5. Protect equipment during storage. Large and small farm machinery should be stored under cover whenever possible. Motors, turbines, mixers and other equipment should be rotated frequently. Inspect idle machinery for rust, condensation and contamination. Don't forget to check all lubricants. Oil-mist lubrication is a good solution for the damaging effects of warm, humid environments.

It should be noted that good maintenance is important for farm worker safety. Farm machinery maintenance can be dangerous. It is often conducted in close contact with running machinery. The conditions can be closely confined and unhealthy. The work is non-routine and subject to human error. There is often time pressure involved as well.

Preventive maintenance and planned capital repairs of farm machinery and equipment will reduce the likelihood of breakdown of equipment and the risks that technical specialists face during on-site repairs. Workplace accidents are also significantly reduced.

With proper maintenance farm machinery will stay in great shape for a long time to come and farm machinery will be much more reliable.

References

1. Farm Machinery Repair and Maintenance – A Collection of Articles on Ploughs, Harrows, Drills and Other Farm Machines / Print-on-Demand (POD), 2011 – 268 p.

2. Quality farm machinery and agricultural equipment. Mode of access https://www.teagle.co.uk/en-gb/ Date of access: 29.04.2020

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BIOFUEL SYSTEM INSTALLATION AND MAINTENANCE

Master Degree Student – Bobko A.A., APF
Student – Luzgin M.A., 21mo, 4th year, TSF
Scientific supervisor – Sysova N.V., senior teacher
EI «Belarusian State Agrarian Technical University»,
Minsk, the Republic of Belarus

Abstract. The article deals with biofuel system installation and maintenance. The article identifies four maintenance areas of particular importance in biomass operation.

Keywords: A biomass boiler, furnace, burnout, combustion system, a maintenance schedule.

Biomass is used for facility heating, electric power generation, and combined heat and power. The term “biomass” encompasses a large variety of materials, including wood from various sources, agricultural residues, and animal and human waste.

Most biopower plants use direct-fired combustion systems. They burn biomass directly to produce high-pressure steam that drives a turbine generator to make electricity.

A simple biomass electric generation system is made up of several key components. For a steam cycle, this includes some combination of the following items: fuel storage and handling equipment, combustor / furnace, boiler, pumps, fans, steam turbine, generator, condenser, cooling tower, exhaust / emissions controls, system controls (automated).

Direct combustion systems feed a biomass feedstock into a combustor or furnace, where the biomass is burned with excess air to heat water in a boiler to create steam. Instead of direct combustion, some developing technologies gasify the biomass to produce a combustible gas, and others produce pyrolysis oils that can be used to replace liquid fuels. Boiler fuel can include wood chips, pellets, sawdust, or bio-oil. Steam from the boiler is then expanded through a steam turbine, which spins to run a generator and produce electricity.

In general, all biomass systems require fuel storage space and some type of fuel handling equipment and controls. A system using wood chips, sawdust, or pellets typically use a bunker for short-term storage and an outside fuel yard for larger storage. An automated control system conveys the fuel from the outside storage area using some combination of cranes, stackers, reclaimers, front-end loaders, belts, augers, and pneumatic transport. Manual equipment, like front loaders, can be used to transfer biomass from the piles to the bunkers, but this method will incur significant cost in labor and equipment operations and maintenance (O&M). A less labor-intensive option is to use automated stackers to build the piles and reclaimers to move chips from the piles to the chip.

The maintenance required by a biomass boiler is greater and more involved than that of an equivalent gas or oil boiler. By 'maintenance' we mean:

- Frequent cleaning of the boiler and removal of ash
- Regular lubrication of mechanical parts and checking for wear
- Checking that the boiler is operating correctly and checking for damage
- Periodic servicing of the boiler

A good maintenance plan is written down and kept near to the boiler. There should be a place to record observations during the maintenance activities and a way of raising these as issues with appropriate personnel or the service company. A history of previous maintenance should be kept near the boiler.

If a maintenance schedule is not followed or is not comprehensive enough, many problems may potentially occur. Small problems picked up during maintenance may be an indication of more important underlying issues. For example, a noisy boiler ash removal system may be caused by damage to the ash removal system which may be caused by clinker in the ash. Ash fusion caused by the wrong air to fuel ratio in the boiler could indicate a problem with the lambda probe.

A regular maintenance schedule should pick up the initial stages of a problem, before it can develop and have further impact on the boiler. Four maintenance areas are of particular importance in biomass operation.

