Industrial Plant Closure Study

Energy Trust of Oregon – Industrial & Ag Program

MetaResource Group
Portland, Oregon

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Executive Summary

This study describes MetaResource Group's assessment of plant closures for participants in Energy Trust's Industrial and Agriculture program (formerly the Production Efficiency or PE program). The report is intended to help Energy Trust better understand the lifetime of energy efficiency measures in the industrial sector.

This assessment covered program measures installed in industrial plants from 2002 to 2009. Those measures not covered in this assessment include Mega Projects, energy efficient motors, transmission efficiency, energy management and water and wastewater. These were not included because Energy Trust uses different approaches for assigning measure life in these cases.

At present Energy Trust uses a lifetime of ten years for the majority of industrial measures, with a few reasoned exceptions. Energy Trust recognizes that industrial equipment can have lifetimes in excess of ten years, but uses this lower lifetime to address the issues of plant closures and process line changes over time. Plant closures have been an issue for many Pacific Northwest industries and economic cycles and geographic shifts have also led to plant closures.

A heroic amount of data mining and manipulation using information from six sources established which of the program participants had experienced a plant closure or a measure removal. The final step involved confirmation from the Program Delivery Contractors that field this industrial program for Energy Trust.

Findings

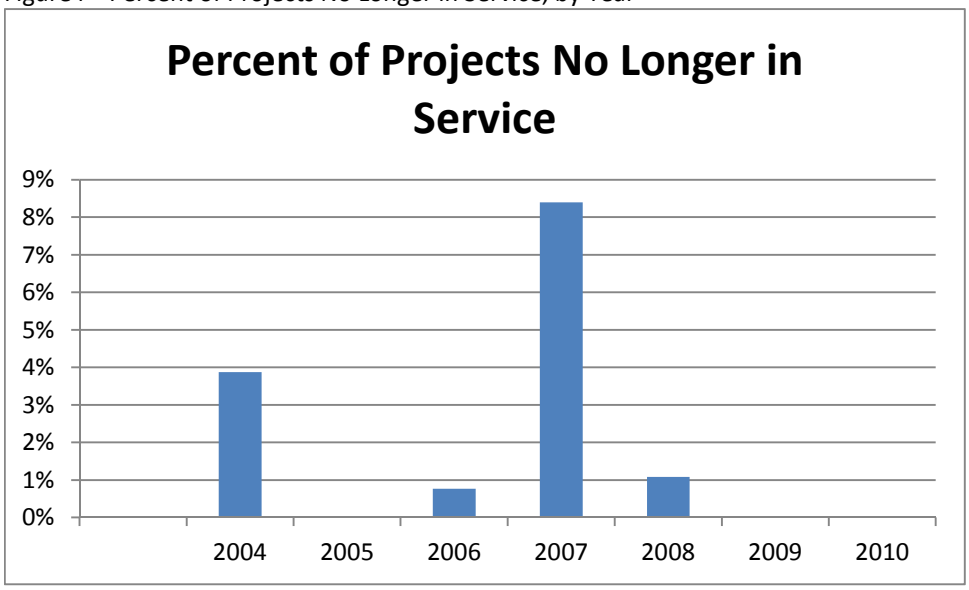
A total of 24 out of 1,419 PE projects were identified as no longer in use – most of them due to plant closures. This is about 1.7 percent. The 24 measures were represented by just 11 sites – one third of removed measures (eight) were at one closed pulp and paper plant.

Total energy savings for the 1,419 PE projects were about 617.1 million kWh. The 24 sites/projects identified as being removed totaled about 8.9 million kWh. This is about 1.4 percent.

In the eight program years under examination here as an overall average about three measures are removed every year and from observation the median life for removed projects or closed sites was about 3.5 years. The vast majority of measures – 98.3 percent – are still in place.

In Figure i below the percent of projects no longer in service is shown by year – note that 2003 is left off the graph for clarity as all of only three projects are no longer in service.

Figure i – Percent of Projects No Longer in Service, by Year



From these findings it appears that the lifetime of ten years used for PE projects is very conservative – the vast majority of measures remain in place longer.

