Biomass Provisions in the Energy Policy Act of 2005

Brian Copeland

On August 8, 2005, President George W. Bush signed into law the Energy Policy Act of 2005 (EPAct). Included in this Act, along with numerous incentives for the energy industry, are authorizations of activities specifically aimed at improving biomass technologies and increasing the amount of biopower, biofuels, and bioproducts used in the U.S. EPAct 2005 calls for a number of research and demonstration programs as well as analyses and promotion activities to support biomass technologies. Responsible agencies included the Environmental Protection Agency (EPA), U.S. Department of Agriculture (USDA), U.S. Department of Energy (DOE), National Science Foundation and others. This article briefly reviews EPAct 2005 as is relates to biomass.

National Biomass Initiative

Through EPAct 2005, Congress made significant changes to the Biomass R&D Act of 2000. It provides specific guidance on awards made under the initiative. The technical areas are now focused on advanced feedstock production and harvesting, overcoming recalcitrance of cellulosic biomass, the diversification of biobased products from a biorefinery, and analysis that provides strategic guidance for biomass technologies. EPAct has increased the authorization of funding from $54 million to $200 million and includes guidance for the distribution of projects funded through the Initiative. Additionally, the Secretary of Energy is required to update the Vision and Roadmap documents.

Research & Development

EPAct requires the DOE to carry out projects relating to hydrogen, renewable energy, and bioenergy. Under an R&D program for the production of hydrogen, EPAct calls for projects which address the production of hydrogen from biomass and biofuels. In the area of renewable energy research, DOE shall conduct projects which look at the renewable energy technologies that help to foster cogeneration of hydrogen and electricity. Through DOE's Office of Science, EPAct calls for integrated bioenergy research and development which is required to be coordinated with the National Science Foundation. More broadly, a program for bioenergy is to be conducted. One area of research includes biorefineries for which proposals for integrated biorefinery demonstration projects should be solicited in six months or less.

Using renewable fuels is becoming popular in several countries. Vandermeer Consulting, a subsidiary of the Australian public company VDM Group Limited, is working closely with Lurgi Pacific on a $45 million project to build Australia's largest renewable fuel plant. Project Developer Natural Fuels Australia Limited says that the Natural Fuels Darwin Biodiesel Plant will produce 150 million liters (40 million gallons) of biodiesel and 12,000 metric tons of byproduct (pharma grade glycerine) per year from imported renewable palm oil produced in Malaysia. The plant, shown in this illustration, is scheduled to be operating towards the end of 2006.

Grants

EPAct calls for a number of grant programs to be initiated by USDA, EPA, and DOE for bioproduct marketing, demonstrations, clean school buses, and the production of ethanol. Through USDA, grants should be made available to promote the growth and development of the bioeconomy, demonstration of pre-processing of feedstocks and efficient harvesting techniques, and for the marketing and certification of biobased products. In an RFG (reformulated gasoline) State with low ethanol production, grants from the EPA can be used for renewable fuel production technologies. Also through the EPA, grants can be awarded for programs which replace or retrofit school buses to use ethanol and biodiesel. Through DOE, a number of grant programs are to be available for:

- Rural and remote communities using biomass, landfill gas, and livestock methane,
- Facilities producing electricity, heat, or fuels from forest thinnings,
- Acquisition of alternative fuels vehicles for use at public airports,
- Creating valuable products from local, renewable biomass resources, and
- Producers of cellulosic biomass ethanol.

Demonstrations and Outreach

One of the main themes of EPAct is the call for biomass technology demonstrations. At the EPA, an "Advanced Biofuel Technologies Program" is to be established to demonstrate advanced technologies for the production of alternative fuels. The DOE is required to establish programs that demonstrate renewable technologies in buildings, hydrogen reformed from agricultural fuels, and distributed generation using renewable sources. Additionally, DOE will fund projects which identify the optimum technology among alternative technologies and test biodiesel in advanced diesel engines. Along with the demonstration projects, USDA is to establish a program of education and outreach on biobased fuels and biobased products.

Assessments, Surveys, and Reports

A number of assessments and reports are required to be submitted to Congress in the upcoming years including:

- A yearly report from the EPA on the market shares of gasoline containing ethanol.
- A report from DOE on the potential for biodiesel to be a major, sustainable alternative fuel.
- Reports on the economic potential of biomass in the U.S. and economic indicators of the biobased economy, from USDA.
- A DOE assessment of renewable energy resources.
- A yearly report from the DOE detailing costs to develop renewable resources, transmission barriers of renewable references, and renewable resource assessments.
- A report detailing the effects on public health and feasibility of using substitutes for MTBE.

