Dubbed the "lasagna" process because of its layers, this technology cleans up liquid-borne organic and inorganic contaminants in dense, claylike soils. Initial work is focused on removing chlorinated solvents.

Because clay is not very permeable, it holds ground water and other liquids well. Traditional remediation for this type of site requires that the liquid in the soil (usually ground water) be pumped out. The water brings many of the contaminants with it, then is chemically treated and replaced—a time-consuming and expensive solution.

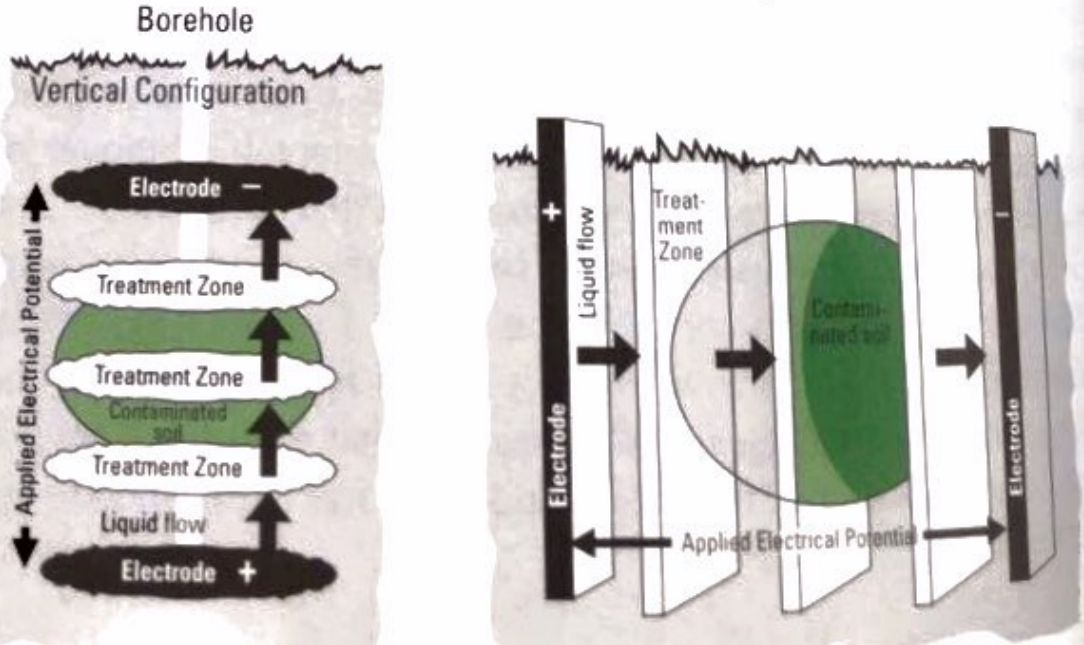
The lasagna process, on the other hand, allows the soil to be remediated *in situ* by using low-voltage electric current to move contaminated ground water through treatment zones in the soil. Depending on the characteristics of the individual site, the process can be done in either a horizontal or vertical configuration. (See figure below.)

The first step in the lasagna process is to "fracture" the soil, creating a series of zones. In a horizontal configuration, a vertical borehole is drilled and a nozzle inserted; a highly pressurized mixture of water and sand (or another [illegible] solid material) is injected into the ground at various depths. The result: a stack of panc[illegible]-shaped, permeable zones in the denser, contaminated soil. The top and bottom zones are filled with carbon or graphite so they can conduct electricity. The zones between them are filled with treatment chemicals or microorganisms that will remediate the contaminants.

When electricity is applied to the carbon and graphite zones, they act as electrodes, creating an electric field. Within the field, the materials in the soil migrate toward either the positive or negative electrode. Along with the migrating materials, pollutants are carried into the treatment zones, where they are neutralized or destroyed.

The vertical configuration works in much the same way, differing only in installation. Because the electrodes and treatment zones extend down from the surface, this configuration does not require the sophisticated hydraulic fracturing techniques that are used in the horizontal configuration.

Schematic Diagram of the Lasagna Process



A Description of the Standard Stethoscope

The stethoscope is a listening device that amplifies and transmits body sounds to aid in detecting physical abnormalities.

This instrument has evolved from the original wooden, funnel-shaped instrument invented by a French physician, R. T. Lennaec, in 1819. Because of his female patients' modesty, he found it necessary to develop a device, other than his ear, for auscultation (listening to body sounds).

This report explains to the beginning paramedical or nursing student the structure, assembly, and operating principle of the stethoscope.

The standard stethoscope is roughly 24 inches long and weighs about 5 ounces. The instrument consists of a sensitive sound-detecting and amplifying device whose flat surface is pressed against a bodily area. This amplifying device is attached to rubber and metal tubing that transmits the body sound to a listening device inserted in the ear.

The stethoscope's Y-shaped structure contains seven interlocking pieces: (1) diaphragm contact piece, (2) lower tubing, (3) Y-shaped metal piece, (4) upper tubing, (5) U-shaped metal strip, (6) curved metal tubing, and (7) hollow ear plugs. These parts form a continuous unit (Figure 1).

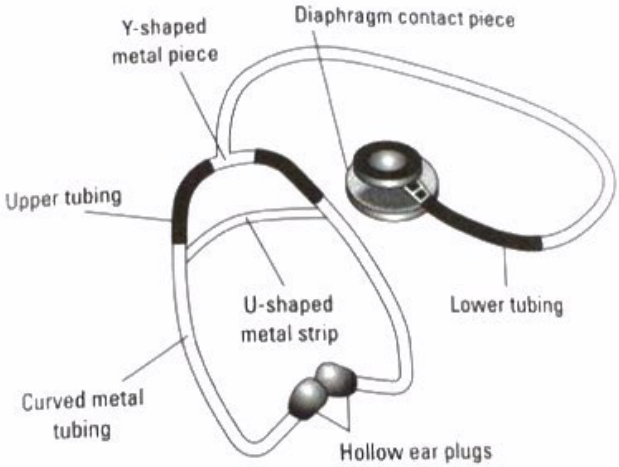


FIGURE 1 Stethoscope with Diaphragm Contact Piece (Front View)

The seven major parts of the stethoscope provide support for the instrument, flexibility of movement for the operator, and ease in use.

In an operating cycle, the diaphragm contact piece, placed against the skin, picks up sound impulses from the body's surface. These impulses cause the plastic diaphragm to vibrate. The amplified vibrations, in turn, are carried through a tube to a dividing point. From here, the amplified sound is carried through two separate but identical series of tubes to hollow ear plugs.

Figure 12.2 A Short Description of a Standard Stethoscope.

I. **Introduction: General Description**
   A. Definition, Function, and Background of the Item
   B. Purpose (and Audience—for classroom only)
   C. Overall Description (with general visuals, if applicable)
   D. Principle of Operation (if applicable)
   E. List of Major Parts

II. **Description and Function of Parts**
   A. Part One in Your Descriptive Sequence
      1. Definition
      2. Shape, dimensions, material (with specific visuals)
      3. Subparts (if applicable)
      4. Function
      5. Relation to adjoining parts
      6. Mode of attachment (if applicable)
   B. Part Two in Your Descriptive Sequence (and so on)

III. **Summary and Operating Description**
   A. Summary (used only in a long, complex description)
   B. Interrelation of Parts
   C. One Complete Operating Cycle

Description of a Standard Bumper Jack

Introduction—General Description

The standard bumper jack is a portable mechanism for raising the front or rear of a car through force applied with a lever. This jack enables even a frail person to lift one corner of a 2-ton automobile.

The jack consists of a molded steel base supporting a free-standing, perpendicular, notched shaft (Figure 1). Attached to the shaft are a leverage mechanism, a bumper catch, and a cylinder for insertion of the jack handle. Except for the main shaft and leverage mechanism, the jack is made to be dismantled. All its parts fit neatly in the car's trunk.

The jack operates on a leverage principle, with the operator's hand traveling 18 inches and the car only $\frac{3}{8}$ of an inch during a normal jacking stroke. Such a device requires many strokes to raise the car off the ground but may prove a lifesaver to a motorist on some deserted road.

Five main parts make up the jack: base, notched shaft, leverage mechanism, bumper catch, and handle.

Description of Parts and Their Function

Base. The rectangular base is a molded steel plate that provides support and a point of insertion for the shaft (Figure 2). The base slopes upward to form a platform containing a 1-inch depression that provides a stabilizing well for the shaft. Stability is increased by a 1-inch cuff around the well. As the base rests on its flat surface, the bottom end of the shaft is inserted into its stabilizing well.

Shaft. The notched shaft is a steel bar (32 inches long) that provides a vertical track for the leverage mechanism. The notches, which hold the mechanism in position on the shaft, face the operator.

The shaft vertically supports the raised automobile, and attached to it is the leverage mechanism, which rests on individual notches.

Leverage Mechanism. The leverage mechanism provides the mechanical advantage needed for the operator to raise the car. It is made to slide up and down the notched shaft. The main body of this pressed-steel mechanism contains two units: one for transferring the leverage and one for holding the bumper catch.

The leverage unit has four major parts: the cylinder, connecting the handle and a pivot point; a lower pawl (a device that fits into the notches to allow forward and prevent backward motion), connected directly to the cylinder; an upper pawl, connected at the pivot point; and an "up-down" lever,

Figure 12.3 (*Continued*)

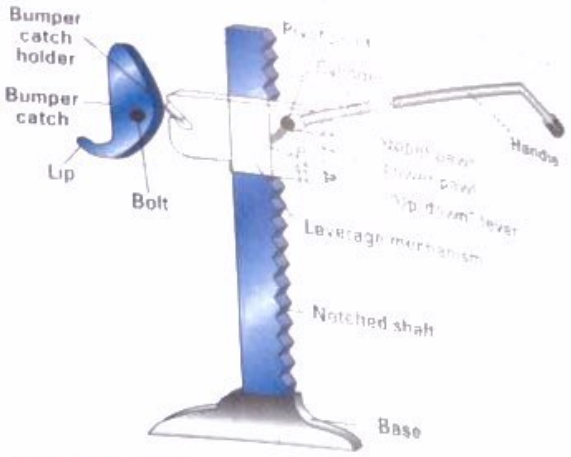


FIGURE 1 A Side View of the Standard Bumper Jack

which applies or releases pressure on the upper pawl by means of a spring (Figure 1). Moving the cylinder up and down with the handle causes the alternate release of the pawls, and thus movement up or down the shaft—depending on the setting of the "up-down" lever. The movement is transferred by the metal body of the unit to the bumper catch holder.

The holder consists of a downsloping groove, partially blocked by a wire spring (Figure 1). The spring is mounted in such a way as to keep the bumper catch in place during operation.

Bumper Catch. The bumper catch is a 9-inch molded plate that attaches the leverage mechanism to the bumper and is bent to fit the shape of the bumper. Its outer $\frac{1}{2}$ inch is bent up to form a lip (Figure 1), which hooks behind the bumper to hold the catch in place. The two sides of the plate are bent back 90 degrees to leave a 2-inch bumper contact surface, and a bolt is riveted between them. This bolt slips into the groove in the leverage mechanism and provides the attachment between the leverage unit and the car.