MEMO

Date: May 24, 2011
To: Board of Directors
From: Philipp Degens, Evaluation Manager
Kim Crossman, Industrial Sector Manager
Fred Gordon, Director of Planning and Evaluation
Subject: Staff response memo: Industrial Plant Closure Study

The Industrial Plant Closure Study is providing Energy Trust with long sought after data to update PE Program measure lifetimes. The study provides us the information needed to adjust the current ten year lifetime. This change is, in part, supported by the longer industrial measure lifetimes used by many energy efficiency programs around the country.

Given the extremely small rate of plant closures that have impacted Energy Trust participants, Energy Trust Staff does not believe the data currently support a precise calculation of measure survival rates. Energy Trust plans to increase the PE Program measure lifetime to fifteen years. Energy Trust will revisit this new estimate in 5 years when the plant closure study will be repeated.

Introduction

This study describes MetaResource Group's assessment of plant closures for participants in Energy Trust's Industrial and Agriculture program (formerly the Production Efficiency program). The intention is to help Energy Trust better understand the lifetime of energy efficiency measures in the industrial sector.

At present Energy Trust uses a measure lifetime of ten years, with some exceptions. One such exception is for energy efficiency measures installed in water and wastewater facilities for which Energy Trust assumes a fifteen year lifetime. Behavior change such as Industrial Energy Improvement (IEI) is another exception; Energy Trust has set measure life at three years for IEI. Additional exceptions are described in the next section.

Energy Trust recognizes that industrial equipment can have lifetimes in excess of ten years but uses this lower overall lifetime to address the issue of plant closures and process line changes over time. Plant closures have been an issue for many Pacific Northwest (PNW) industries recently, and a number of industries have experienced significant structural changes. Aluminum smelting which once made up about a quarter of US production has virtually disappeared in the PNW and wood product and paper plants have gone through significant consolidation and closures. Cyclic trends in many other industries and geographic shifts (electronics, food processing, etc.) have also led to plant closures and shutdowns.

Because plant closures impact energy savings from efficiency measures, Energy Trust was interested in obtaining a better estimate of measure lifetime by conducting a systematic analysis of plant closures. Where possible, Energy Trust also sought to identify individual measures that were no longer in use or had been removed from plants that were otherwise still operating.

This report includes:

- A description of the data sources, approach and methodology used in this assessment,
- A list of program measures and the date when each was installed, and
- A list of program measures no longer in place, and the approximate date when each was removed.

Although this is a plant closure study, not a measure life study, the definition of measure life is provided here as useful context:

> *"Measure life is defined as the median value of the effective useful life (EUL) of the measure. This means the length of time until half the measures are no longer*

in service and providing savings and half still are. This is different than the average life (usually lower) and very, very, different than how long the measure could last in a laboratory test."[1]

Study Goals

The primary goal of this study was to identify plant closures among industrial customers that had participated in Energy Trust's Production Efficiency (PE). A second goal was to identify removed measures within plants that are otherwise still operating.

Scope of this Study

This plant closure assessment covered all installed measures from Energy Trust's Production Efficiency program (now called the Industrial and Agriculture program) from 2002 to 2009 with the exception of the following measure types and projects:

- Mega Projects – Energy Trust independently determined and assigned individual measure lives to these three very large projects.
- Energy Efficient Motors – incentives for energy motors are no longer offered and would be difficult to assess individually as some may have been 'incented' into inventory rather than actual use.
- Transmission and Electric Generation Projects – these were considered unlikely to close and Energy Trust assigns individual measures lives to these projects.
- Energy Management (Industrial Energy Improvement) – Energy Trust assigned a measure life of three years.
- Irrigation, Water and Wastewater – Energy Trust assigned a measure life of fifteen years.
- Nursery and Greenhouse Projects – Energy Trust assigned a measure life longer than ten years because they assumed the projects would be in place longer as the business would not be able to move locations readily.
- MetaResource Group included all lighting measures, but consolidated individual lighting measures into one 'project' per site per year. We totaled working energy savings for all the lighting measures for that site for that year. More detail on this approach is provided later in the report.

