The U.S. Department of Energy Industrial Assessment Centers

Resource Streams

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Energy Streams (E)

The energy streams, with the exception of electricity, remain unchanged in the data sets. All units are in MMBTU for comparison purposes. With quaternary data reporting and subsequent database inclusion, the possibility exists for recommendations to include four energy streams.

EC – Electrical Consumption

Electrical consumption, EC, refers to actual electric energy used in the facility. The units for this resource are in KWHs. On Version #8 the units were changed from MMBtus to KWHs for clarity.

Ex. Lighting throughout the plant is currently provided by conventional light bulbs. Recommended action is to replace existing bulbs with those of reduced wattage. There will be savings in electrical energy consumption (EC) and also in demand (ED) based on annual demand avoided which is calculated from the differential wattage of all bulbs in a given year.

ED – Electrical Demand

Electrical demand, ED, accounts for any charge applied by the utility company to serve peak loads. Demand should be reported in kilowatt-months /year.

Ex. Certain equipment in the plant is operated intermittently during an 18-hour period. Recommended action is to move all operations of the equipment to nighttime off-peak hours. Though there will be no energy savings (EC), the electrical demand (ED) will be reduced.

EF – Other Electrical Fees

Electrical fees are total electric billing less the consumption cost and the demand cost. Electric consumption, demand and fees must add up to the electric bill. There are no units associated with this stream.

Ex. The manufacturing company pays its electrical bills. Filing for sales tax credit for electricity used in manufacturing process is recommended. The total tax burden will be lowered (EF).

Ex. A company is operating an electric annealing furnace. Recommended action is to replace the electric furnace with a gas furnace. The electrical consumption charge (EC), demand charge (ED), and the electrical service fees (EF) will be lower, however there is an increase in gas usage (E2).

E2 – Natural Gas

Natural gas is a gas consisting primarily of methane and various other hydrocarbons or inert gases. Natural gas consumption is typically expressed in units of therms, where 1 therm =100,000 Btu.

E3 – Liquefied Petroleum Gas, L.P.G.

LPG is a mixture of hydrocarbon gases used as a fuel in heating appliances and vehicles. LPG includes mixes that are primarily propane, mixes that are primarily butane, and mixes including both propane and butane.

E4 – #1 Fuel Oil

Fuel Oil No. 1 is similar to kerosene and is the fraction that boils off right after gasoline during the distillation process.

E5 – #2 Fuel Oil

Fuel Oil No. 2 is diesel fuel, which is commonly used in trucks and cars. It is also referred to as heating oil.

E6 – #4 Fuel Oil

Fuel Oil No. 4 is a blend of distillate and residual fuel oils, such as Fuel Oils No. 2 and No. 6. Fuel Oil No. 4 may be classified as diesel, distillate or residual fuel oil.

E7 – #6 Fuel Oil

Fuel Oil No. 6 is called residual fuel oil or heavy fuel oil. Fuel Oil No. 6 is what remains of crude oil after gasoline and the other distillate fuels are extracted through distillation.

E8 – Coal

Coal is a fossil fuel which is composed primarily of carbon along with variable quantities of other elements. There are a variety of classifications of coal pertaining to its geological process of formation and molecular makeup. From hardest to softest or highest to lowest heating value, coal can be classified as: Anthracite, Bituminous, Sub-bituminous, Lignite and Peat.

E9 – Wood

Burning of wood is currently the largest use of energy derived from a solid fuel biomass. Wood fuel may be available as firewood, charcoal, or by-products of industrial processes such as: wood chips, pellets and sawdust.

E10 – Paper

Paper is a thin material mainly used for writing and printing upon. It is produced by pressing together moist fibers, typically cellulose pulp derived from wood or grasses, and drying them into flexible sheets. Waste paper can be processed and burned as fuel for heating.

E11 – Other Gas

Other Gas includes the use of gaseous fuels as part of the energy streams that do not fall into the previous categories such as: gasoline used for transportation.

E12 – Other Energy

Other Energy includes any energy source, whether it is solid, liquid or gaseous, as part of the energy streams that do not fall into any of the previous categories.

Waste Streams (W)

Waste stream tracking is integral to pollution prevention and waste minimization opportunity analysis. Waste stream classification is by physical properties such as liquid, solid, or gas and capability for causing harm (hazardous versus non-hazardous). A brief description of each waste stream type and a brief example illustrating the application of each classification follows:

W1 – Water Disposal

Water disposal, W1, refers simply to any water-based solution leaving the plant through the public sewage system for treatment. The units associated with water disposal are gallons.

