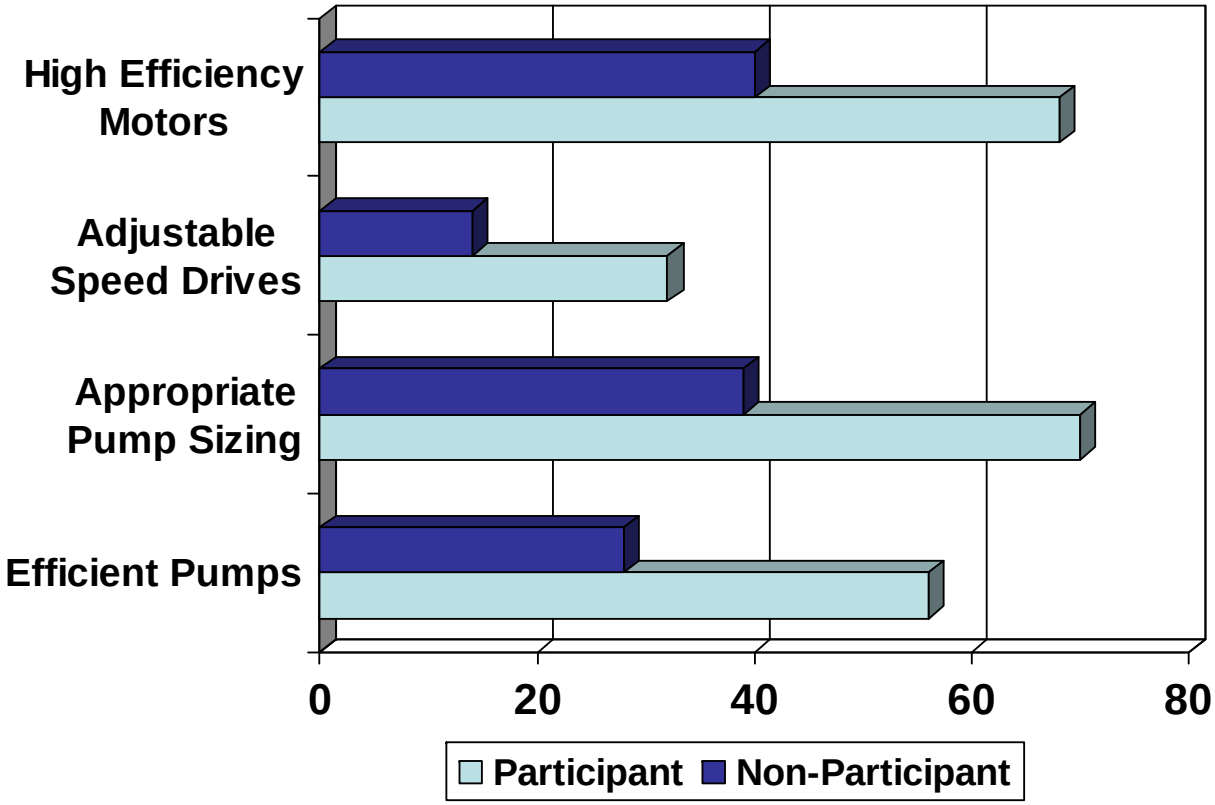
All differences are significant at 10% level