[1] Ken Keating, April 2007.
http://www.bpa.gov/Energy/N/reports/newsletter/July2007/Keating_0407.pdf

Methodology

MetaResource Group found it necessary to use a number of methodologies and data sources to assess industrial plant closures in Oregon. No one source proved to be definitive. We found a surprising number of gaps in data sources and conflicts among different sources. Altogether MetaResource Group found it necessary to conduct more research and analysis than anticipated to form a coherent body of results. However, this experience itself should prove useful to future work, and the report contains recommendations in this regard,

To start, Energy Trust provided us an extraction from their FastTrack database. This extraction was mostly complete and accurate. It contained 7,547 Production Efficiency (PE) measures installed from 2003 to 2009. Through the process described below MetaResource Group derived a working dataset of 1,419 records for this study.

In addition to eliminating the three Mega Projects as mentioned earlier, we also removed the following measure subtypes as determined in discussions with the Energy Trust Evaluation Manager:

- Energy Efficient Motors
- Transmission and Electric Generation
- Energy Management
- Irrigation, Water and Wastewater
- Nursery and Greenhouse

We also consolidated lighting measures. A discussion of the rationale and methodology for consolidation of lighting projects follows.

In Table 1 below we summarize the number and energy savings (Working kWh) for each of the program measure subtypes used by Energy Trust. In this table we include all subtypes – even those listed above that were otherwise excluded from the assessment.

In the table the reader will note that the percentage of the *Number* of projects is generally proportional to the percentage of the *Working kWh* (the annual energy savings). The exceptions are for Primary Process where the number of projects is low compared to the savings, and for Lighting (and Motors) where the number of projects is high compared to savings. (As Motors were excluded, we were not concerned about that difference.) The table shows that while lighting projects were 62% of the total number before consolidation, they include just 17% of the Working kWh savings.

For lighting, the high number of projects compared to the Working kWh results from the manner in which Energy Trust contractors describe and logs lighting projects in the program database; there is an entry for each type and group of fixtures and controls into

FastTrack – each group is recorded as an individual measure. In other words, lighting projects done at the same time in the same facility and even in the same space may be entered in FastTrack as multiple 'measures' even though these measures make up a single comprehensive lighting retrofit project. Since this study looked at measure life on a measure by measure basis, including a disproportional number of lighting projects could bias the results. Thus for lighting projects we 'rolled up' or consolidated multiple individual measure records for projects with the same installation date into a representative single project for lighting for each site.

Table 1 – Distribution of Project Subtype and Energy Savings

Energy Trust Project Subtype	Number of Measures	% of Measures	Working kWh (w/o Mega Projects)	% of Working kWh
Primary Process	113	1%	118,397,738	24%
Lighting	4,686	62%	86,079,056	17%
Compressed Air	432	6%	79,740,659	16%
Secondary Process	67	1%	34,403,469	7%
Pneumatic Convey	63	1%	31,040,788	6%
Refrigeration	81	1%	25,882,345	5%
HVAC	114	2%	22,902,622	5%
Pumping	39	1%	18,684,550	4%
Process Fans	13	0%	16,392,712	3%
Wastewater	32	0%	16,226,213	3%
Irrigation	700	9%	14,151,427	3%
Energy Mgmt.	10	0%	13,508,600	3%
Fresh Water	26	0%	8,642,958	2%
Motors	1,158	15%	7,766,697	2%
Hydraulics	7	0%	3,266,571	1%
Transmission	3	0%	242,841	0%
Totals	7,544		497,329,246	

This table includes Motors, Irrigation, Fresh Water and Wastewater for comparison.

FastTrack Data Review

Another step was to review the FastTrack data coding and correct it as necessary. One correction involved changing or adding some NAICs codes (North American Industry Classification System).

Some of the FastTrack entries had no NAICS code – we added it based on inspection of the company name or when required by review of the company web site. Other FastTrack NAICS code appeared inaccurate and we revised those, again usually by inspection. For example, 118 records were coded as industry type "other" that we revised with a more specific NAICS assignment.

Other corrections involved ensuring that the company name was consistent for multiple projects at the same site, and that there was a consistent address used with each unique site identification number.

In addition to the recoding, records for Mega Projects and the other excluded project and measure types mentioned earlier were removed to create a working FastTrack data set for use in this plant closure study.