EPA Takes Important First Step in RFS Implementation

The U.S. Environmental Protection Agency (EPA) has released its interim rule governing the implementation of the Renewable Fuels Standard (RFS) included in the Energy Policy Act (EPAct) of 2005. The EPA's interim rule provides much needed guidance to oil companies as the RFS is introduced.

"This is an important and logical first step toward complete implementation of the RFS," said Renewable Fuels Association President Bob Dinneen. "The White House, the EPA, and the whole administration have remained dedicated to putting a simple and workable program in place and their efforts are greatly appreciated."

Dinneen continued, "This interim rule provides maximum flexibility to refiners, which will help lower consumer gasoline prices at the pump. At the same time, this rule preserves the certainty of market demand that is critical to the continued investment in domestically produced renewable fuels such as ethanol and biodiesel. As the rulemaking process continues, we look forward to working with the EPA, the Department of Energy and the petroleum industry to put a program in place that meets everyone's needs."

The interim rule imposes the RFS requirement of 4 billion gallons of renewable fuel use in 2006 in the aggregate, rather than on a refiner-by-refiner basis, because the details of the credit trading program have not yet been resolved. Should the nation fall short of 4 billion gallons of renewable fuel use in 2006 for any reason, the deficit would be added to the 4.7 billion gallon requirement for 2007. Virtually all the stakeholders agree, however, that the demand for high octane, clean-burning gasoline components will result in well more than 4 billion gallons of ethanol and biodiesel being used next year.

The RFS is a nationwide program establishing baselines for the use of renewable fuels. As outlined by the EPAct of 2005, the U.S. will be required to use 4 billion gallons of renewable fuel beginning in 2006. That usage will increase to 7.5 billion gallons in 2012.

Currently, 94 ethanol refineries nationwide have the capacity to produce over 4 billion gallons annually. There are 30 ethanol refineries and nine expansions under construction with a combined annual capacity of nearly 1.8 billion gallons.

Incentives

EPAct calls for many incentives programs, including multiple changes to the Internal Revenue Service Tax Code. To reach the goal of producing the first one billion gallons of annual cellulosic biofuels production by 2015, an incentive program will be established at DOE for the production of cellulosic biofuels. Additionally, the DOE may provide loan guarantees to carry out demonstration projects for cellulosic biomass, the construction of facilities for converting municipal solid waste (MSW) into ethanol and other byproducts, demonstration projects for ethanol derived from sugarcane and bagasse, and rebates for a renewable energy system connected to a house or small business. EPAct calls for credits for vehicles capable of operating on a renewable fuel, alternative refueling stations, investments in gasification projects converting product from biomass.

Purchasing and Production Requirements

One of the most lauded sections of the EPAct contains a requirement that gasoline in the U.S. contain 4.0 billion gallons of renewable fuel in 2006 and 8.0 billion gallons of renewable fuel in 2012. Other requirements include:

- The amount of electricity the Federal Government consumes must contain 3 percent renewable energy in 2007 and shall increase to 7.5 percent in 2013.
- Dual fueled vehicles in federal fleets shall operate on alternative fuels.
- The Capitol Complex shall procure biobased products.

Through the availability of projects to demonstrate bioenergy production, grants for increased biomass use, Federal R&D programs to work toward developing the technology to make biomass processes feasible, and requirements for the use of biobased fuels, power, and products, the signing of the Energy Policy Act of 2005 should help to increase the use of biomass technologies across the U.S.

USDA and the Department of Energy To Map Soy DNA Genome for Biodiesel

Two federal government departments have joined forces to decode the DNA of the soybean in an effort to boost its use. The sequencing of the soybean genome is the first project resulting from a new agreement between the Departments of Energy and Agriculture to share resources and coordinate the study of plant and microbial genomics.

The Department of Energy said that its Joint Genome Institute in Walnut Creek, California, will be the lead facility in the project. To date, the Institute has sequenced and released a total of 150 microbial organisms. The soybean genome is about 1.1 billion base pairs in size, less than half the size of the corn genome. The DOE Joint Genome Institute, supported by the DOE Office of Science, unites the expertise of five national laboratories, Lawrence Berkeley, Lawrence Livermore, Los Alamos, Oak Ridge, and Pacific Northwest, along with the Stanford Human Genome Centre to advance genomics in support of the DOE mission for clean energy generation and environmental characterization and cleanup.