1. Ineffective cleaning. If a boiler is not cleaned thoroughly or often enough, dust can build up inside the boiler and inside flue gas pathways. This can then become entrained in the flue gas and result in higher than normal emissions. This problem will be exacerbated if cyclones and filters are not cleaned regularly and then cease to remove particulate matter effectively. Dust entering the boiler through the fuel feed can also cause maintenance issues.

Unburned material and pieces of clinker that are not removed from the combustion chamber and surrounding walls can interfere with the air distribution, leading to a reduction in efficiency and increase in emissions. This problem will be compounded if air inlets become blocked through a build-up of debris.

If pieces of unburnt fuel and clinker find their way into the ash removal system this could cause mechanical problems, particularly with augers as part of automated systems. Similarly, a failure to correctly lubricate and check for wear could lead to otherwise preventable damage to augers and fuel delivery systems.

A visual inspection of the boiler is the best way to identify problems with cleaning or servicing. If the boiler has automatic cleaning mechanisms, running them manually through the control panel is an effective way of checking their performance. Listen for unusual noises or vibrations when the boiler performs any mechanical operation such as running augers. Plant rooms should be clear and free from clutter, particularly in the area surrounding the boiler. If there is fuel dust around the feed system it could indicate a problem with the fuel delivery system or the fuel itself. Periodic inspection of the ash removed from the boiler during normal operation may also reveal the presence of unburned fuel or clinker, which may indicate poor cleaning or poor air distribution.

Visible smoke, or a “characteristic wood smoke smell”, particularly during steady burning, may indicate that the boiler internals require cleaning or that cyclones or filters have become blocked. Higher than normal flue gas temperatures are also an indication that boiler tubes may have a build-up of deposits which reduce heat transfer.

2. Unrepaired or unnoticed damage to biomass boilers. It is important to check all parts of the boiler thoroughly for signs of wear and tear or damage because if left untreated this may worsen over time and lead to a catastrophic failure which is likely to be expensive to rectify.

For example, damage to the grate and refractory material surrounding the combustion chamber could be an indication of other problems such as clinker formation. Damage caused by normal wear and tear should be routinely repaired as it may lead to overheating or sudden failure of the refractory material.

3. Failure of safety features. Biomass boilers have a range of safety features to ensure that unsafe situations do not arise. Should these features fail due to a lack of maintenance there may potentially be very serious consequences. Maintenance of safety features should therefore be a priority. The burn back protection should be serviced at regular intervals and that if it uses water, the water works independently of the boiler. The boiler house should be kept tidy and

free of flammable material. Ensure that the limit stat is connected and is serviced at regular intervals to ensure it will operate correctly when required.

4. Incorrect air supply/ fuel ratios. Good maintenance of biomass boilers will maximise their operational lifetime. Over time, the air to fuel ratio in the boiler can drift due to fans not being as effective, or oxygen and temperature sensors becoming less accurate. This causes problems with control of air and fuel rates which could either result in too much oxygen being supplied to the boiler which has the result of lowering efficiency or too little oxygen supplied to the boiler which can lead to incomplete combustion. High levels of CO and tar due to incomplete combustion can lead to damage of the boiler internals, or to an increase of particulate emissions and damage to flues.

In conclusion it should be noted that to solve problems caused by poor maintenance a maintenance plan and schedule are as essential as is operator training. The operator should be trained on how to operate and maintain the boiler according to the manufacturer's recommendations. In general biomass boiler operators must be proactive about repairs and fix problems as they arise and not allow them to deteriorate. They should observe their boiler for a period of time and see if its behaviour changes over the long-term. A good maintenance log will allow subtle changes that happen gradually to become noticeable. Boiler maintenance duties should be carried out according to the schedule.

References

1. https://energypedia.info/wiki/Costs_of_a_Biogas_Plant – Date of eccess:23.04.2020.

2. www.hcs.harvard.edu – Date of eccess:23.04.2020.

3. biomassmagazine.com/articles/8344/global-costs-of-biomass-power– Date of eccess:23.04.2020.

4. www.iea-biogas.net – Date of eccess:23.04.2020.

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INSTALLATION AND MAINTENANCE OF HIGH VOLTAGE POWER LINES

Students – Ibel A.S., 50 ept, 1st year, APF'
Parmanchuk O.A., 21 mo, 4th year, TSF
Scientific supervisor – Sysova N.V., senior teacher
EI «Belarusian State Agrarian Technical University»,
Minsk, the Republic of Belarus

Abstract. The article deals with the main stages of installation and maintenance of high voltage power lines. The purpose of the study is to determine the features of