The goal of this project was to determine the feasibility of utilizing a gasification system fueled by poultry litter as an economically suitable method of producing energy, and specifically power. The components of the project consisted of (1) a test burn to confirm the ability of the process to deliver the desired results; (2) data collection to determine the volume of material available and potential applications; (3) a sample detailed project design; and (4) the impact on the service area if the potential projects were pursued.

All 4 tasks were successfully completed and the individual reports from each task are included in the final report. During the efforts to complete the project, there were several questions raised, and several conclusions reached. This summary will take the results of the project and identify the conclusions and define the logical progression toward commercial projects.

The first step of the project was the test burn. Turkey litter from a Michigan grower was used and the results were very positive. The process worked well and the data collected was sufficient to develop an initial design for a commercial system. One of the benefits to conducting a test burn at the Coaltec facility is the potential benefits that can be derived through other projects being pursued simultaneously. A small commercial poultry project is now underway for a chicken producer in West Virginia. While this system is too small to consider power generation, it helped to evaluate the benefits of providing heat for the chicken houses; thus opening new options for co-generation projects.

One of the members of the group of growers that supplied the litter for the test also requested a system design. This was the subject of the design that was completed to satisfy task #3 of the project. This system included supplying steam for a feed mill that is part of his facility. This provided another option for co-generation.

One of the critical components of these projects is the power generation equipment. Since the design developed in this project included a steam need, it was a natural fit to utilize a boiler and steam turbine. However, for most applications, this is a very expensive and low efficiency system – even though it is proven and very reliable. Again, in the pursuit of other projects, alternative power generation equipment has been evaluated, and better systems for this application have been found. In applications where process steam is not required, alternatives that are lower capital cost and provide higher efficiencies have been found. Since most of these projects are below 3 MW, this is an important component of an economically viable project. One of the most attractive options is a Cascading Closed Loop system using propane as the pressurized fluid – this system is marketed by WOW Energy. While this is only one option of many, it provides several benefits over a steam system.

There are many approaches to the development of biomass projects, especially agricultural waste projects. This technology, and the desired application, is based on
projects that are either single farm, or a small cluster of farms. When economic evaluations are done on any energy project, the cost of fuel is a major component. Biomass fuels may be basically free at the source, but since they are lower in energy content and density, the cost of handling and transportation is exacerbated by both of those components. For example, assume it cost $100 to haul a truck load of material to a plant. If that material is coal, there will be approximately 40 tons per truck, 12,000 BTU/pound; or a cost of $0.10 per MMBTU. If that material is poultry litter, there will be 20 tons per truck at 4,700 BTU/pound; or a cost of $0.53 – over 5 times the cost. There is also the same relationship between the handling cost of each fuel. Therefore, it is critical to minimize the handling and transportation of the fuel to the extent practical. The view is that it is more economical to develop small scale, localized projects, rather than large centralized systems. Offsetting the economies of scale are also the factors of lower engineering and design costs for small projects, and the fact that there are no transmission upgrades necessary for small, distributive generation projects. It also makes it easier to develop co-generation opportunities and minimize any emissions issues. Finally, in the case of poultry litter, it also eliminates the critical issue of dealing with the spread of disease. With the potential disease issues, the concerns about Homeland Security and any possibility of intentional spread of contamination, and the issues surrounding odors when transporting litter on public highways; the development of single farm projects seems to have major favorable factors.

The other 2 phases of this project were focused on the identification of available projects and the impact on the electrical grid. There are multiple opportunities for projects, both those producing power and those too small to economically produce power but with an energy need that provides an economic return for the investment. Due to the security issues surrounding this data, the information targeted geographical areas, rather than specific farms. However, the potential project areas are identified and the size and impact of those projects were also identified.

Probably the final question to be answered from the project is: Why should this type of project be developed, and what benefit does it bring? There are some obvious initial positive impacts:

- Energy produced from poultry litter reduces the drain on other energy sources – both as electricity and other forms of energy.
- Emissions from gasification are low; and since there are emissions already coming from litter both on the farm and after land application, the offsets of reducing these existing emissions dramatically lowers the environmental impact.
- Current land application methods are creating huge issues in many poultry growing regions, and this situation is only going to worsen. Eliminating the need to land apply has a major environmental impact.
- All pathogens in the litter are destroyed, eliminating disease issues.
- Alternative economical benefits to the host farm – heating of houses, disposal of mortalities, and reduction of cost of litter
disposal. One of the unique benefits discovered when evaluating projects was the fact that using the gasifier to supply heat to the houses not only eliminates the cost of propane, but it also lowers the moisture content in the houses; thus also reducing the ammonia levels. This potentially can be more beneficial than all of the other benefits as it improves the animal health.

- The ash product from the gasifier is a dry, fine particle material that has the phosphorus and potassium nutrients from the litter without the pathogens and odors.

And there are negative questions that must be answered:

- There is value in the litter in land application, why not land apply and not gasify? Land application provides no control – you must use whatever volume is produced, and there is usually not a good balance between need and availability. The gasifier ash has the same nutrients, minus the nitrogen, without all of the issues. The ash from the test burn contained over 15% Phosphorus. It is also in a form that is easy to handle and transport.
- Why not use digestion? Digesters produce a high quality methane product; but poultry litter is a poor fuel, and most of the digesters attempted in the dairy industry where it is supposed to be the best application have failed. Digestion can’t handle the volume or the consistency of the litter, and are typically more complicated to operate.
- Energy projects using poultry litter have emissions problems. There are many misconceptions concerning emissions. Many past projects involve incinerators, not gasifiers. There is a big difference, both in technology and in the emissions they create. The gasifier can easily control NOx formation. There is some sulfur in the fuel, but not at the level that will create problems. Particulate matter is not an issue with the gasifier as there is minimal air movement inside the unit causing a very low amount of carryover.
- Individual farm projects are not as economical as large, centrally located projects. It is difficult on smaller projects to make them economical. One of the major benefits to individual farm projects is the alternative energy benefits that can be used in addition to power generation. The biggest difference is that most large projects look at their capital cost and do a very poor job in identifying the operational and installation costs. When you consider the fuel transportation and its assorted issues, the cost of those projects increase dramatically. There is also a huge difference in a small project that can be installed in 2 or 3 weeks, versus a 6-month construction project.
The criteria used to evaluate the value of a technology and its application is whether or not it adds value to the user. Not only does it need to show an economic benefit on paper, it must also provide an overall benefit to the business. One of the major issues with many of the technological options is their complexity. A poultry producer wants and needs to be able to concentrate on their core business, not working on energy systems. This technology is easy to operate and requires minimal attention, thus not only providing a theoretical economic benefit, but one that can be realized by the owner.