Article by Brian Copeland of BCS Incorporated (www.bcs-hq.com). BCS is a small business that specializes in energy, environment and health research, industry analysis, technology assessment, database design and development, knowledge management, and communication and outreach. BCS staff provide program support to the Office of the Biomass Program, including the National Biomass Initiative, a research and development collaboration of the U.S. Department of Agriculture and the Department of Energy that coordinates and accelerates Federal biobased products and bioenergy research and development. ■

Oil Mill Gazetteer • Volume 111, February 2006

The Journey to RCM (Reliability Centered Maintenance)

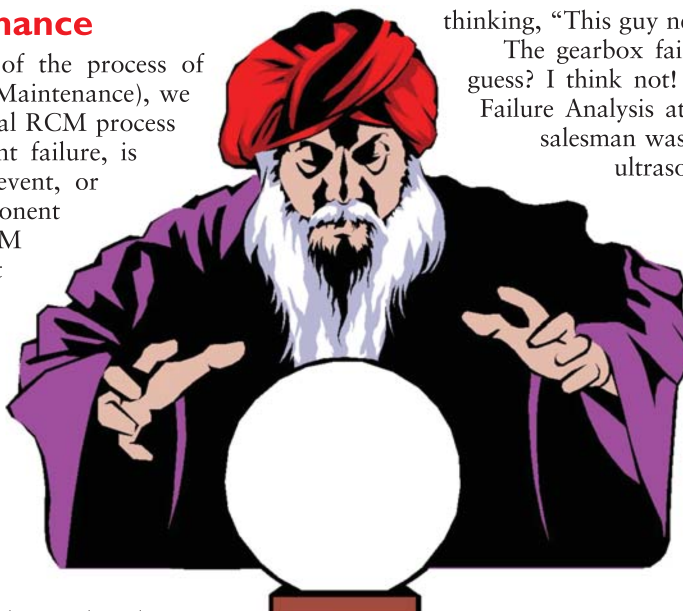
Evolution: From Firefighter to Technician

Terry Harris, CMRP

Predictive Maintenance

As we continue the series of the process of RCM (Reliability Centered Maintenance), we need to discuss a fundamental RCM process question. On any component failure, is there a way to Predict, Prevent, or Eliminate the specific component failure? This is where the RCM process guides us to the next evolutionary step of Predictive Maintenance.

I sometimes think about and miss how exciting it was coming in at 2:00 a.m. for a breakdown. Thinking about it on the drive into work and planning my strategy. How we would handle this emergency before ever even seeing the real problem. But I knew the plant so well that most of the time just a brief explanation on the phone call, and I was wide awake, shifting in to firefighter mode, and preparing to fix the failure.



Experience

As I grew older it was getting harder—my evenings became more important to me. We had to find a better way. The plant was getting bigger and the calls were increasing as we grew larger and more complex. Was there a "Silver Bullet" that could solve all my problems? I was going to find it if it was out there.

My actual first experience with a predictive technology method happened in 1980 when a supervisor walked up to me with a 16-inch screwdriver in his hand. He said, "Come over here and listen to this gearbox." He took his screwdriver and wrapped his hand around the handle, and placed the screwdriver on the gearbox. He then put his ear against the handle. After listening for about 30 seconds, and a few strategic moves, he handed it to me and said, "Listen and see if you think there is a bearing going out." I was looking around to make sure no one was looking, but I listened, nodded in agreement, and walked away thinking, "This guy needs something to do."

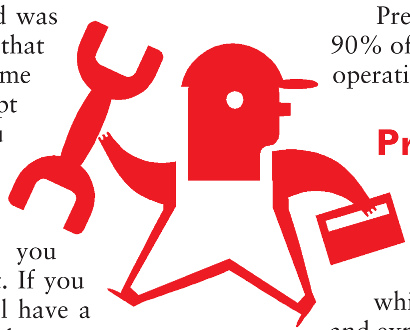
The gearbox failed three months later. Lucky guess? I think not! This was primitive Predictive Failure Analysis at work. A few months later a salesman was at my desk demonstrating an ultrasonic listening device. The U.E. Model 2000 was the ultimate screwdriver replacement. After some testing and experimenting, we started a program of testing every motor, pump, and fan bearing each month. We were using this tool to detect ultrasonic emissions that occur when bearings are in the early stages of failure. We started changing motors and bearings out before they failed. We once had a run of almost seven years without a motor failing on emergency downtime.

Seeds of Knowledge

In the early 90s, I listened to a guy talk about all these tools that were available for predicting equipment failures. I walked out of this session thinking, "What is this guy talking about? I have the ultrasonic device. What more could I want to know?" As has always happened in my career when I listened to these guys talk and I attended seminars, there are seeds planted. These are seeds of knowledge, and they always seem to grow. And once they start growing, I need to know more.