Ex. Water used as process coolant is currently dumped into the manufacturers' metered sewage system in large quantity. The recommended IAC measure includes the installation of a heat exchanger and water circulator. Water disposal cost and volume reductions are coded as W1. Additional savings relate to energy cost reduction coded in a similar fashion (electrical consumption, EC, in this case) and water purchase reductions (R5).

W2 – Other Liquid (non-hazardous)

Waste Stream, W2, applies to liquid waste leaving the facility by means other than the public sewer. This liquid is classified as non-hazardous. The units for the stream are in gallons.

Ex. Ethylene glycol is used in a plant to cool equipment. The recommended action specifies the collection of the used liquid as opposed to the prior practice of waste disposal into the sewer. The ethylene glycol collected (liquid nonhazardous, W2) is to be sold to an outside recycling firm.

W3 – Other Liquid (hazardous)

Other liquid (hazardous), W3, refers to hazardous liquid material requiring treatment before disposal. The units are in gallons.

Ex. A plant uses trichloroethane-1, 1, 1 for cleaning process material before painting. Currently, the company pays an outside firm to dispose of this liquid hazardous waste. A still is recommended to recycle the polluted solvent. The resulting reduction in the amount of liquid waste produced (W3) from the cleaning process lowers the disposal cost of the trichloroethane-1, 1, 1 liquid. Additional savings will be realized from smaller purchase needs of cleaning fluid (not coded) while new expenses accrue from still bottom disposal (solid hazardous waste, W5).

W4 – Solid Waste (non-hazardous)

Waste stream, W4, refers to solid materials classified as non-hazardous. The waste units are pounds.

Ex. Raw materials are shipped into a plant in bags stacked on wood pallets for easy forklift handling. Currently the company personnel are disposing of the pallets in the dumpster. The recommendation presented suggests burning the pallets to provide process heat. Solid non-hazardous waste volume (W4) decreases along with energy purchases, in this case natural gas (E2).

W5 – Solid Waste (hazardous)

In contrast to waste stream, W4, the waste stream, W5, refers to those substances which are classified as hazardous solid waste. The units for this waste stream are also in pounds.

Ex. Energy efficient lighting measures are currently being implemented by a manufacturer to save electricity costs. Changing out the light bulbs also requires replacement of the old ballasts. These older model ballasts contain hazardous PCBs. When these ballasts are removed, the plant is charged for disposal based on the combined total weight of the ballasts (approximately 3 pounds each) and the PCB containing capacitor (approximately 1 ounce each). If the contaminated capacitor is removed and disposed of separately as hazardous waste (W4), the remaining portion of the ballast can be recycled. Hazardous waste volume and associated cost decreases substantially and are partially offset by the recycling income (not coded).

W6 – Gaseous Waste

The waste stream, W6, refers to gases emitted into the atmosphere. The units for this stream are pounds.

Ex. A metal separation and recycling plant pays permitting fees and heavy emission fines as a function of the amount of cyanide fumes released into the atmosphere. These emissions result from uncovered liquid vats losing product to evaporation. The recommendation for the installation of fume collection and condensation units for each vat will result in gaseous waste (W6) savings, ancillary material (R4) purchase savings, administrative cost reductions (R2), and a slight increase in electricity usage (not coded).

Resource Costs (R)

Resources other than energy are directly tracked in the IAC program database. Important matters such as personnel changes, material costs, water costs and administrative considerations can be broken down into separate recommendations.

R1 – Personnel Changes

For many Assessment Recommendations an additional amount of work may result (the opposite may also be true). Thus, personnel changes (R1) must be considered.

Ex. For a natural gas refinery, the installation of a cogeneration system is recommended for in-house electricity generation and the sale of excess energy production. To manage the system properly, a skilled professional must be added to the payroll as a recurring cost. This is not a one-time cost. This personnel cost (R1) is tracked along with electricity production (EC) and natural gas usage (E2).

R2 – Administrative Costs

Administrative costs (R2) represent any fees or charges which are not directly related to the production process. These costs include taxes, inventory control, and late fees on billing.

Ex. The purchase of a manufacturing facility's process equipment is recommended in lieu of current leasing agreements. In this instance, there are greater tax deductions allowed for equipment depreciation with ownership compared to the benefits of leasing. A net decrease in tax payments (administrative costs, R2) helps improve the payback of the process machinery purchases.