Jack Handle. The jack handle is a steel bar that serves both as lever and lug bolt (or lugnut) remover. This round bar is 22 inches long, $\frac{5}{8}$ inch in diameter, and is bent 135 degrees roughly 5 inches from its outer end. Its outer

igure 12.3 (*Continued*)

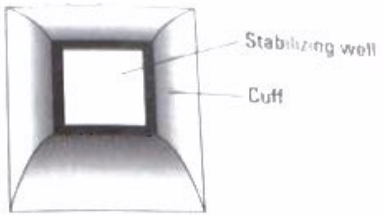


FIGURE 2 A Top View of the Jack Base

end is a socket wrench made to fit the wheel's lug bolts. Its inner end is beveled to form a bladelike point for prying the wheel covers and for insertion into the cylinder on the leverage mechanism.

Conclusion and Operating Description

One quickly assembles the jack by inserting the bottom of the notched shaft into the stabilizing well in the base, the bumper catch into the groove on the leverage mechanism, and the beveled end of the jack handle into the cylinder. The bumper catch is then attached to the bumper, with the lever set in the "up" position.

As the operator exerts an up-down pumping motion on the jack handle, the leverage mechanism gradually climbs the vertical notched shaft until the car's wheel is raised above the ground. When the lever is in the "down" position, the same pumping motion causes the leverage mechanism to descend the shaft.

Figure 12.3 (*Continued*)

In an online document, such as a Web page or o... tions such as these can easily be linked to the ma... clicks on "leaching field" would be taken to a wi... tion and other important information.

A slightly longer way to define a phrase is to u... method. You begin by stating the term. Then you indicate the broader ... this item belongs to, followed by the features that distinguish it from other ... in that general grouping. Here are some examples.

Term	Class	Features
Carburetor:	A mixing device . . .	in gasoline engines that blends air and fuel into a vapor for combustion within the cylinders
Diabetes:	A metabolic disease . . .	caused by a disorder of the pituitary gland or pancreas.

Brief definitions are fine when the audience does not require a great deal of information. For example, the sentence about the leaching field might be adequate in a progress report to a client whose house you are building. But a document that requires more detail, such as a public health report on groundwater contamination, would call for an expanded definition.

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Expanded. Expanded definitions are appropriate when audiences require more detail. Depending on audience and purpose, an expanded definition may be a short paragraph or may extend to several pages. If a device, such as a digital dosimeter (used for measuring radiation exposure), is being introduced for the first time to an audience who needs to understand how this instrument works, your definition would require at least several paragraphs, if not pages. In such cases, your document would evolve from a simple definition to one that both defines and describes the device.

Typical Components of Definitions and Descriptions

Etymology. Sometimes a word's origin (etymology) can help users understand its meaning. *Biometrics,* for example, is derived from the Greek *bio,* meaning "life," and *metron,* meaning "measure." You can use a dictionary to learn the origins of most words.

History and background. In some cases, the history or background of a term, concept, or procedure can be useful in defining and describing it. For students or researchers who want in-depth information, history and background are

appropriate. However, for users trying to perform a task, history and background can be cumbersome and unnecessary. If you wanted to install a new modem, you might be interested in a quick sentence explaining that *modem* stands for "modulator/demodulator." But you would not really care about the history of how modems were developed.

Operating principle. If part of the document's purpose is to teach people to use a product correctly, it is usually helpful for your audience to understand how a device operates. For example, a manual for a garden rototiller is intended to help people use the tiller. Therefore, users should have a sense of how the tiller operates: It uses gasoline, it needs a clean spark plug, and so on. A list of parts is another way of illustrating how a device operates.

Usability Considerations

Use appropriate levels of technicality. Your language in a definition or description needs to match the particular audience's level of experience. An audience of medical technicians will easily understand jargon related to their field, but nonexperts will need language they find familiar. For example, the sentence

> A tumor is a neoplasm.

would make sense to most medical professionals. But for an audience outside that field, you would need to unpack the term *neoplasm* and use more accessible language, as in

> A tumor is a growth of cells that occurs independently of surrounding tissue and serves no useful function.

Consider length and placement. The length of a definition or description should be appropriate for your audience and purpose. For example, if your audience needed to know only the very basics about a term (such as *tumor*), you could write a short sentence. But if your audience needed more information, you would need to amplify your definition with a description (say, of the process by which tumor cells displace healthy tissue).

Placement is also important. Each time an audience encounters an unfamiliar term or concept, it should be defined or described in the same area on the page or screen. In a printed text, you can accomplish this by placing brief definitions in an outside margin. On the screen, you would use a hypertext link. Hypertext and the Web are perhaps the best answer yet to making definitions and descriptions accessible, because readers can click on the item, read about it, and return to their original place on the page.

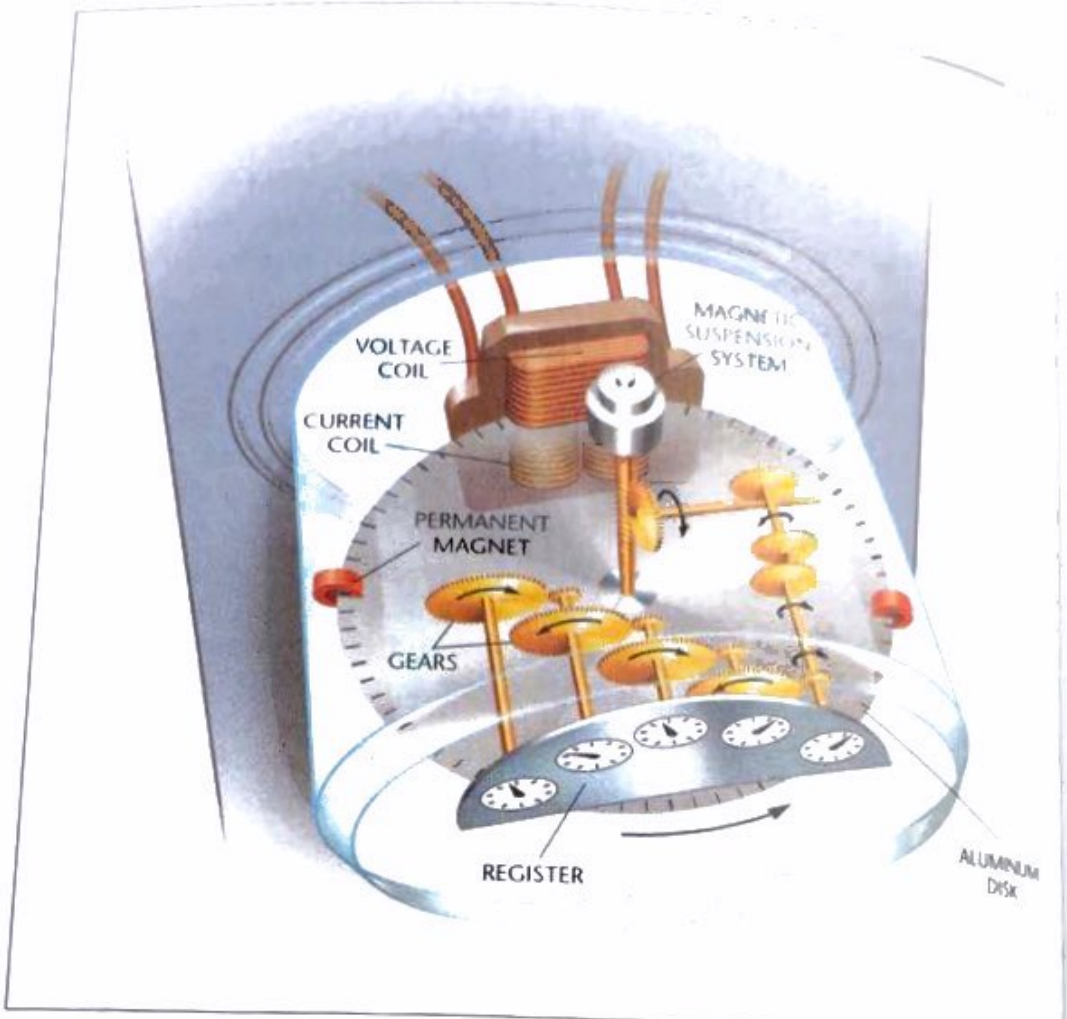


Figure 12.4 Description of an Electricity Meter. This exploded diagram helps make the written description it accompanies come to life.

Source: From Rosenau L. (2000, March). Working knowledge: Electric Meters, *Scientific American*, 108. Reprinted by permission of George Retseck.

Use visuals. Visuals can be very important in definitions and descriptions. You can explain as clearly as you like, but as the saying goes, a picture is worth a thousand words—even more when used with clear, accurate prose. The cutaway diagram (top view) in Figure 12.4 is a description of an electricity meter, designed for a general audience.

Use clear, concise language. Use sentences that are brief and to the point. Provide readers with the most important information quickly. If all your audience needs is a one-sentence definition, don't write a long description, no matter how interesting you think it might be.

Choose words with precision. Choose words carefully, and use the same word to refer to the same item. Is a tumor a "growth of cells" or simply "cells"? When describing fiber optic technology, don't suddenly switch and call it "high-speed cable."

Use comparisons and examples. By comparing new information to ideas your audience already understands, you help build a bridge between people's current knowledge and the new ideas. For example, for a group of nonexperts, you could explain how earthquakes start in this manner:

> Imagine an enormous block of gelatin with a vertical knife slit through the middle of its lower half. Giant hands are slowly pushing the right side forward and the left side back along the slit, creating a strain that eventually splits the block. (Earthquake hazard analysis, 1984, p. 8.)

Use an appropriate organizational sequence. For longer descriptions, choose the organizational pattern that is most consistent with your purpose. If you want to describe how something looks or what parts it has, use a *spatial* sequence: Describe the items as your audience will see them. If you want to describe how something works, use a *functional* sequence: Describe the workings (functions) of the device. And if you want to describe how something is assembled, use a *chronological* sequence (see "Brief Instructions" and "Procedures" in Chapter 11).

Checklist for Definitions and Descriptions

- Is the length of the definition or description suited to its audience and purpose?
- Is the expanded definition adequately developed for its audience?
- Are visuals used adequately and appropriately?
- Does the definition appear in the appropriate location?
- Are comparisons and examples used to enhance understanding?
- Are any details missing, needless, or confusing for this audience?
- Does the description follow the clearest possible sequence?
- Will the level of technicality connect with the audience?
- Is the language clear and concise?
- Is the terminology precise and consistent?

contents, appendixes, and an index. Like short reports (Chapter 10), long reports present ideas and facts to interested parties, decision makers, and other audiences. Technical professionals rely on reports as a basis for making informed decisions on a range of matters, from the possible side effects of a new pain medication to the environmental risks posed by a certain gasoline additive.