The first thing I had to figure out and accept was the reason for using these tools. My method of getting the maximum life out of every piece of equipment had worked well for years and my costs were still good (when you compared them to bad benchmarks). It was one of those life experiences you live where "you don't know what you don't know." And I didn't know that repair cost should be 3% of your RAV. RAV is the Replacement Asset Value of your plant. This 3% includes repair costs, maintenance labor, contract labor, rental equipment, etc.

The next thing I had to understand was how knowing six months ahead of time that something was going to fail would save me money. Once you understand and accept this, you're on your way. When you know there is a failure mode early, you have time to make a correction.



Example: Vibration analysis tells you that a coupling is out of alignment. If you don't correct the problem, you will have a bearing failure and may damage other components also. It sometimes may be a failure that you can't do anything about, but by knowing the failure is there, you can get the parts or the replacement ready. You can plan the work for the right time (not at 2:00 a.m. when you are behind on product). You can do the work correctly instead of in a hurry. And the biggest reason is that you do not damage other components. If a technology detects a bearing failure early in a gearbox, and you don't take action on the failure, you will damage attached gears, shafting, bearings bores, etc.

Technologies

So how many equipment component failures can be detected in operating plants? At least 90% of all equipment failures can be detected months before the failure eliminates function of the device. So what are these magical technologies?

Vibration Analysis can detect coupling misalignment, out of balance, bearing problems, gear wear or damage, looseness, motor problems, etc.

Mechanical Ultrasonics detect bearing wear, gear problems, air leaks, steam leaks, steam trap function, bad electrical contacts, electrical corona, etc.

Thermography detects electrical loose connections, mechanical equipment hot spots, bad bearings, bad or misaligned couplings, loose belts, bad sheaves, etc.

Oil Analysis detects foreign material, moisture, oxidation, and loss of additives in the lubricating oil.

Wear Particle Analysis detects metal particles in the oil from gears, bearings, and other machine components.

Motor Circuit Evaluation detects all failures in motors, from electrical to mechanical, months and years before the failure occurs. It can be used to check these failures on motors that are running or your spares before you install a spare motor with failure modes.

Crystal Ball

I could now be informed of eminent component failures. Is there one "Silver Bullet" technology that works for all equipment? Many people make the mistake of using all the technologies on all the components in an effort to find every eminent failure. It's a combination of technologies that has to be thought out and planned to make it cost effective. This is where the RCM process comes in to play. RCM helps us make logical decisions on which technology should be used for a specific component failure mode.

Predictive technologies are available to detect 90% of all equipment component failures in a plant operating process. There is a crystal ball!

Proactive Maintenance

We started on the journey from being reactive to equipment failures to using predictive technologies to predict failures. In my plant operations and maintenance life, which covered 12–20 years, we were learning and experimenting along the way. The calls at night had reduced to a few per month instead of many per week. The seriousness of the breakdowns were less and the downtimes were shorter. We had expanded and added other business units to the facility and not increased the manpower to perform maintenance work. We were doing more with less.

In the next couple years after predictive maintenance was being implemented, we started the process of looking at ways to make equipment last longer. We attended training classes on lubrication techniques, alignment training, and inspecting parts and equipment arriving at the plant.

Every time you rebuild a piece of process equipment, you run the risk of inducing what is called "infant mortality." Every time we lubricate a fitting we may actually be shortening the life by putting in contaminants. Infant mortality is very common in most maintenance operations. It occurs when a component is scheduled for rebuild and the maintenance crew is asked to take the component and rebuild it to like-new condition. Many times after the rebuild, its life is very short and failures occur days, weeks, or months after it is put back into operation. Why would this happen?

This happens because we don't have written rebuild procedures. People think they know how to make the rebuild because they have done similar things before. Or maybe they watched someone else do it a couple times. "I don't really need to check that bearing bore, it looks pretty good," or "The shaft has a few small nicks but I'll just sand them down and the bearing will fit just fine."

I've heard maintenance supervisors say "I don't need a written procedure, I have Bill and he's done that a hundred times." I wonder if we had the proper procedure if we would have only done it 20 times, or maybe once! Well, some operations decided, "I'll fix those problems. I won't rebuild anything onsite. I'll send them to a rebuild shop." Well, guess what happens at the rebuild shop? They hire the guys that are let go from maintenance shops when you stopped rebuilding onsite. I remember when I did my first visit and audit of a motor rebuild shop. I was walking around the shop and it was pretty clean. I walked up to a rebuild technician that was rebuilding a Toshiba motor for my plant. I asked, "Where are the Toshiba rebuilding specifications?" He said, "I don't need them, I've been rebuilding motors for 20 years." I turned and asked the shop owner, and he said he keeps all that stuff in his office so it doesn't get lost. I then asked the technician what the balance specification for this motor was. He replied, "It's the same for all our motors, less than one." I changed motor rebuild shops the next week.