NAICS Distribution

While on the topic of NAICS classification, it was suggested early on that we might find plant closures falling disproportionally in one or two industries (as indeed we have). For a more formal look at Oregon industry in general in Table 2 we compared the distribution of NAICS in three datasets:

1. PE Participants (as sites however, rather than projects),
2. InfoUSA Industrial Firms (an interim subset of the provided dataset), and
3. Oregon Employment Department Data (plant closure news items only).

As we could have expected, the portion of plant closures news items for paper mills and wood products plants are several times that of the other datasets. And interestingly, it is also so for transportation and aerospace – this is due to multiple RV plant closures. Interesting also was that descriptions of closure in fabricated metals facilities were at a lower rate than expected.

Note that the Employment Department news items over time do not correlate well to the number of PE participants facilities that we found closed. But that's another story.

Table 2 – Distribution of Industrial Firms vs. Business Changes

Industrial Sector	PE Participants		InfoUSA		OR Employment Dept. News Items	
Apparel products	7	1%	43	1%	2	1%
Chemicals	11	1%	96	3%	2	1%
Cold Storage	10	1%	25	1%	0	0%
Electronic Mfg.	44	5%	296	8%	15	9%
Fabricated Metals	69	8%	336	9%	4	2%
Food Products	148	17%	372	10%	24	14%
Furniture and Fixtures	16	2%	47	1%	2	1%
Industrial Machinery	47	6%	444	12%	7	4%
Metals (iron-steel-alum foundry)	45	5%	74	2%	4	2%
Misc.-manufacturing	155	18%	441	12%	18	10%
Nonmetallic (glass-concrete)	37	4%	140	4%	3	2%
Paper Mfg. (mills-converting)	15	2%	63	2%	12	7%
Petroleum and Coal	2	0%	41	1%	1	1%
Printing and Publishing	30	4%	554	15%	2	1%
Rubber and Plastics	30	4%	103	3%	1	1%
Textile Product Mills	2	0%	7	0%	1	1%
Transportation and Aerospace	42	5%	131	3%	21	12%
Wood Products	141	17%	565	15%	56	32%

Informing on Plant Closure

As mentioned earlier, we used a number of methods and data sources to identify plant closures among PE participants. These included:

- InfoUSA data (initially anticipated to be the principal and sole source of data to identify closures),
- Wood Products Plant Closures (as tracked by an industry consultant),
- Oregon Department of Environmental Quality (hazardous waste sites – some described as closed industrial sites),
- Oregon Employment Department (business changes gathered from periodicals),
- Internet research (limited research to support final conclusions), and
- PDC inquiry (confirmation of conclusions).

Each one of these data sources contributed to the final conclusions but none provided definitive results. We describe each of them in the section below.

InfoUSA Data

Energy Trust and MetaResource Group initially anticipated that the InfoUSA data would be the principal and sole source of data to identify plant closure. The planned approach was to match current InfoUSA records for industrial plants to past PE participants. If any PE participant in the FastTrack database could not be found in the InfoUSA database, this would be a 'negative' indication – that the facility that was no longer operating or otherwise in business.

InfoGroup compiles a database called InfoUSA that purports to include all operating businesses for the purpose of making business to business contacts. To compile their data, InfoGroup uses phone directories and information on new businesses from sources such as Secretaries of State, county courthouses, and public record notices. InfoGroup's website also says that they do millions of phone calls each year to verify that businesses are still in operation. Energy Trust owns a subscription to the InfoUSA database and provided us with an Excel extraction for Oregon manufacturing businesses. The initial InfoUSA database extraction provided contained 5,172 records, each representing an industrial plant location in Oregon.

There were barriers to effective use of this method. One was business name changes and business name matching. Since the PE program began, a number of businesses have changed names or been acquired by other companies and changed names. In some cases

small variations in how the name was entered in the databases precluded matching (WR Grace vs. W.R. Grace, as an example).

The majority of the matching attempted was by address; this would match the physical sites of the businesses. However, small differences in addresses precluded matching. Sometimes the FastTrack database used a business office (for mailing incentive checks) or a PO Box rather than the physical address in the InfoUSA source. There were also 335 InfoUSA records that had no address or zip code – these were nearly impossible to match to a specific facility.