Long reports are called for in situations where an audience needs detailed information, statistics, and background information—the whole story. For example, your team of engineers needs to make far-reaching decisions about the best site for a toxic waste containment field. You have several months to research and make a decision, so you hire a consulting firm to report on all the relevant information. Their resulting product, a long report describing the geologic conditions of potential sites, might contain an appendix with detailed comparisons of topsoil, groundwater, and other conditions.

Audience and Purpose Analysis

Do your best to determine who will read the report. For instance, even if the report is addressed to team members, it may be sent on to other managers, the legal department, or sales and marketing. If you can learn about the actual audience members in advance, you can anticipate their various needs as you create the report. Before you start the report, be clear about its true purpose. For example, you may be under the impression that the report is intended simply to inform an audience. But after some initial research, you learn that your manager really wants you to recommend an action, not just state the facts. Recommending is different from informing, so it's important to understand the reason you are writing the report in the first place. For instance, the writers of the biodiesel report excerpted in Figure 12.5 made it clear that the audience was Georgia legislators and others making decisions whether or not to produce or use biodiesel. The document also has a clear purpose, stating clearly in the introduction, "The purpose of this report is . . ."

Types of Long Reports

Causal. Causal reports are used in situations where you need to explain what caused something to happen. For example, medical researchers may need to explain why so many apparently healthy people have sudden heart attacks. Or you might need to anticipate the possible effects of a particular decision, say, the effects of a corporate merger on employee morale.

Comparative. Comparative reports are used when you need to rate similar items on the basis of specific criteria. For example, you may need to answer questions such as "Which type of security procedure—firewall or encryption—should we install in our company's computer system?"

Feasibility. Feasibility reports are used when your purpose is to assess the prac quality of an idea or plan. For example, if your company needs to know whethe increased business will justify the cost of an interactive Web site, you would nee to do some research and describe the results in a feasibility report.

Sometimes these categories overlap. Any single study may in fact require you to take several approaches. The sample report in Figure 12.9 is an example. The report is designed to answer the question, "Should the state of Georgia use and produce biodiesel?"

A General Model for Long Reports

After analyzing your audience and purpose, do some basic research. Then sketch a rough outline with headings and subheadings for the report.

Introduction. The introduction engages and orients the audience and provide background as briefly as possible for the given situation. Often writers who are fa miliar with the product are tempted to write long introductions because they have lot of background knowledge about the product or issue. But readers don't generall

Introduction

The State of Georgia faces two issues that may provide a unique opportunity for rural economic growth. The first issue is that major urban areas of the State have air quality problems that will require actions to reduce sources of pollution. One major pollution source is from exhaust emissions from cars and trucks. The use of alternative fuel sources such as biodiesel can make a significant reduction in certain exhaust emissions, thus reducing pollution and improving air quality.

The second issue facing the State is depressed crop farm incomes due to low market prices for the many oilseeds produced. Prices for soybeans, cottonseed and crush quality peanuts have been at very low levels for the last four years. These low prices have reduced farm incomes. Additionally, disposal of animal fat by-products and spent vegetable oils may become increasingly difficult in the future.

The opportunity for economic growth resides in the processing of these oilseeds and other suitable feedstocks produced within the State into biodiesel. The new fuel can be used by vehicles traversing the State, thus reducing air pollution and providing another market for Georgia produced oilseeds while creating a value added market for animal fats and spent oils. The benefits of biodiesel go far beyond the clean burning nature of the product. Biodiesel is a renewable resource helping reduce the economy's dependency on limited resources and imports. Also, biodiesel will help create a market for farmers and certain feedstocks and help reduce the amount of waste oil, fat and grease being dumped into landfills and sewers.

The purpose of this report is to provide decision makers with information on the feasibility of producing biodiesel in Georgia.

need long history lessons about the topic. In the introduction to the report, you might begin and significance, define or describe the problem or issue, and [illegible] in the report's purpose. Briefly identify your research methods (interviews, literature [illegible] and so on). List working definitions, but if you have more than two or three, place definitions in a glossary. Finally, briefly state your conclusion. Don't make readers wade through the entire report to find out what you are recommending or advising. The strength of such brevity can be seen in the introduction to the biodiesel report shown in Figure 12.5.

Body. The body describes and explains your findings. Present a clear and detailed picture of the evidence, interpretations, and reasoning on which you will base your conclusion. Divide topics into subtopics, and use informative headings as aids to navigation, as in the body section of the biodiesel report excerpted in Figure 12.6.

Potential Drawbacks to Biodiesel

Biodiesel can be corrosive to rubber materials and liner materials. Biodiesel cannot be stored in concrete lined tanks. In some cases, the fuel intake orifices may need to be reduced in size to create a higher cylinder pressure. And, given current petroleum prices, biodiesel is more costly to produce than biodiesel.

Georgia Diesel Demand

According to the Petroleum Marketing Monthly, published by the Energy Information Administration, 4.64 million gallons of diesel were sold per day in Georgia in 2000. This included all diesels, low and high sulfur, auto and farm, amounting to about 3.89% of the national annual demand.

Several institutions that are influenced or controlled by the state government are large users of diesel fuel. Demand from school districts in the metro Atlanta (21 counties) amounted to 9,702,798 gallons used in 2000. MARTA estimates using 6,644,070 gallons of diesel in 2000. Finally, the Georgia Department of Transportation used 1,521,957 gallons of diesel in 2000 statewide. These three institutions alone use close to 18 million gallons of diesel per year. Map 1 illustrates the amount of diesel used in the Metro Atlanta counties during 2000.

The Biodiesel Production Process

The technology of converting vegetable oils and animal fats into biodiesel is a well established process. The most commonly used and most economical process is called the *base catalyzed esterification of the fat with methanol*, typically referred to as "the methyl ester process". Essentially the process involves combining the fat/oil with methanol and sodium or potassium hydroxide. This process creates four main products - methyl ester (biodiesel), glycerine, feed quality fat and methanol that is recycled back through the system. The primary product, methyl ester, is better known as biodiesel. The glycerine and fats can be sold to generate added income from the process.

Figure 12.6 Body of the Biodiesel Report.

Source: From "A Study on the Feasibility of Biodiesel Production in Georgia" by Professor George A. Shumaker, et al. February 3, 2003. Reprinted by permission of George A. Shumaker.

The body of your report will vary greatly, depending on the audience, topic, purpose, and situation.

Conclusion. As seen in the portion of the biodiesel report excerpted in Figure 12.7, the conclusion is important because it answers the questions that originally sparked the analysis. In the conclusion, you summarize, interpret, and recommend. Although you have interpreted evidence at each stage of your analysis, your conclusion presents a broad interpretation and suggests a course of action where appropriate. Your conclusion should provide a clear and consistent perspective on the whole document. Don't introduce new ideas, facts, or statistics in the conclusion.

Conclusions

There exist a variety of potential feedstocks both in Georgia and nearby states that could be utilized to produce biodiesel. These feedstocks vary significantly in price depending on supply and demand condition as well as market structural conditions. Feedstock costs represent between 50 and 75 percent of the cost of producing biodiesel, and thus a reliable source of low priced feedstocks is critical to success. A 15 million gallon biodiesel plant would require about 27% of the vegetable and animal fats currently available within the state of Georgia. This facility would produce 750 million gallons of 2% blend for approximately twice the state demand. A 20% blend will create 75 million gallons of B20 or roughly 20% of the Georgia diesel market.

The processing technology for producing biodiesel is well established and presents little technological risk. The production of biodiesel is a very efficient process, returning about 3.2 units of energy for each unit used in production. Biodiesel is thus an excellent renewable fuel source. Biodiesel can be very easily integrated into the existing petroleum distribution system from the handling, chemical, physical and performance perspectives.

Lacking government mandates or subsidies, a feedstock cost of about 10 cents per pound or less, given current diesel fuel prices, is needed for biodiesel to be cost competitive.

technical sections. Users can refer to any of these sections or skip them as together, according to their needs.

Title page. The title page gives the report title, the name of all authors, and their affiliations or the name of the organization that sponsored the report. The title announces the report's purpose and subject by using descriptive words such as *analysis, proposal, feasibility,* or *progress* (as in Figure 12.9).

Letter of transmittal. Many long reports include a letter of transmittal, addressed to a specific reader. This letter might

- Acknowledge individuals and organizations that helped with the report
- Refer to sections of special interest
- Discuss limitations of your study or any problems in gathering data
- Discuss possible follow-up investigations
- Offer personal (or off-the-record) observations
- Urge the recipient to immediate action

If a report is being sent to numerous people who are variously qualified and bear various relationships to you, individual letters of transmittal may vary.

Table of contents. Help readers find the information they're looking for by providing a table of contents. In designing your table, follow these guidelines:

- Number the front-matter (transmittal letter, abstract) pages with lowercase roman numerals. (The title page, though not listed, is counted as page i.) Number glossary, appendix, and endnote pages with arabic numerals, continuing the page sequence of your report proper, in which page 1 is the first page of the report text.
- Include no headings in the table of contents not listed as headings or subheadings in the report; the report may, however, contain subheadings not listed in the table of contents.
- Phrase headings in the table of contents exactly as in the report.
- List headings at various levels in varying type styles and indention.
- Use *leader lines* (. . . . . .) to connect headings to page numbers. Align rows of dots vertically, each above the other.

List of tables and figures. On a separate page following the table of contents or integrated with it, list the tables and figures appearing in the report.

Abstract or executive summary. Reports are often read by many people: researchers, developers, managers, vice presidents, customers. For readers who are interested only in the big picture, the entire report may not be relevant, so most

long reports are commonly preceded by an abstract (short) or an executive summary (longer). In this brief description, you explain the issue, describe how you researched it, and state your conclusion. Busy readers can then flip through the document to locate sections of importance to them.

In preparing your abstract, follow these suggestions:

- Make sure your abstract stands alone in terms of meaning.
- Write for a general audience. Readers of the abstract are likely to vary in expertise, perhaps more than those who read the report itself; therefore, translate all technical data.
- Add no new information. Simply summarize the report.
- Present your information in the following sequence:
  1. Identify the issue or need that led to the report.
  2. Offer the major findings from the body of the report.
  3. Include a condensed conclusion and recommendations, if any.

Appendixes. Add one or more appendixes to your report if you have large blocks of material or other documents that are relevant but will bog readers down if placed in the middle of the document itself. For example, if your report on the cost of electricity at your company refers to another report issued by the local utility company, you may wish to include this second report as an appendix.

Other items that belong in an appendix might include complex formulas, interview questions and responses, maps, photographs, sample questionnaires and tabulated responses, texts of laws and regulations, and the like. Do not stuff appendixes with needless information or use them unethically for burying bad or embarrassing news that belongs in the report proper. Title each appendix clearly: "Appendix A: Projected Costs." Mention the appendix early in the introduction, and refer readers to it at appropriate points in the report: "(see Appendix A)."

See, for example, Appendixes A and B in this textbook.

