10: TECHNICAL REPORTS: COMPONENTS AND DESIGN

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CHAPTER OVERVIEW

10: Technical Reports: Components and Design

10.1: Cover letter

The cover letter is either attached to the outside of the report with a paper clip or is bound within the report. It is a communication from you—the report writer—to the recipient, the person who requested the report and who may even be paying you for your expert consultation. Essentially, it says “Here is the report that we agreed I’d complete by such-and-such a date. Briefly, it contains this and that, but does not cover this or that. Let me know if it meets your needs.” The cover letter explains the context—the events that brought the report about. It contains information about the report that does not belong in the report.

In the example of the cover letter that follows, notice the standard business-letter format. If you write an internal report, use the memorandum format instead. In either case, the contents and organization are the same:

First paragraph. Cites the name of the report, putting it in italics. It also mentions the date of the agreement to write the report.

Middle paragraph. Focuses on the purpose of the report and gives a brief overview of the report’s contents.

Final paragraph. Encourages the reader to get in touch if there are questions, comments, or concerns. It closes with a gesture of good will, expressing hope that the reader finds the report satisfactory.

As with any other element in a report, you may have to modify the contents of this letter (or memo) for specific situations. For example, you might want to add another paragraph, listing questions you’d like readers to consider as they review the report.

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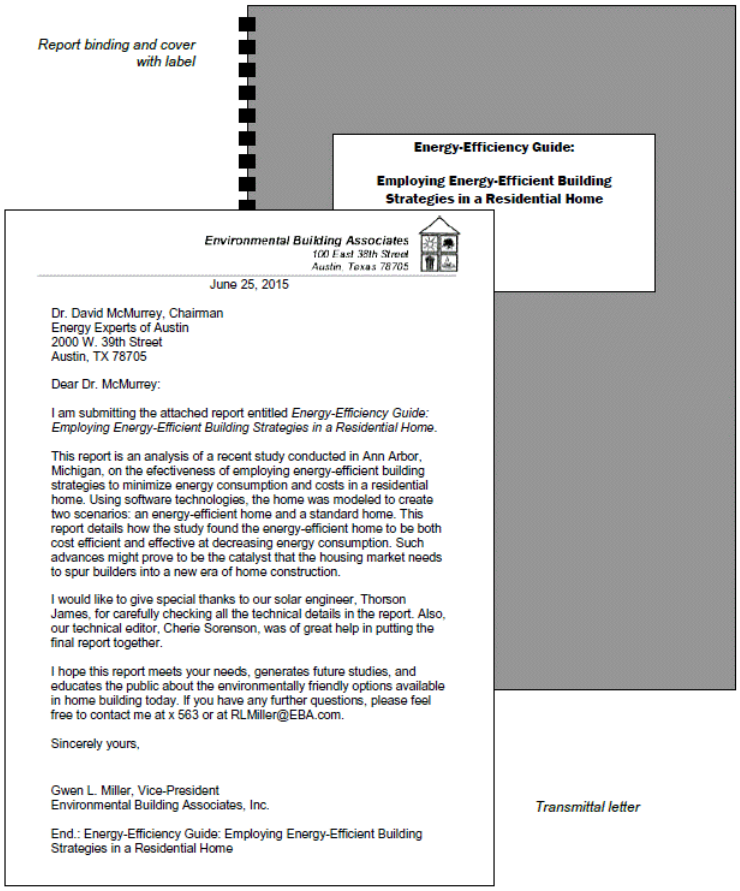
10.2: Cover page

Be sure to create a cover page for your report. It's a step that some report writers forget. Without a label, a report is anonymous; it gets ignored.

The best way to create a cover page is to use your word-processing software to design one on a standard page with a graphic box around the label information. Not much goes on the label: the report title, your name, your organization's name, a report tracking number, and a date. There are no standard requirements for the label, although your company or organization should have its own requirements. (An example of a report label is shown below.)



Transmittal letter and report cover (with cover label).