This is part of Proactive Maintenance—selecting suppliers and services. Developing a process to select good parts is another part of this effort. Develop written precision-based rebuild procedures and follow them. This is just one of the steps. Let's look at some others that can turn your program in the right direction.

Lubrication Excellence

This proactive function is another step in the process. It's not just a written lubrication program but defining lube cleanliness standards and changing the way we lube. We will be filtering oils, installing auto lubricators, installing desiccant filters. We will be heating and air conditioning our oil storage rooms. We will be using specialized lubricating equipment and keeping it in clean storage. We will be learning how to develop excellence standards.

Precision Maintenance

These are items like Precision Alignment. Not just saying I have an alignment program and here are the written procedures. It is using quality laser alignment tools or reverse dial indicators to achieve accurate results. It's the use of torque wrenches and new shims. It's understanding the terms "soft foot" and "heel and toe" to get to precise alignment.

Precision Balance specification on existing and new equipment is another precision technique that must be understood and practiced. All rotating equipment must be balanced precisely to extend equipment life to its maximum potential.

Precision Rebuild Specifications

Written rebuild procedures assure all the correct tolerances are used on each component of the rebuild. No guessing or assuming!

Select Suppliers

Are we currently using the best motor rebuild shops? Are we buying the best motors, gearboxes, and pumps for our processes? Are bearing suppliers delivering good products? You need to look at all the equipment and parts you are purchasing and find out exactly how they rate for quality. This is a tough process but will pay long-term benefits.

RCM (Reliability Centered Maintenance)

This process helps you define all the possible failure modes in a process. By knowing each failure mode, you can define the exact maintenance process to do one of four things: predict when the failure may occur; prevent the failure from occurring; eliminate the failure; or reduce the consequence of the failure if you can't do the previous three.

RCA (Root Cause Analysis)

This process is used to determine the causes of a failure. There is usually more than one reason that a failure occurred. Using a process to determine three dominant failure modes will very likely give you the information to keep it from happening again. An example: A bearing failed due to lack of lubrication. This may be caused by a procedure, a hard to reach location, bad equipment giving or taking the lube, or many others. Getting to more than one cause will eliminate the failure from recurring.

RCD (Reliability Centered Design)

This process uses RCM or a group of professionals to design reliability methods into all new processes being designed. Using RCM defines all the failure modes of the components of a process to be defined before the install is completed. All written maintenance procedures can be written before startup.

TPM (Total Productive Maintenance)

This process uses one of your most valuable resources at any facility—the operator! TPM involves the operator in doing some of the minor maintenance work and inspections on the equipment. The operator must go through a culture change in thinking and may need some training in minor maintenance. This process works best to get operations and maintenance on the same page and working together for a common goal.

Maintenance and Operating Procedures

Nothing is better than detailed written procedures for getting things completed correctly. Those details make maintenance work flow smoothly and reduces the chance of inducing infant mortality or having plant operations downtime.

Training Programs

You can't have too many. People sometimes tell me they have run out of things to train on. Well if you are having zero downtime, zero quality issues, and no safety incidents, then yes, you may be close and you can make a fortune writing a book about your successes. My guess would be to keep training and no detail is too small to cover. When I was a production supervisor, I would write in the evening instructions to operate at 157.5 degrees. Many times you see notes such as "keep it around 155." This is a training tool, it forces the operator look at the process more closely and they learn from it.

Proactive Maintenance is action you can take while the process is running smoothly . . . before there are any failure modes to contend with! Being proactive by using these techniques will make you more efficient.

Conclusion

The RCM process is needed to determine the likely failure mode of every component in our plants and then determine the correct maintenance task to perform on that component. Without using this process, the airline industry would not be as reliable as it is. The cost to maintain the fleet would be a third higher and so would the cost for us to fly.

Can your industry afford to keep having failures and planning maintenance activities after the failure has occurred? Start your own evolution at your plant.

Terry Harris is a Certified Maintenance and Reliability Professional (CMRP) and has a Mechanical Engineering Technology degree. He has 26 years of experience in the oilseeds processing industry and has worked in many capacities including Steam Plant Supervisor, Assistant Plant Superintendent, and Maintenance and Reliability Superintendent. Mr. Harris currently offers RCM consulting and training to the grain processing industry. For more information about this article or RCM practices, contact Mr. Harris at 937-371-1644 or visit his website at www.reliableprocesssolutions.com. ■