Glossary. Use a glossary if your report contains more than two or three technical terms that may not be understood by all audience members. Use standard definitions in your glossary: Refer to company style guides or technical dictionaries. If fewer than five terms need defining, place them in the report introduction as working definitions, or use footnote definitions. If you use a separate glossary, announce its location: "(see the glossary at the end of this report)."

List of references. List each of your outside references in alphabetical order or in the same numerical order as they are cited in the report proper.

Not all reports have all of these supplements. For example, the biodiesel report (Figure 12.9) omits the letter of transmittal because this report was presented in person. And, in that report, the introduction (Figure 12.5) also functions as the abstract. No glossary is needed because the opening pages present an expanded definition of biodiesel, its uses and production. A long appendix con-

taining calculations and formulas has been omitted here, to save space. Finally, there is no formal list of references because the bulk of the research is based on public sources or hired consultants, each cited in the text (as on page 10, bottom, in Figure 12.9).

For examples of many of these supplements in a student-written report, see "Feasibility Analysis of a Career in Technical Marketing," on the accompanying Web site, at www.ablongman.com/gurak.

Usability Considerations

Clearly identify the problem or goal. To address the true purpose of the situation, you must carefully identify your goal. Begin by defining the main questions involved in the report and then outlining any subordinate questions. Your legislator, for example, might pose this question: "Will producing biodiesel benefit the state of Georgia?" Answering this question is the main goal of the report; however, this question leads to others, such as "What are the drawbacks of biodiesel use?" Create a goal statement, such as "The goal of this report is to examine and evaluate claims about the production of biodiesel in the state of Georgia." (See pages 276–281 for the complete Biodiesel report.)

Provide enough information but not too much. Any usable analysis must address the needs, interests, and technical expertise of your audience. A long history of the development of the pacemaker may be interesting to you but inappropriate for your report. As you plan the report, find out how much of the information you've gathered readers need in order to make a decision. Also, make sure your technical terms are not too complex for your audience. If you have a mixed audience, provide a glossary where readers can look up unfamiliar terms. If your report is posted to a Web site, you can use hyperlinks for glossary terms.

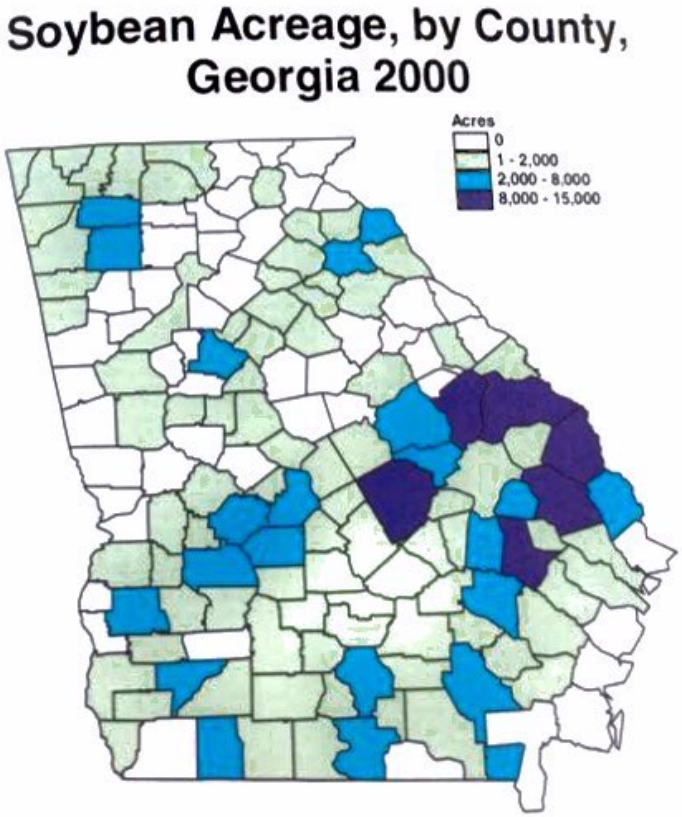
Provide accurate information. Make sure your information is as accurate as possible and, to the best of your ability, without bias. Use reputable information sources, particularly for statistical data. Be careful when taking information from the Web; Web sites often sound credible but can be based on biased or inaccurate information (see Chapters 4 and 5). Also, make sure you interpret information fairly and provide valid conclusions based on your best research. Assume, for example, that you were writing a report to recommend the best brand of chain saw for a logging company. In reviewing test reports, you learned that one brand, Bomarc, is easiest to operate but also has the fewest safety features. Both pieces of information should be included in the report, regardless of your personal preference for this brand.

Use appropriate visuals. As discussed in Chapter 9, visual information can make complex statistics and numeric data easy to understand. Graphs are especially useful for analyzing rising or falling trends, levels, and long-term forecasts. Tables and charts are helpful for comparing data. Photographs and diagrams are an

excellent way to show a component or special feature. Be sure your visual is placed near the accompanying text, and be careful not to overuse visuals. For example, the biodiesel report in Figure 12.9 makes good use of diagrams, such as the one featured in Figure 12.8.

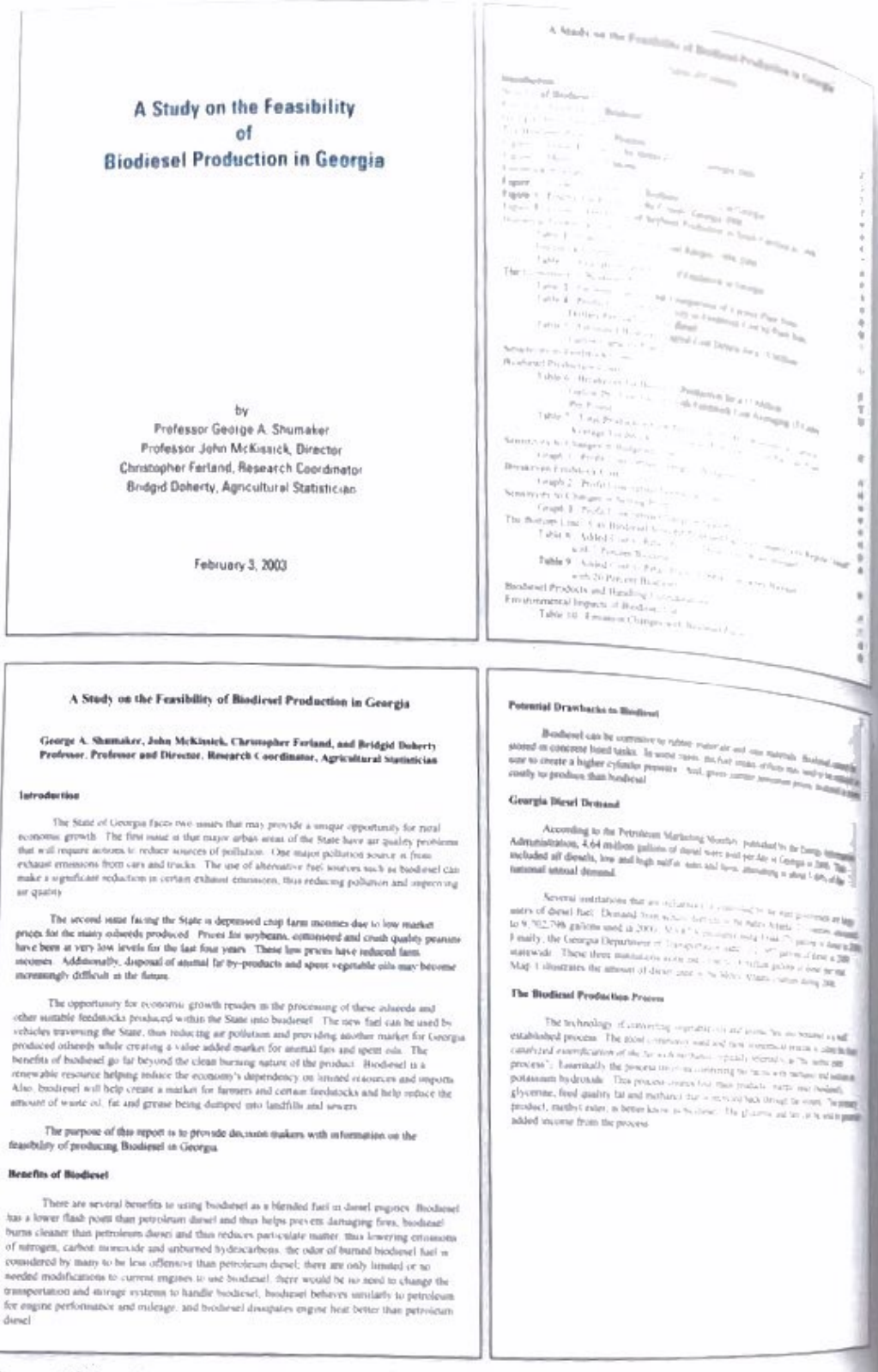
Use informative headings. Headings and subheadings in your report announce what each section contains. The heading "Data Analysis" does not really say much, whereas the heading "Physiological Effects and Health Risks" offers a clear, informative preview of the content of a section.

Write clearly and concisely. Even readers who need every bit of information in your report don't want to be bogged down with prose that is cumbersome, long-winded, and hard to read. Keep your language crisp and clear. Use active voice whenever possible. Ask a colleague or editor to copyedit your report before it is printed.



Source: Center for Agribusiness and Economic Development

Figure 12.8 Visual from the Biodiesel Report.



A Study on the Feasibility of Biodiesel Production in Georgia

by
Professor George A. Shumaker
Professor John McKissick, Director
Christopher Fortand, Research Coordinator
Bridgid Doherty, Agricultural Statistician

February 3, 2003

A Study on the Feasibility of Biodiesel Production in Georgia

George A. Shumaker, John McKissick, Christopher Fortand, and Bridgid Doherty
Professor, Professor and Director, Research Coordinator, Agricultural Statistician

Introduction

The State of Georgia faces two issues that may provide a unique opportunity for rural economic growth. The first issue is that major urban areas of the State have air quality problems that will require actions to reduce sources of pollution. One major pollution source is from exhaust emissions from cars and trucks. The use of alternative fuel sources such as biodiesel can make a significant reduction in certain exhaust emissions, thus reducing pollution and improving air quality.

The second issue facing the State is depressed crop farm incomes due to low market prices for the many oilseeds produced. Prices for soybeans, cottonseed and crush quality peanuts have been at very low levels for the last four years. These low prices have reduced farm incomes. Additionally, disposal of animal fat by-products and spent vegetable oils may become increasingly difficult in the future.

The opportunity for economic growth resides in the processing of these oilseeds and other suitable feedstocks produced within the State into biodiesel. The new fuel can be used by vehicles traversing the State, thus reducing air pollution and providing another market for Georgia produced oilseeds while creating a value added market for animal fats and spent oils. The benefits of biodiesel go far beyond the clean burning nature of the product. Biodiesel is a renewable resource helping reduce the economy's dependency on limited resources and imports. Also, biodiesel will help create a market for farmers and certain feedstocks and help reduce the amount of waste oil, fat and grease being dumped into landfills and sewers.