Initial attempts by an Energy Trust intern to match InfoUSA to FastTrack PE participants resulted in less than one in ten matches, leaving many hundreds to be matched by hand inspection.

Notwithstanding all the problems outlined above the major issue in the use of this approach was that the InfoUSA data were not complete. There were many cases (hundreds in total) where we expected to find a PE participant in the InfoUSA database, but did not, resulting in a false negative.

For example, a number of plants had been visited personally by MetaResource Group staff and yet were not found in the InfoUSA database. This brought into question the suitability of the InfoUSA database and the initial approach. Fundamentally, negative indications from matching InfoUSA data to PE FastTrack were not definitive and could not be used for this plant closure study.

Wood Products Plant Closures

We obtained an Excel database containing references to changes in Oregon wood product plants. The data is maintained privately by a consultant in the wood products industry[2].

The list purported included all primary wood product mills that have closed since 2003 through 2010, including sawmills, plywood mills, veneer mills, composite board mills, and pulp mills. There were a total of 24 records in this list which we were able to use directly.

Even though we had confidence in how these data was collected and maintained, it proved to be non-definitive in that some of the sites described as closed were indicated as operating per the PDC – the PDC firsthand knowledge of the site would trump these closure data. We believe that these are cases where the plant was shut down but later reopened and not tracked by the consultant.

Oregon Department of Environmental Quality

The Oregon Department of Environmental Quality tracks hazardous waste sites including industrial sites. We obtained an Excel database containing 62,189 records regarding

[2] Paul F. Ehinger & Associates, Eugene, Oregon.

Oregon hazardous waste sites. This data is maintained by Oregon DEQ for the purpose of documenting all the locations in Oregon that have any environmental contamination issues – many of which relate to underground storage tanks in commercial and residential settings. As these data document industrial sites that have closed leaving behind environmental issues we felt that it could provide some indications of plant closure. We removed all non-regulated heating oil tank clean-up records along with municipal, domestic, waste tire, sludge lagoon, compost, generator, study areas and stormwater related records removed. Sites with active permits were also removed.

All records with dates before December 31, 2002 were removed, as well as all records without a date, and all records with no facility name as well as those that indicated auto or truck fueling (keywords such as cardlock, service station, Texaco, Shell, Arco, Chevron, gas, oil etc.) were also removed. Also removed were cleaners, laundry, store, ODOT, landfill, disposal, hospital, and those with county and city in the name. This left 1,356 records – some of which identified industrial firms that have closed.

Only a few of these records could be connected to PE participants – 38 in total. These were used primarily as indicators of possible plant closures.

Oregon Employment Department

The Oregon Employment Department tracks business changes that are described in newspapers and business publications. We obtained an Excel database containing 10,420 newspaper articles citations and other references to changes to Oregon business and employment from January 2003 through October 2010.

We identified 850 citations related to changes in Oregon industrial plants that were already flagged in the database. Through examination and searches for key words, we identified another 548 citations related to industrial plants. This subset was examined further to identify changes relating to employment and operation resulting in a working set of 524 records. We then categorized these citations as shown below. Only the first citation category indicated definite closure.

- Plant has been closed – 169 closures cited.
- Plant layoffs but no reported closure – 269 layoffs cited.
- Temporary or partial closure at some time in the past – 8 so identified.
- Plant hiring or expansion – 18 so identified.
- Company moved – 54 moves cited.
- Other employment change or mention – 6 references found.
- Of the 525 records indicating changes in Oregon business, 149 could be identified as PE Program participants.

Internet Research

We conducted a few hours of Internet research on 77 records where we had conflicting information on plant closure. Some of these stemmed from name changes, which might indicate new ownership or it could be a different business occupying the premises of a shuttered plant. We used this research to support final conclusions, however only a small handful of potentially definitive plant closures were identified with this approach.