R3 – Primary Raw Material

Many process changes may result in the savings of a primary raw material. Therefore, raw material costs (R3) can be considered while assessing recommendations.

Ex. A plastics plant rejects deformed bottles as part of the quality control process. If these bottles can be reground and reused in the process as recommended, the primary raw material (R3) cost can be reduced. Additional savings will result from decreased non-hazardous solid waste disposal (W4) and electricity costs (EC) will increase.

R4 – Ancillary Material Cost

As with the cost of primary raw materials, a cost savings may result from a decrease in the use of an ancillary material. An ancillary material is any additional material other than the primary materials.

Ex. A children's furniture manufacturer uses standard spray guns to paint the exterior of each item. Overspray reduction recommendations require installation of high volume, low pressure paint nozzles. The ancillary cost (R4) for paint will decrease. There will also be a reduction in gaseous waste (W6) for environmental losses and reduced electrical usage (EC) due to the lower compressed air pressure.

R5 – Water Consumption

Although water consumption (R5) is usually overlooked when assessing utility bills, it is usually a large cost to the plant. This consumption is recorded in dollars.

Ex. A chemical plant currently ships their product as an aqueous based solution. Process alterations are recommended by the IAC allowing the company to package the product in bulk powder form. Savings result from water consumption (R5) reductions and decreased transportation costs (Fuel E11). Additional cost accrues from increased product handling requirements (Personnel changes R1).

R6 – One-time Revenue or Avoided Cost

There are times when a recommendation not only includes annualized savings, but also a one-time cost savings or increase in revenue. A new resource stream, R6, has been introduced in the database for such cases of one-time savings. In the past, these types of cost benefits were included in the implementation cost and should now be reported as their own resource streams.

Ex. A facility is in the process of replacing an old 100 hp compressor with a new, more efficient 100 hp compressor. The IAC has determined that this unit is oversized and that a new and efficient 80 hp unit should be purchased instead. Since the facility already budgeted for the 100 hp unit and since the 80 hp unit is cheaper and will consume less energy, there will be a yearly electricity consumption (EC) savings as well as a one-time avoided cost (R6) by purchasing the smaller compressor. The AR will also reflect a $0 implementation cost.

Ex. A glass company produces both clear and colored glass. The clear glass can be re-melted in the furnaces as cullet, but the colored glass cannot. 1,500 tons per year of colored glass is rejected and over the years, the company has acquired many tons of the rejected glass and has stored it outside of the facility. A recycler has been located which will come and haul away the scrap and will also contract with the glass manufacturer to buy the yearly production of rejected colored glass. There will be a yearly income from the recycler (P2) and also one-time revenue for the initial sale of the “alps” to the recycler (R6).

Production Streams (P)

Production stream tracking will allow data analysis of recommendations involving productivity methods such as Total Quality Management initiatives and other innovative strategies.

P1 – Primary Product without improvement in energy efficiency

The primary product stream (P1) refers to anything which directly effects cost of production but not energy efficiency. This may include any changes which affect production cost per unit or the amount of time needed for production.

Ex. The manufacturer should improve packaging of the product to prevent damage in shipment. Previously a number of products shipped to customers were damaged in transit and had to be shipped back to the manufacturer for repair. Improved packaging has reduced the number of products damaged in shipping.

P2 – By-product Production

By-products (P2) are salable items which are secondary results of the primary product. It is anticipated that markets can be found for these items, thereby improving the profits of the plant.

Ex. A furniture maker is currently burning sawdust produced and collected by his main process. A local horse breeder is found who can purchase the sawdust. Increased income due to sale of the sawdust appears as increased by-product production (P2). There would also be an increase in energy costs due to the reduction in wood burning (E9).

P3 – Primary Product with improvement in energy efficiency

The primary product stream (P3) refers to anything which directly effects energy needed to produce a given number of products. This may include any changes which affect production cost per unit or the amount of time needed for production.

Ex. A manufacturer currently produces 100 garbage cans in 1 hour of which 5 are rejected by plant inspection personnel. The quality control problems are linked to unreadable instruments on key machinery. This situation was rectified through the recommended instrument cleaning program resulting in a usable production of 99 cans per hour, an increase of 4% (P3). The result of this is an increase in production of garbage cans without the need for additional energy.