The purpose of this report is to provide decision makers with information on the feasibility of producing Biodiesel in Georgia.

Benefits of Biodiesel

There are several benefits to using biodiesel as a blended fuel in diesel engines. Biodiesel has a lower flash point than petroleum diesel and thus helps prevent damaging fires. biodiesel burns cleaner than petroleum diesel and thus reduces particulate matter, thus lowering emissions of nitrogen, carbon monoxide and unburned hydrocarbons. the odor of burned biodiesel fuel is considered by many to be less offensive than petroleum diesel; there are only limited or no needed modifications to current engines to use biodiesel. there would be no need to change the transportation and storage systems to handle biodiesel, biodiesel behaves similarly to petroleum for engine performance and mileage, and biodiesel dissipates engine heat better than petroleum diesel.

Potential Drawbacks to Biodiesel

Biodiesel can be corrosive to rubber, natural air and some materials. Biodiesel cannot be stored in concrete lined tanks. In some cases, the fuel erodes effects that, used or be combined to use to create a higher cylinder pressure. And, given current petroleum prices, biodiesel is costly to produce than biodiesel.

Georgia Diesel Demand

According to the Petroleum Marketing Monthly, published by the Energy Information Administration, 4.64 million gallons of diesel were sold per day in Georgia in 2000. This included all diesels, low and high sulfur, rural and farm, amounting to about 1.6% of the national annual demand.

Several estimates that are reliable [illegible] by the state government are based users of diesel fuel. Demand from [illegible] to the entire Atlanta [illegible] estimated to 9,702,796 gallons used in 2001. [illegible] Finally, the Georgia Department of [illegible] gallons of diesel in 2000 statewide. These three [illegible] Map 1 illustrates the amount of diesel used in the Metro Atlanta [illegible] during 2000.

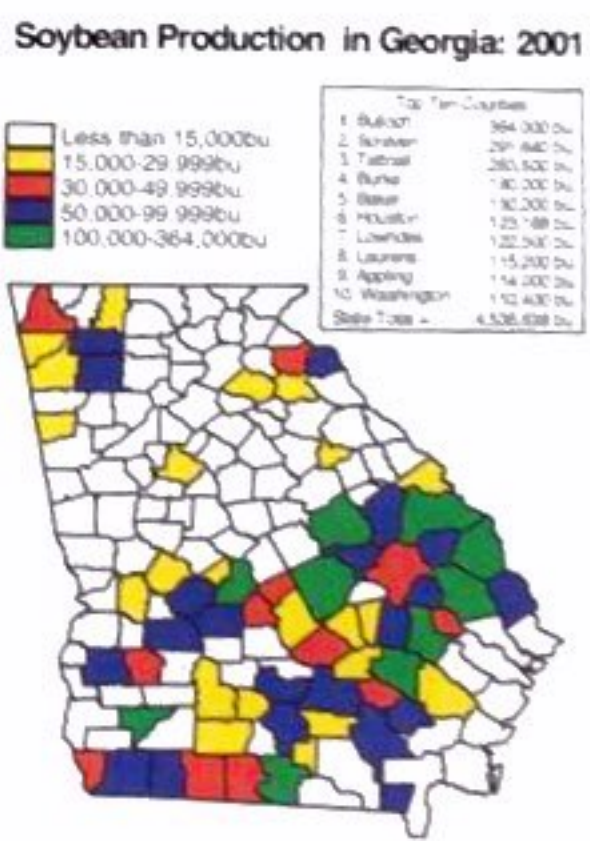
The Biodiesel Production Process

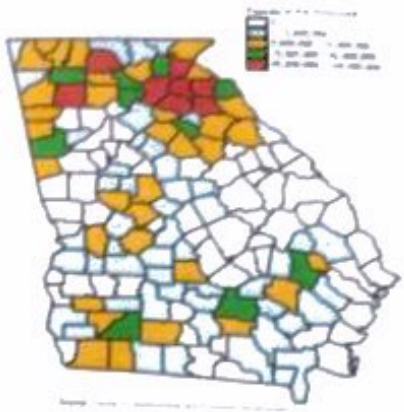
The technology of converting vegetable oils and animal fats into biodiesel is a well established process. The most commonly used and most economical process is called the base catalyzed esterification of the fat with methanol (typically referred to as "the methanol process"). Essentially the process involves combining the fat with methanol and sodium or potassium hydroxide. This process creates two main products, methyl ester (biodiesel), glycerine, feed quality fat and methanol that is recycled back through the system. The primary product, methyl ester, is better known as biodiesel. The glycerine and fat are sold to generate added income from the process.

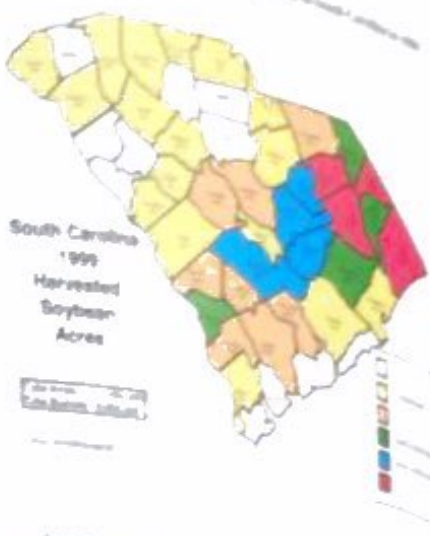
Figure 12.9 The Biodiesel Report in Full.

Source: From "A Study on the Feasibility of Biodiesel Production in Georgia" by Professor George A. Shumaker, et al. February 3, 2003. Reprinted by permission of George A. Shumaker.

Figure 3. County Distribution of Soybean Production in Georgia.







currently used in animal feeds.

Across the United States, another large market for yellow grease is the export market accounting for 35% of disappearance. It is estimated that this will continue to rise, absent other emerging domestic markets. A study done at the University of Georgia mentions that the high value of yellow grease has made it a target for theft in certain areas. Yellow grease has been used in the commercial food production industry where petroleum lubricants cannot come in contact with food.

It is difficult to get an exact estimate of the volume of rendered yellow grease availability in Georgia. While there is a significant volume handled, the amount available for sale is not yet determined. It is estimated that given a profitable return from biodiesel production, rendered yellow grease could be a good feedstock source.

Historical Feedstock Costs

Vegetable and animal fat prices vary depending upon supply and demand for each of the products and also upon the overall supply and demand situation for the entire fat-oil complex due to substitutability between products in some uses. In general, the vegetable oils have a higher unit value than do the animal fats. The following table shows the recent historical range of prices for some of the leading perennial feedstock sources.

Table 1. Historical Feedstock Cost Ranges, 1996-2000.

Feedstock	Price Range Per Pound	Pre-processing Cost Per Pound	Feedstock Cost Per Pound
Crude Soy Oil	$0.15-0.27	$0.005-0.01	$0.16-0.28
Refined Cottonseed Oil	$0.15-0.28	not able as is	$0.15-0.28
Crude Canola Oil	$0.12-019	$0.05-0.01	$0.13-0.20
Crude Corn Oil	$0.15-0.29	$0.005-0.01	$0.16-0.30
Crude Peanut Oil	$0.20-0.50	$0.005-0.01	$0.21-0.51
Yellow Grease	$0.08-0.14	$0.02-0.025	$0.105-0.165
Poultry Fat	$0.06-0.12	$0.005-0.10	$0.07-0.13

Feedstock Constraints

It appears that only a limited supply of viable feedstocks exist in Georgia for a large-scale biodiesel operation. One of the problems is the high concentration of the poultry industry in Georgia demanding similar feedstock for poultry feed. Another problem is the other uses for recycled oil and beef tallow existing in the Southeast with soap, lubricant, rendering and further processing of poultry.

Regional vegetable oil mills which use fats or biodiesel plants. Those mill sites available situated on a railroad siding.

Table 2 provides the apparent quantities available of the feedstock categories along with prices paid for as indicated in the Feedstock publication.

Table 2. Availability and Prices of Feedstock in Georgia

Feedstock	Quantity (Million gallons)	Price Range	Price Per Gallon	Available
Beef Tallow				
Poultry Fat				
Recycled Oil				
Unused				
Total Available				

The proposed biodiesel production facility would be capable of using any of the above feedstocks. Obviously, it would be to the best interest to secure as much economical possible at the least cost in order to reduce the cost to the consumer of the resulting product. However, it is unlikely that enough yellow grease and poultry fat could be secured to operate a plant full time so that other oils would also be needed. The most likely vegetable oils would be soybean oil, cottonseed oil and peanut oil.

In summary, it appears that there is currently an adequate supply of feedstock available in the State to meet the needs of a medium sized biodiesel production plant. The plant would need approximately 115 million pounds of feedstock or 1% of the domestic soybean market. The question yet to be answered is whether or not sufficient biomass can be secured at a price that would make biodiesel production economically feasible.

The Economics of Biodiesel Production

The Center for Agribusiness and Economic Development at the University of Georgia secured the services of Frazier Barnes & Associates, P.A., of Memphis, TN, a consulting firm specializing in vegetable oil processing, to assess the capital cost of various size vegetable production facilities. Each of the plant cost estimates are for facilities capable of handling a wide variety of feedstocks for biodiesel production. The capital cost estimates include all of facilities needed to pre-process any feedstock and the conversion to biodiesel using the methyl ester process described earlier. FBA evaluated four different sized plants site

[illegible] construction and operating costs. Tables 3 and 4 [illegible]

Table 3. Estimated Capital Cost Comparison of 3 arious Plant Sizes [illegible]

[illegible]

[illegible] Total includes capital cost for [illegible]

The capital cost ranges from [illegible] gallon depending on the capacity of the [illegible] ranged from 1.25 million pounds at the [illegible] million pounds at the highest level of production.

Table 4. Production Cost Sensitivity to Feedstock Cost by Plant Size, Dollars per Gallon of Biodiesel

Plant Size (million gallons/yr)	3	5	15	30
[illegible]	$1.[illegible]	$1.[illegible]	$1.11	$1.19
[illegible]	$1.[illegible]	$1.70	$1.48	$1.48
[illegible]	$2.[illegible]	$2.08	$1.85	$1.85
[illegible]	$2.72	$2.46	$2.21	$2.21
[illegible]	$3.09			

Based on the data provided in Tables 3 and 4, it appears the most appropriate size facility [illegible] produces about 15 million gallons of biodiesel per year with a capital [illegible]. In Table 3 we see that most of the economies of scale are realized at [illegible] costs of production do not appear to fall by doubling the size to [illegible] gallon plant. Therefore, the remainder of this report will focus on a plant size of 15 million gallon capacity.

Capital Costs for the 15 Million Gallon Biodiesel Facility

The following table presents a breakdown of the capital cost components of a 15 million gallon per year capacity biodiesel production facility. The cost estimates represent a "turn-key" [illegible] based upon a green site near transportation access.

Table 5. [illegible] Capacity Plant

[illegible]

The physical plant [illegible] and [illegible] level of development. The building [illegible] square feet and [illegible] laboratory for quality control [illegible] feet. The tank farm [illegible] gallons capacity [illegible] This plant would operate [illegible] would require an operating [illegible] sales, accounting and clerical.