PDC Inquiry

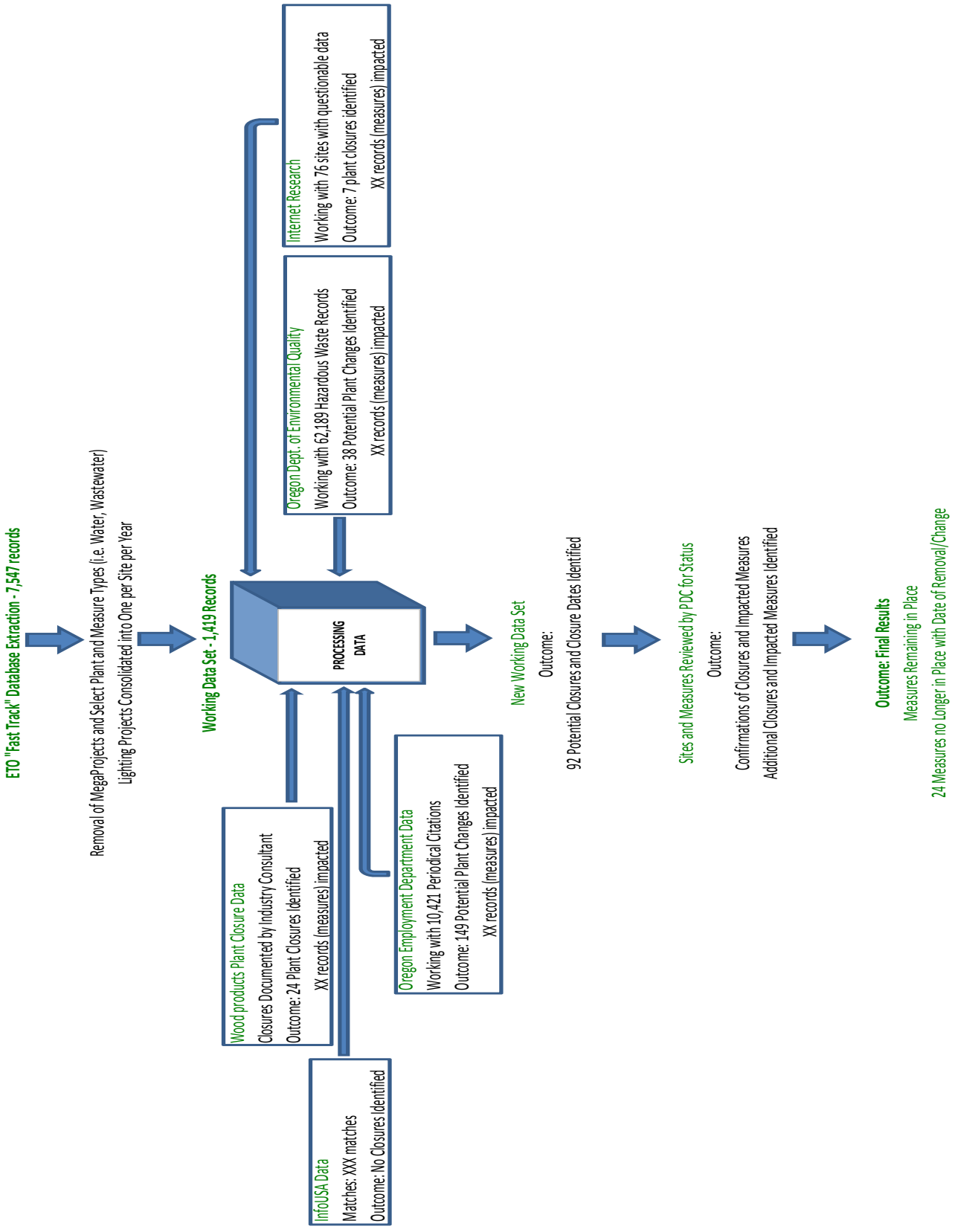
We considered that PDC knowledge of the industrial firms that they have worked with would be the final arbiter of plant closure. This turned out to not be a simple case, very much in line with the research previously described. The PDC often have irregular contact with the customers in their service territory – and although they knew much, they did not know everything – even with the limited records that we put in front of them. But a more significant factor was that PDC assignments have changed over time and one PDC is no longer serving the program.

Out of the 1,419 selected records of PE projects implemented from October 2003 to September 2010 we submitted to the PDC 92 projects believed or suspected of being removed or closed.

The PDC confirmed only 24 projects that were removed or plants that were closed.

The overall process used to determine plant closure is diagramed in Figure 1 on the following page.