Results: Selected Fan & Blower Technologies Saturations



All differences are significant at 10% level

Results: Selected Pump Technologies Saturations



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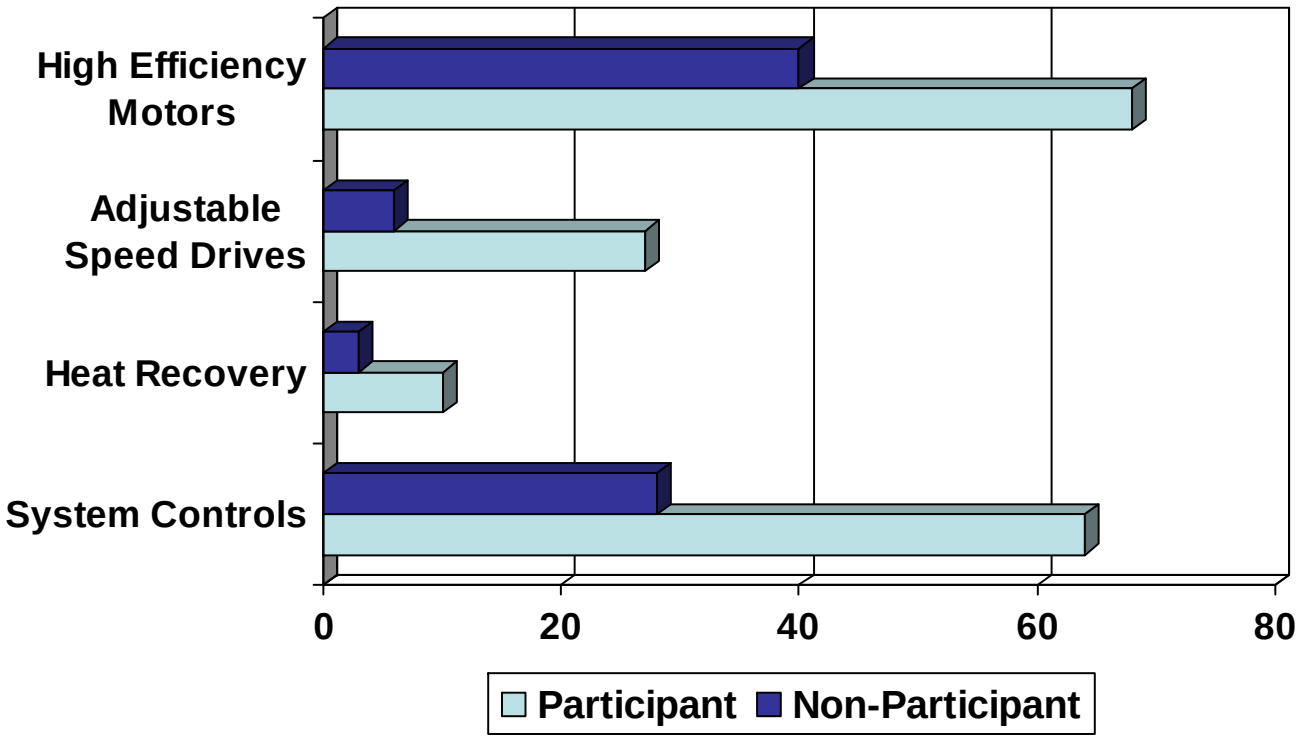
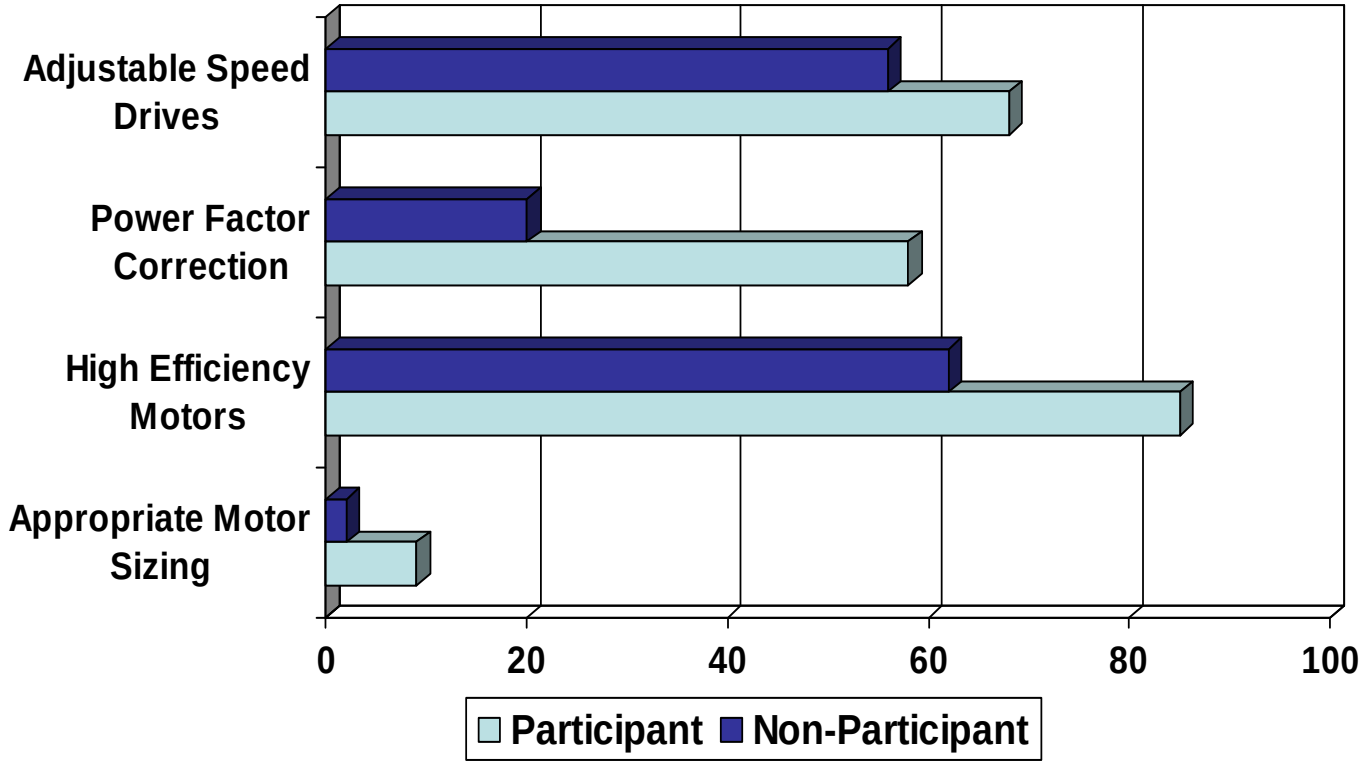
Results: Selected Compressor Technologies Saturations