Sensitivity to Feedstock Costs

The actual [illegible] total production costs (see Table [illegible]) final production cost. In the 15 million gallon per year plant [illegible] be about $22.942 million. Actual [illegible] while feedstock acquired at $0.15 per pound [illegible] total cost. Clearly, the ability to acquire low priced [illegible] cost of biodiesel production.

Biodiesel Production Costs

The cost of producing a gallon of methyl ester is highly dependent upon the average cost of the feedstocks used to produce it. The following table presents a detailed breakdown of

biodiesel production costs for a 15 million gallon facility with average feedstock costs of 15 cents per pound.

Table 6. Breakeven for Biodiesel Production for a 15 Million Gallon per Year Facility with Feedstock Cost Averaging 15 Cents per Pound.

Item	Total	Per Gallon
Income	$18,123,000	$1.21*
Feedstock & Direct	$20,215,640	$1.35
Labor	$722,500	$.05
Variable Cost	$678,043	$.05
Fixed Cost	$1,332,780	$.09
Total Cost	$22,947,363	$1.48
Profit/Loss	($4,824,362)	($.032)
*Includes glycerin & feed fat by-products		

Table 6 exhibits that the greatest portion of the cost in manufacturing biodiesel is the feedstock and direct cost. The direct cost consists of the catalyst and methanol. These costs total [illegible] of the total cost when the feedstock is purchased for $.15 per pound.

Table 7. Total Production Cost per Gallon of 100% Biodiesel at Various Average Feedstock Costs from a 15 Million Gallon per Year Plant.

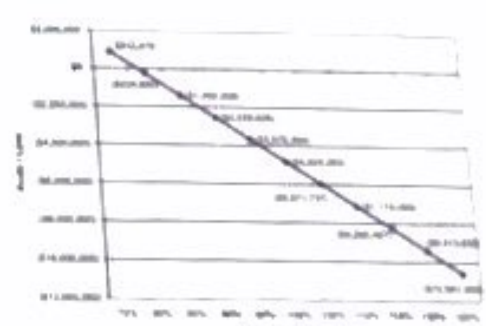
Average Feedstock Cost	Total Production Cost Per Gallon
$0.10	$1.11
$0.15	$1.48
$0.20	$1.85
$0.25	$2.21
$0.30	$2.58
$0.35	$2.94

The results in Table 7 reveal the strong relationship between the final product cost and the feedstock cost. If Canogus wishes to compete and produce biodiesel, a relatively cheap ($.10–$.20) feedstock needs to be used in the biodiesel production.

Sensitivity to Changes in Budgeted Costs

Sound analysis of a proposed project calls for a look at what would happen if the assumed production cost structure changes. The following chart demonstrates the impact of both higher and lower costs of production upon the net returns of the operation. As one might expect, net return increases with lower costs and decreases with higher costs. The point to be made is not that relationship but rather the magnitude of changes in net return given various changes in costs.

Graph 1. Profit/Loss versus Change in Budgeted Costs

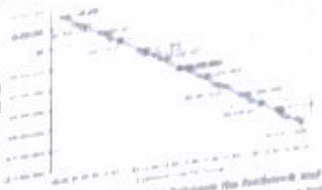


Graph 1 indicates the 15 million gallon facility needs to reduce cost by 22% to breakeven. This may be achievable with a subsidy on the feedstock.

Breakeven Feedstock Cost

The following graph clearly illustrates the relationship between the profitability or loss of a 15 million gallon facility as feedstock costs change. The breakeven cost of feedstock, assuming all other costs remain constant, is about $0.108 per pound. Returns above costs would obtain if average feedstock cost is below $0.108 per pound while operating losses would result if average feedstock cost is above $0.108 per pound.

Graph 2. Profit/Loss versus Feedstock Costs

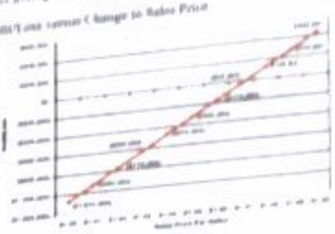


Graph 2 exhibits the strong relationship between the feedstock and biodiesel. When the feedstock price approaches $.16 per pound the facility creates a positive net return.

Sensitivity to Changes in Selling Price

Another source of risk involves changes in the selling price of the methyl ester product. The following chart illustrates the relationship between net returns and differing methyl ester sales prices. The breakeven selling price of methyl ester is about $1.48 per gallon when feedstock costs average 17 cents per pound.

Graph 1. Profit/Loss versus Change in Sales Price



Graph 1 shows a sales price of $1.48 is needed to create a positive return.

17

Table 9. Added Cost to Retail Price of Diesel Fuel When Blended with 20 Percent Biodiesel

	Retail Diesel Prices Per Gallon						
	$0.60	$0.75	$0.90	$1.05	$1.20	$1.35	$1.50
	Added Cost in Cents per Gallon						
Biodiesel Cost 100%							
$1.25	0.130	0.100	0.070	0.040	0.010	(0.020)	(0.050)
$1.50	0.180	0.150	0.120	0.090	0.060	0.030	
$1.75	0.230	0.200	0.170	0.140	0.120	0.080	0.050
$2.00	0.280	0.250	0.220	0.190	0.160	0.130	0.100
$2.25	0.330	0.300	0.270	0.240	0.210	0.180	0.150

Biodiesel can be produced and marketed in a 2% blend formulation at competitive price if:

1. Feedstock costs are near 10 cents per pound and retail diesel prices near $1.15 per gallon
2. Retail diesel prices are above $1.25 per gallon with feedstock costs of 15 cents per pound
3. There is a tax reduction (State or Federal or both) that would make up the difference between the delivered cost of the biodiesel and diesel

Biodiesel Products and Handling Considerations

The methyl ester from the plant can be used directly to run a diesel engine. However, in most cases, the product is blended with regular diesel fuel. The most commonly used blends are 2 and 20 percent blends where either 2 or 20 percent of the blend is the methyl ester and the dominant remainder is regular diesel fuel. These products are easily mixed and require no special equipment to accomplish the blending process. Typically the methyl ester is placed in a container and the diesel fuel is then poured into the methyl ester and "splash blended." No further stirring is needed to accomplish blending. Once blended the two products are reported to remain stable.

According to the National Biodiesel Board in Jefferson, MO, biodiesel can be stored in the same containers as petroleum diesel, however concrete storage tanks should not be used. Biodiesel is non-toxic and biodegradable. If stored above ground in a blended form the requirements are the same as for petroleum. When held as 100% methyl ester, it should be handled similar to vegetable oils.

Biodiesel can gel in cold weather conditions similar to diesel. This problem is solved either through storage in heated environments or by the addition of additives that inhibit gelling.

Table 8. Added Cost to Retail Price of Diesel Fuel When Blended with 2 Percent Biodiesel

[illegible]

Gelling of biodiesel varies depending upon the chemical composition of the feedstock [illegible] the temperature at which gelling occurs. [illegible] biodiesel should be stored and transported at temperatures above [illegible] should be above 40 F.

Environmental Impacts of Biodiesel Use

Studies completed by the Environmental Protection Agency (EPA) [illegible] 20% blend is "basically a trade off between cost, emissions, cold weather [illegible] and solvency issues." Researchers believe the 20% blend [illegible] without encountering major issues. Higher blends often cause [illegible] nitrogen oxide emissions.

Table 10. Emission Changes with Biodiesel Fuels

Emission	100% Biodiesel*	20% Biodiesel*
Carbon Monoxide	[illegible]	[illegible]
Hydrocarbons	[illegible]	[illegible]
Particulates	[illegible]	[illegible]
Nitrogen Oxides	[illegible]	[illegible]
Air Toxics	[illegible]	[illegible]
Mutagenicity	[illegible]	[illegible]
Carbon Dioxide**	[illegible]	[illegible]

* Average of data from 14 EPA FTP heavy duty [illegible]
** Life Cycle Emissions

It would appear that the use of biodiesel can be an effective means in reducing [illegible] emissions. The relevant question becomes how does the cost of reducing [illegible] using biodiesel compare to other means of obtaining the same level of emission reduction. The answer to that question is beyond the scope of this inquiry.

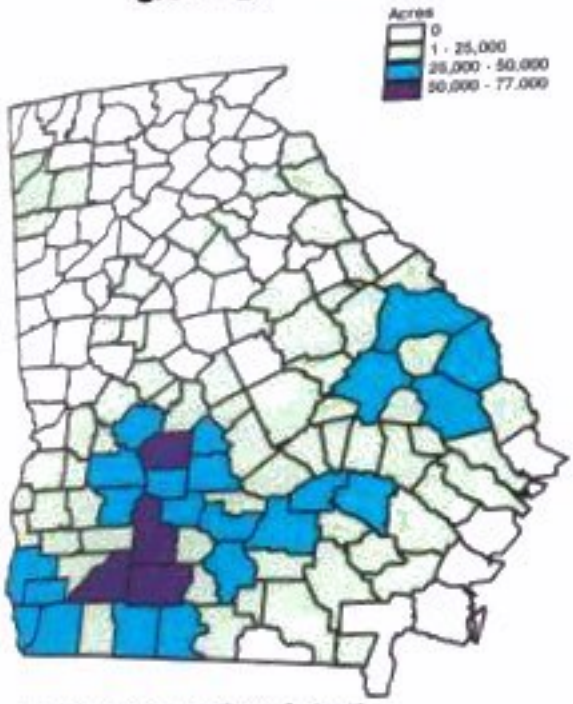
Impact Analysis

Impact analysis is a key component of any feasibility study. [illegible] the effect of a new venture on the economy. Building a new biodiesel facility [illegible] impact the economy on two levels. The new plant will generate [illegible] biodiesel and its by-products. These sales will [illegible] purchases inputs. The suppliers to the plant will [illegible]

Figure 12.9 (*Continued*)

Figure 6. Cotton Acreage by County, Georgia, 2000

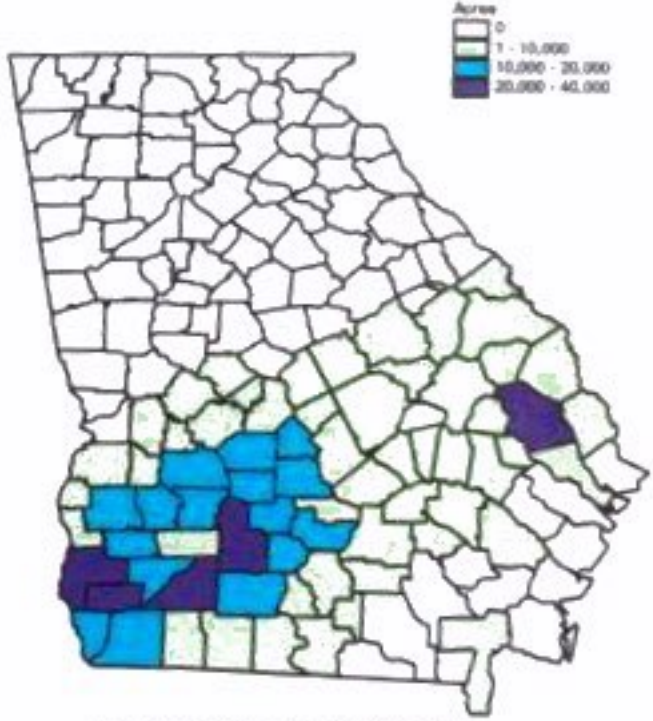
Cotton Acreage, by County, Georgia 2000



Source: Center for Agribusiness and Economic Development

Figure 7. Peanut Acreage by County, Georgia 2000

Peanut Acreage, by County, Georgia 2000



Source: Center for Agribusiness and Economic Development

Use action verbs. Especially when recommending a plan of action, use action verbs such as *examine, evaluate, determine,* or *recommend.* Avoid nominalizations. Don't use *determination* when you mean *determine,* for example.