Figure 1 – Overall Process Flow



Conclusions

It's important to note that plant closure information was gathered through calendar year 2010 and did not include closures in 2011 such as the Blue Heron Paper Company – as this was also a Mega Project it would not have been included for that reason alone.

A total of 24 measures out of 1,419 measures were identified as no longer in use – most of them due to plant closures. This is about 1.7 percent. Most of the removed measures or plants closed occurred in 2005 – half of the total. See Table 3 below for the distribution of year installed. The 24 measures were represented by just 11 sites – one third of removed measures (eight) were at one closed pulp and paper plant.

The total energy savings (Working kWh) for the 1,419 PE projects is about 617.1 million kWh. Note that this is a selected subset of all PE projects and not the total program savings. The 24 sites/projects identified as being removed total about 8.9 million kWh. This is about 1.4 percent.

In the eight program years under examination here as an overall average about three measures are removed every year.

From these findings it appears that the lifetime of ten years used for PE projects is very conservative – it would appear that the vast majority of measures will remain in place longer. The vast majority of measures – 98.3 percent – are still in place.

Table 3 – Year Installed for Measures Removed or Plants Closed

Year Installed	Frequency	Percent of Removed	Percent of Projects That Year
2003	3	13%	100%
2004	12	50%	4%
2005	1	4%	0%
2006	0	0%	1%
2007	5	21%	8%
2008	3	13%	1%
2009	0	0%	0%
2010	0	0%	0%

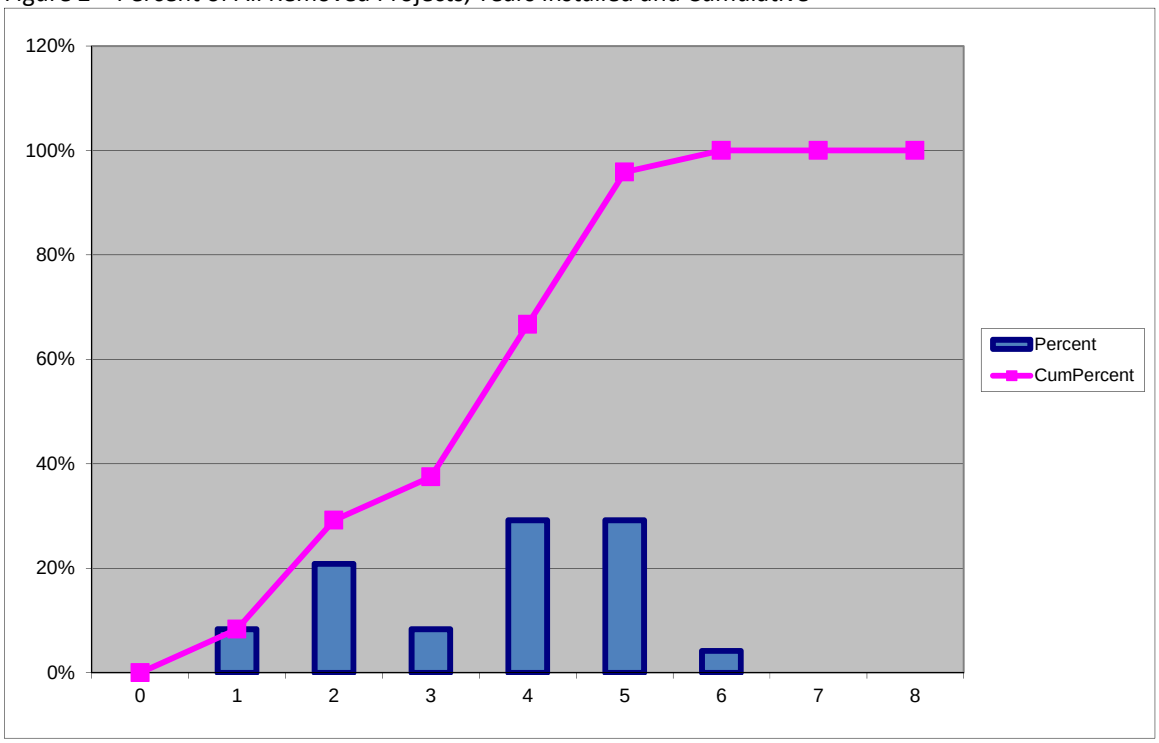
The distribution of number years installed for removed projects or closed sites is shown in Table 4 below and the figure following. From observation the median life for removed projects or closed sites was about 3.5 years.