All differences are significant at 10% level

Results: Selected Other Process Technologies Saturations



All differences are significant at 10% level

Results: Total Program Savings FY 2003 - 2006

	Expected Savings	Gross Evaluated Savings	Net Evaluated Savings
Energy (GWh per year)	497.3	513.4	**469.3**
Peak (MW)	68.1	70.3	**64.5**

Lessons Learned

Lesson 1. Program Definition and Strategy. Ensure that the initial program definition and program strategy are clear, well defined and accepted by program staff and key stakeholders

Lesson 2. Program Responsibility and Authority. Clearly define project management roles and responsibilities, and ensure that program staff, trade allies and customers clearly understand who is responsible for what

Lesson 3. Staff and Contractor Qualifications and Training. Use trained and experienced engineers to assess the validity of an industrial project concept, estimate or validate ex ante (pre) savings, and facilitate and manage industrial project planning, monitoring and implementation

Lessons Learned

Lesson 4. Program Plan, Objectives and Metrics. Develop a program plan with clearly articulated program logic that states the program activities, operational outputs, objectives and resources required, ensure that program schedules are well defined and realistic, and that suitable allowance is allowed for slippage and contingencies

Lesson 5. Marketing and Outreach. Leverage scarce marketing dollars through key account managers' relationships with customers and through partnerships and cooperation with other market players

Lesson 6. Program Procedures and Incentives. Keep program procedures (including applications, measurement and verification) as simple and transparent as feasible to maximize participation and energy savings

Invitation to Attend

International Energy Program Evaluation Conference

August 11 – 14, 2009

Portland, Oregon USA

www.iepec.org

International Energy Program Evaluation Conference

Europe - June 2010