Checklist for Long Reports

- Does the report grow from a clear audience and purpose analysis?
- Does the report address a clearly identified problem or goal?
- Is the report's length and information adequate and appropriate for the subject?
- Is the information accurate and unbiased?
- Is there enough information for readers to make an informed decision?
- Are all necessary components (including front and end matter) provided?
- Are visuals used whenever possible to aid communication?
- Are headings informative and adequate?
- Are action verbs used generously?
- Is the level of technicality appropriate for the intended audience?
- Is the language clear and concise?

Proposals

Proposals encourage an audience to take some form of direct action: to authorize a project, purchase a service or product, or otherwise support a specific plan for solving a problem. Although proposals often contain the same basic elements as reports, they have one specific purpose: to propose an action or series of actions. This purpose differs from more generic reports, which can be used for other purposes, as noted earlier. Proposals can be called for in a variety of situations: a request to fund a training program for new employees, a suggestion to change the curriculum in your English or biology department, a bid to the U.S. Defense Department on a missile contract. Depending on the situation, proposals may be short or long and may be written in the form of a report, a letter, or a memo.

Audience and Purpose Analysis

In science, business, industry, government, and education, proposals are written for any number of audiences: managers, executives, directors, clients, board members, or community leaders. Inside or outside the organization, these people review various proposals and then decide whether the plan is worthwhile, whether the project will materialize, and whether the service or product is useful. At the most general level, the purpose is to persuade your audience. More specifically, proposals often answer questions about the nature of the problem or

product, the benefits of your proposed plan, cost, completion dates, schedules, and so on.

Types of Proposals

Proposals may be solicited or unsolicited. Solicited proposals are those that have been requested by a client or customer. For example, if you represent an engineering firm specializing in highway construction, you may receive a request for proposal (RFP) from a local township asking you to bid on a road project. Typically, an RFP is issued to numerous companies, and your proposal will need to stack up against all the others. Unsolicited proposals have not been specifically requested. If you are a new advertising agency in town, you may send out short proposals to local radio stations suggesting that they use your agency for their advertising needs.

Because the audience for a solicited proposal has made the request, you may not need to spend as much time introducing yourself or providing background on the product or service. For an unsolicited proposal (sometimes called a "cold call" in sales), you will need to catch your readers' attention quickly and provide incentives for them to continue reading: perhaps by printing a price comparison of your fees on the first page, for example.

Both solicited and unsolicited proposals can take the following forms.

Planning proposal. A planning proposal offers solutions to a problem or suggestions for improvement. It might be a request for funding to expand the campus newspaper, an architectural plan for new facilities at a ski area, or a plan to develop energy alternatives to fossil fuels. Figure 12.10 is a short planning proposal that was solicited and will be used internally within the company. The XYZ Corporation has contracted a team of communication consultants to design in-house writing workshops, and the consultants must convince the client that their methods will succeed. After briefly introducing the problem, the authors develop their proposal under three headings and two subheadings, making the document easy to read and to the point.

Research proposal. Research (or grant) proposals request approval and funding for research projects. A chemist at a university might address a research proposal to the Environmental Protection Agency for funds to identify toxic contaminants in local groundwater. Research proposals are solicited by many agencies, including the National Science Foundation and the National Institutes of Health. Each agency has its own requirements and guidelines for proposal format and content. Successful research proposals follow these guidelines and carefully articulate the goals of the project. In these cases, proposal readers will generally be other scientists, so writers can use language that is appropriate for other experts. Other research proposals might be submitted by students requesting funds for undergraduate research projects. In Figure 12.11, the writer used the prescribed form and was careful to relate his research to the goals of the program.

Dear Mary

Thanks for sending the writing samples from your technical support staff. Here is what we're doing to design a realistic approach.

Assessment of Needs
After conferring with technicians in both Jack's and Terry's groups and analyzing their writing samples, we identified this hierarchy of needs:

- improving readability
- achieving precise diction
- summarizing information
- organizing a set of procedures
- formulating various memo reports
- analyzing audiences for upward communication
- writing persuasive bids for transfer or promotion
- writing persuasive suggestions

Proposed Plan
Based on the needs listed above, we have limited our instruction package to eight carefully selected and readily achievable goals.

Course Outline. Our eight, two-hour sessions are structured as follows:

1. achieving sentence clarity
2. achieving sentence conciseness
3. achieving fluency and precise diction
4. writing summaries and abstracts
5. outlining manuals and procedures
6. editing manuals and procedures
7. designing various reports for various purposes
8. analyzing the audience and writing persuasively

Classroom Format. The first three meetings will be lecture-intensive with weekly exercises to be done at home and edited collectively in class. The remaining five weeks will combine lecture and exercises with group editing of work-related documents. We plan to remain flexible so we can respond to needs that arise.

Limitations
Given our limited contact time, we cannot realistically expect to turn out a batch of polished communicators. By the end of the course, however, our students will have begun to appreciate writing as a deliberate process.

If you have any suggestions for refining this plan, please let us know.

re 12.10 Planning Proposal.

To: Dr. John Lannon
From: T. Sorrells Dewoody
Date: March 16, 2006
Subject: *Proposal for Determining the Feasibility of Marketing Dead Western White Pine*

Introduction

Over the past four decades, huge losses of western white pine have occurred in the northern Rockies, primarily attributable to white pine blister rust and the attack of the mountain pine beetle. Estimated annual mortality is 318 million board feet. Because of the low natural resistance of white pine to blister rust, this high mortality rate is expected to continue indefinitely.

If white pine is not harvested while the tree is dying or soon after death, the wood begins to dry and check (warp and crack). The sapwood is discolored by blue stain, a fungus carried by the mountain pine beetle. If the white pine continues to stand after death, heart cracks develop. These factors work together to cause degradation of the lumber and consequent loss in value.

Statement of Problem

White pine mortality reduces the value of white pine stumpage because the commercial lumber market will not accept it. There are two major implications of this problem: First, in the face of rising demand for wood, vast amounts of timber lie unused; second, dead trees are left to accumulate in the woods, where they are rapidly becoming a major fire hazard here in northern Idaho and elsewhere.

Proposed Solution

One possible solution to the problem of white pine mortality and waste is to search for markets other than the conventional lumber market. The last few years have seen a burst of popularity and growing demand for weathered barn boards and wormy pine for interior paneling. Some firms around the country are marketing defective wood as specialty products. (These firms call the wood from which their products come "distressed," a term I will use hereafter to refer to dead and defective white pine.) Distressed white pine will quite possibly find a place in such a market.

Scope

To assess the feasibility of developing a market for distressed white pine, I plan to pursue six areas of inquiry:

1. What products are presently being produced from dead wood, and what are the approximate costs of production?

Figure 12.11 **Undergraduate Research Proposal.**

2. How large is the demand for distressed-wood products?
3. Can distressed white pine meet this demand as well as other species meet it?
4. Does the market contain room for distressed white pine?
5. What are the costs of retrieving and milling distressed white pine?
6. What prices for the products can the market bear?

Methods

My primary data sources will include consultations with Dr. James Hill, Professor of Wood Utilization, and Dr. Sven Bergman, Forest Economist—both members of the College of Forestry, Wildlife, and Range. I will also inspect decks of dead white pine at several locations and visit a processing mill to evaluate it as a possible base of operations. I will round out my primary research with a letter and telephone survey of processors and wholesalers of distressed material.

Secondary sources will include publications on the uses of dead timber and a review of a study by Dr. Hill on the uses of dead white pine.

My Qualifications

I have been following Dr. Hill's study on dead white pine for two years. In June of this year, I will receive my B.S. in forest management. I am familiar with wood milling processes and have firsthand experience at logging. My association with Dr. Hill and Dr. Bergman gives me the opportunity for an in-depth feasibility study.

Conclusion

Clearly, action is needed to reduce the vast accumulations of dead white pine in our forests. The land on which they stand is among the most productive forests in northern Idaho. By addressing the six areas of inquiry mentioned earlier, I can determine the feasibility of directing capital and labor to the production of distressed white pine products. With your approval, I will begin research at once.

Sales proposal. Sales proposals offer services or products and may be solicited or unsolicited. If solicited, several firms may be competing for the contract, so your proposal may be ranked by a committee against several others. Sales proposals can be cast as letters if the situation calls for them to be brief. If the situation requires a longer proposal, you follow the guidelines for writing a report: Use a title page, make sure you have clear headings, and so on. A successful sales proposal persuades customers that your product or service surpasses those of any competitors. In the sample sales proposal in Figure 12.12, the writer explains why his machinery is best for the job, what qualifications his company can offer, and what costs are involved. What you include in a sales proposal is determined by the guidelines from the client or by a thorough analysis of the kinds of information your audience needs.

Typical Components of Proposals

After conducting your audience and purpose analysis, you should perform some basic research. For example, you might look into the very latest technology for solving the problem or doing the project; compare the costs, benefits, and drawbacks of various approaches; contact others in your field for their suggestions; and so on. Then generate a rough outline with headings and subheadings for the proposal. The outline in Figure 12.13 is general enough to adapt to your specific situation.

As noted, proposals can be short (letter or memo format) or long (report format). For a long proposal, include the components and supplements ordinarily contained in a long report: abstract, introduction, body, conclusion, and appendixes. Include a letter of transmittal, especially if your proposal is unsolicited.

Background. A background section (sometimes used as an introduction) can be brief or long. In Figure 12.10, the writer's opening sentence ("Thanks for sending the writing samples from your technical support staff") provides a quick reminder of the context for the project. This sentence is brief because the writer correctly assumes that the reader is very familiar with the project. For a new audience, this single sentence might need to be expanded into a longer paragraph of background on the project. The background section may contain a statement of the problem or issue. If the topic warrants it, the background section may take up several pages.

Objective. If your audience needs this information spelled out, you may wish to provide a clear statement of the proposal's objectives: "Our objective is to offer a plan to make areas of the library quiet enough for serious study."