Table 4 – Number of Years Installed for Measures Removed or Plants Closed

Years	Frequency	Percent	CumPercent
0	0	0%	0%
1	2	8%	8%
2	5	21%	29%
3	2	8%	38%
4	7	29%	67%
5	7	29%	96%
6	1	4%	100%
7	0	0%	100%
8	0	0%	100%

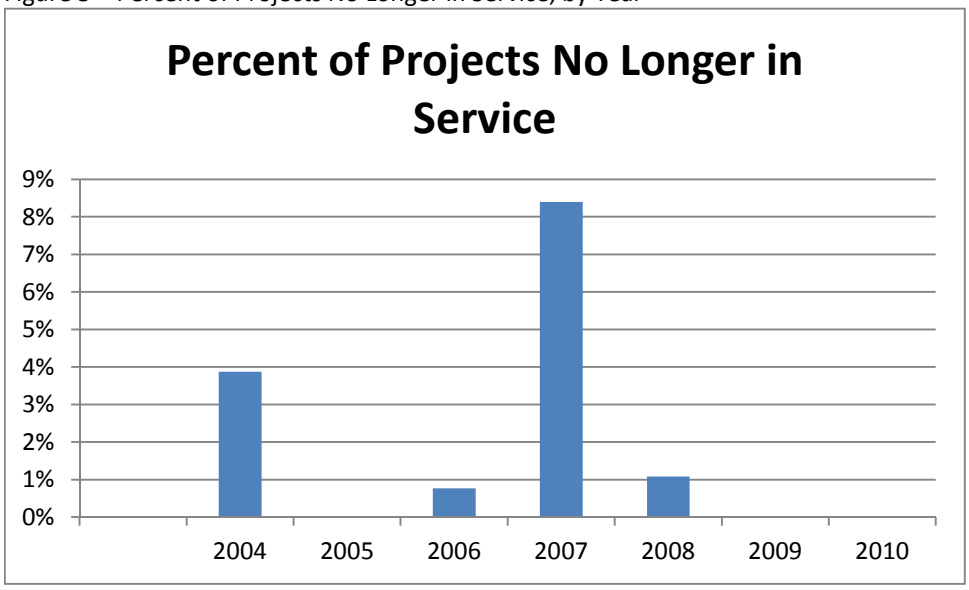
Figure 2 below shows the distribution of the number of years installed for removed projects or closed sites and the cumulative distribution of same.

Figure 2 – Percent of All Removed Projects, Years Installed and Cumulative



In Figure 3 below the percent of projects no longer in service is shown by year – note that 2003 is left off the graph for clarity as all of only three projects are no longer in service.

Figure 3 – Percent of Projects No Longer in Service, by Year



Recommendations for Future Research

With the experience gained from examination of business changes with no less than six different approaches we would like to suggest a seventh to use on the next occasion for tracking plant closures for the purposes of understanding measure life. We suggest that this work be conducted about every five years, or more often if there are indications of substantial changes in plant closures or measure retention.

We recommend a telephone survey be conducted. This should likely be a census of select participants (similar to the participants selected in this study) – a census is suggested because closure rates appear to be very low and sampling may not give good results. The survey may not actually need to have questions and answers – the calls could be made to the businesses in question after normal business hours and if the voicemail system identified the business in question, then it could be considered to be still in business. If the number was disconnected, it might be assumed to be closed or these 'potential positives' be referred to an additional survey step for confirmation. If a person was reached (even outside of business hours) the surveyor could apologize for disturbing them and terminate the call (assuming that they answer with the business name).

Of course, this survey could be turned into something more formal with a few questions to establish that the business was still operating. This would not increase the cost substantially and may provide additional certainty that the plant was operating.

In addition to the research approach outlined above the PDC could be made aware of evaluation's interest in tracking the removal or disuse of individual measures that they may come across. There may be a semi-formal mechanism put in place for the PDC to report these as they come across them. Of course they could also report wholesale plant closures as they hear about them in their service territory.