Clear statement of what is being proposed. Whether your proposal is short or long, make it easy for your audience to locate the exact details of what you are

Subject: *Proposal to Dig a Trench and Move Boulders at Bliss Site*

Dear Mr. Haver:

I've inspected your property and would be happy to undertake the landscaping project necessary for the development of your farm.

The backhoe I use cuts a span 3 feet wide and can dig as deep as 18 feet—more than an adequate depth for the mainline pipe you wish to lay. Because this backhoe is on tracks rather than tires and is hydraulically operated, it is particularly efficient in moving rocks. I have more than twelve years of experience with backhoe work and have completed many jobs similar to this one.

After examining the huge boulders that block access to your property, I am convinced they can be moved only if I dig out underneath and exert upward pressure with the hydraulic ram while you push forward on the boulders with your D-9 Caterpillar. With this method, we can move enough rock to enable you to farm that now inaccessible tract. Because of its power, my larger backhoe will save you both time and money in the long run.

This job should take 12 to 15 hours, unless we encounter subsurface ledge formations. My fee is $200 per hour. The fact that I provide my own dynamiting crew at no extra charge should be an advantage to you because you have so much rock to be moved.

Please phone me anytime for more information. I'm sure we can do the job economically and efficiently.

ure 12.12 Sales Proposal.

I. Introduction
   A. Statement of Problem and Objective
   B. Background
   C. Need
   D. Benefits
   E. Qualifications of Personnel
   F. Data Sources
   G. Limitations and Contingencies
   H. Scope

II. Body
   A. Methods
   B. Timetable
   C. Materials and Equipment
   D. Personnel
   E. Available Facilities
   F. Needed Facilities
   G. Cost
   H. Expected Results
   I. Feasibility

III. Conclusion
   A. Summary of Key Points
   B. Request for Action

Figure 12.13 A General Proposal Outline That You Can Adapt to Your Situation.

proposing. In the research proposal shown in Figure 12.11, the third heading, "Proposed Solution," is the obvious place for readers to turn if they want to see the details of the solution.

Budget and costs. If your proposal involves financial costs, make sure your cost and budget section is accurate and easy to understand. If you work with an accountant or other financial specialist, ask that person to check your figures. If the proposal is solicited, make sure you follow the client's guidelines for establishing a budget.

Usability Considerations

Understand the audience's needs. The proposal audience wants specific suggestions to meet their specific needs. Their biggest question is "What will this plan do for me?" Make your proposal demonstrate a clear understanding of the client's problem and expectations, and then offer an appropriate solution. In the planning proposal in Figure 12.10, the writer begins with a clear assessment of needs and then moves quickly into a proposed plan of action.

Maintain a clear focus on benefits. Show your reader how [illegible] what they will gain by adopting your plan. The plan [illegible] includes a numbered list of exactly what tasks will be [illegible] echnical support staff takes the instruction course[illegible]

se honest and supportable claims. Because they typically [illegible] f money as well as contractual obligations, proposals require a sound [illegible] egal foundation. False promises not only damage the writer's or company's rep- tation but also invite lawsuits. If the solutions you offer have certain limitations, nake sure you say so. For example, if you are proposing to install a new network erver, make it clear what capabilities this server has, as well as what it cannot do nder certain circumstances.

Use appropriate visuals. See Chapter 9 for a discussion of visuals.

Write clearly and concisely. Make sure your document is easy to read, uses ac- ion verbs, and avoids puffed-up language or terms that are too technical for your udience. If necessary for a mixed audience with differing technical levels, include glossary.

Use convincing language. There is no need to be coy when writing a proposal. You are trying to sell yourself or your ideas. So be sure to write a document that will move people to action. Use statistics ("for the third year in a row, our firm has been ranked as the number 1 architecture firm in the Midwest") and direct entences ("We know you will be satisfied with the results").

Checklist for Proposals

- Are all required proposal components included?
- Is the problem clearly identified?
- Is the objective clearly identified?
- Is the proposed plan, service, or product stated clearly and prominently?
- Does the proposal demonstrate a clear understanding of the client's problem and expectations?
- Is the background section appropriate for this audience's needs?
- Does the proposal maintain a clear focus on benefits?
- Is the proposed solution appropriate and realistic?
- Is the cost and budget section accurate and easy to understand?
- Are the claims honest and supportable?
- Are all foreseeable limitations identified?
- Are visuals used effectively?
- Is the language convincing and precise?
- Does the tone encourage acceptance of the proposal?

Exercises

1. **FOCUS ON WRITING.** Choose a situation and an audience, and prepare an expanded technical definition specifically designed for this audience's level of technical understanding. In addition to the usability considerations on pages 265–267, use these guidelines:

   - *Decide on the level of detail.* Definitions vary greatly in length and detail, from a few words in parentheses to a complete essay. How much does this audience need in order to follow your explanation or grasp your point?
   - *Classify the term precisely.* The narrower your class, the clearer your meaning. *Stress* is classified as an applied force; saying that stress "is what . . ." or "takes place when . . ." fails to reflect a specific classification. *Diabetes* is precisely classified as a metabolic disease, not as a medical term.
   - *Differentiate the term accurately.* If the distinguishing features are too broad, they will apply to more than this one item. A definition of *brief* as a "legal document used in court" fails to differentiate a brief from all other legal documents (wills, affidavits, and so on).
   - *Avoid circular definitions.* Do not repeat, as part of the distinguishing feature, the word you are defining. "*Stress* is an applied force that places stress on a body" is a circular definition.
   - *Expand your definition selectively.* Begin with a one-sentence definition, and select from a combination of development strategies.
   - *Use negation to show what a term does not mean.* For example, *raw statistics* are not "information"; data become information only after they have been evaluated, interpreted, and applied.

2. **FOCUS ON WRITING.** Choose another situation and audience, and prepare a technical description for this audience's level of technical understanding. As you prepare your description, refer to the usability considerations on pages 265–267 and to these guidelines:

   - *Always begin with some type of orienting statement.* Descriptions rarely call for a standard topic or thesis statement, because their goal is simply to catalog the details that readers can visualize. Any description, however, should begin by telling readers what to look for.
   - *Choose descriptive details to suit your purpose and the reader's needs.* Select only details that advance your meaning. Use objective details to provide a picture of something exactly as a camera would record it. Use subjective details to convey your impressions—to give readers a new way of seeing or appreciating something, as in a marketing brochure (see Figure 11.12).

- *Select details that are concrete and specific enough to convey an unmistakable picture.* Most often, description works from [illegible] abstraction and generality.

Vague	*Exact*
at high speed	80 miles per hour
a tiny office	an 8-by-10-foot office
the seal	the rubber O-ring

- *Use sensory details as needed.* Allow readers to see, hear, and feel. Let readers touch and taste. Use vivid comparisons to make the picture come to life. Rely on action verbs to convey the energy of movement.
- *Order details in a clear sequence.* Descriptions generally follow a spatial or general-to-specific order—whichever parallels the angle of vision readers would have if viewing the item. Details may also be arranged according to the dominant impression desired.

3. **FOCUS ON WRITING.** Choose a specific situation and audience, and prepare a long report that documents a causal, comparative, or feasibility analysis—or some combination of these types. As you prepare your report, refer to the usability considerations on pages 274–282 and the following guidelines:

For Causal Analysis

- *Be sure the cause fits the effect.* Keep in mind that faulty causal reasoning is extremely common, especially when people ignore other possible causes or confuse mere coincidence with causation.
- *Make the links between cause and effect clear.* Identify the immediate cause (the one most closely related to the effect) as well as the distant causes (the ones that precede the immediate cause). For example, the immediate cause of a particular airplane crash might be a fuel tank explosion, caused by a short circuit in frayed wiring, caused by faulty design or poor quality control by the manufacturer. Discussing only the immediate cause often only scratches the surface of the problem.
- *Clearly distinguish among possible, probable, and definite causes.* Unless the cause is obvious, limit your assertions by using *perhaps, probably, maybe, most likely, could, seems to, appears to,* or similar qualifiers that prevent you from making an unsupportable claim.

For Comparative Analysis

- *Rest the comparison on a clear and definite basis.* Make comparisons on the basis of costs, uses, benefits and drawbacks, appearance, or results. In evaluating the merits of competing items, identify your specific criteria and rank them in order of importance.
- *Give both items balanced treatment.* Discuss points for each item in identical order.

- *Support and clarify the comparison or contrast through credible examples.* Use research, if necessary, to find examples that readers can visualize.
- *Follow either a block pattern or a point-by-point pattern.* In the block pattern, first one item is discussed fully and then the next. Choose a block pattern when the overall picture is more important than the individual points.

  In the point-by-point pattern, one point about both items is discussed, then the next point, and so on. Choose a point-by-point pattern when specific points might be hard to remember unless placed side by side.

Block pattern	**Point-by-point pattern**
Item A	First point of item A
First point	First point of item B
Second point	
Third point, etc.	
Item B	Second point of item A
First point	Second point of item B
Second point	etc.
Third point	
etc.	

- *Order your points for greatest emphasis.* Try ordering your points from least to most important, dramatic, useful, or reasonable. Placing the most striking point last emphasizes it best.
- *If you are writing an evaluative comparison, offer your final judgment.* Base your judgment squarely on the criteria presented.

For Feasibility Analysis

- *Consider the strength of supporting reasons.* Decide carefully which are the best reasons supporting the action or decision being considered, based on solid evidence.
- *Consider the strength of opposing reasons.* Remember that people usually see only what they want to see. Avoid the temptation to overlook or downplay opposing reasons, especially for an action or decision that you have been promoting. Consider alternative points of view, and examine all the evidence.
- *Recommend a realistic course of action.* After weighing all the pros and cons, make your recommendation—but be prepared to backtrack if you discover that what seemed like the right course of action turns out to be wrong.

The Collaboration Window

Working in groups of four, develop an unsolicited proposal for solving a problem, improving a situation, or satisfying a need in your school, community, or workplace. Begin by brainstorming as a group to come up with a list of possible issues or problems to address in your proposal. Narrow your list, and work as a group to focus on a specific issue or idea that you think will work well as the topic for a persuasive proposal (review pages 283–287 for details on the different types of proposals and the components of each).

Your proposal should address a clearly identified audience of decision makers and stakeholders on the issue you are discussing. Conduct an audience and purpose analysis to define the characteristics of the audience you are trying to persuade.

As you develop and revise your proposal, keep the following guidelines in mind:

- *Spell out the problem (and its causes) clearly and convincingly.* Give enough detail for your audience to appreciate the problem's importance. Answer the implied question "Why is this such a big deal?"
- *Point out the benefits of solving the problem.* Answer the implied question "Why should we spend time, money, and effort to do this?"
- *Offer a realistic solution.* Stick to claims or assertions you can support. Answer the implied question "How do we know this will work?"
- *Address anticipated objections to your solution.* Consider carefully the audience's skepticism on this issue. Answer the implied question "Why should we accept the things that seem wrong with your plan?"
- *Induce readers to act.* Decide exactly what you want readers to do, and give reasons why they should be the ones to act. Answer the implied question "What action am I supposed to take?"