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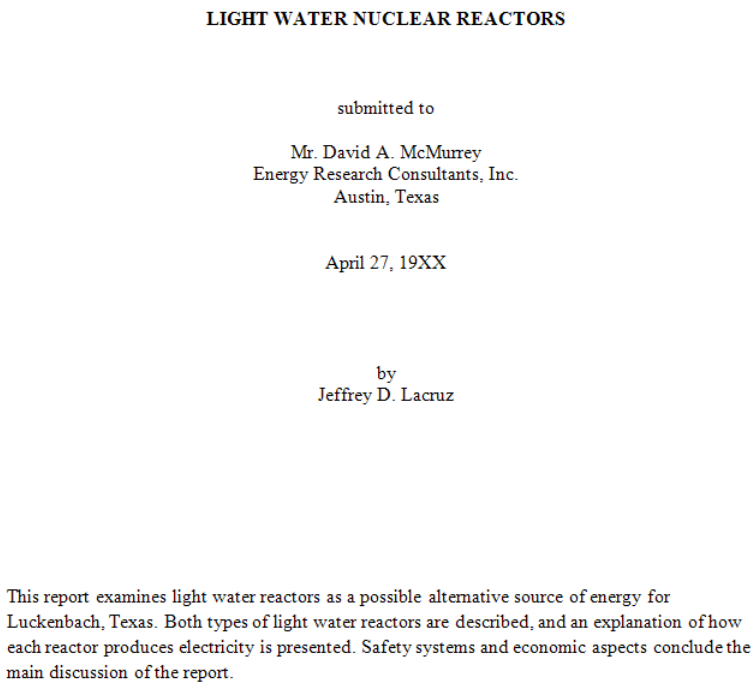
10.3: Abstract and executive summary

Most technical reports contain at least one abstract—sometimes two, in which case the abstracts play different roles. Abstracts summarize the contents of a report, but the different types do so in different ways:

- Descriptive abstract. This type provides an overview of the purpose and contents of the report. In some report designs, the descriptive abstract is placed at the bottom of the title page, as shown in the following:



LIGHT WATER NUCLEAR REACTORS

submitted to

Mr. David A. McMurrey
Energy Research Consultants, Inc.
Austin, Texas

April 27, 19XX

by
Jeffrey D. Lacruz

This report examines light water reactors as a possible alternative source of energy for Luckenbach, Texas. Both types of light water reactors are described, and an explanation of how each reactor produces electricity is presented. Safety systems and economic aspects conclude the main discussion of the report.

Descriptive abstract. Traditionally, it is placed on the title page (not the cover page).

- Executive summary. Another common type is the executive summary, which also summarizes the key facts and conclusions contained in the report. Think of this as if you used a yellow highlighter to mark the key sentences in the report and then siphoned them all out onto a separate page and edited them for readability. Typically, executive summaries are one-tenth to one-twentieth the length of reports ten to fifty pages long. For longer reports, ones over fifty pages, the executive summary should not go over two pages. The point of the executive summary is to provide a summary of the report—something that can be read quickly.

If the executive summary, introduction, and transmittal letter strike you as repetitive, remember that readers don't necessarily start at the beginning of a report and read page by page to the end. They skip around: they may scan the table of contents; they usually skim the executive summary for key facts and conclusions. They may read carefully only a section or two from the body of the report, and then skip the rest. For these reasons, reports are designed with some duplication so that readers will be sure to see the important information no matter where they dip into the report.

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10.4: Table of contents

You are familiar with tables of contents (TOC) but may never have stopped to look at their design. The TOC shows readers what topics are covered in the report, how those topics are discussed (the subtopics), and on which page numbers those sections and subsections start.

In creating a TOC, you have a number of design decisions:

- Levels of headings to include. In longer reports, consider not including only the top two levels of headings. This keeps the TOC from becoming long and unwieldy. The TOC should provide an at-a-glance way of finding information in the report quickly.
- Indentation, spacing, and capitalization. Notice in the illustration below that items in each of the three levels of headings are aligned with each other. Although you can't see it in the illustration, page numbers are right-aligned with each other. Notice also the capitalization: Main chapters or sections are all caps; first-level headings use initial caps on each main word; lower-level sections use initial caps on the first word only.
- Vertical spacing. Notice that the first-level sections have extra space above and below, which increases readability.

Using the automatic TOC creator in your word processor can help you produce a clean, professional document. If you prefer to make your own, learn to use dot leader tabs in order to line up the page numbers correctly.

One final note: Make sure the words in the TOC are the same as they are in the text. As you write and revise, you might change some of the headings—don't forget to change the TOC accordingly. See the example of a table of contents:

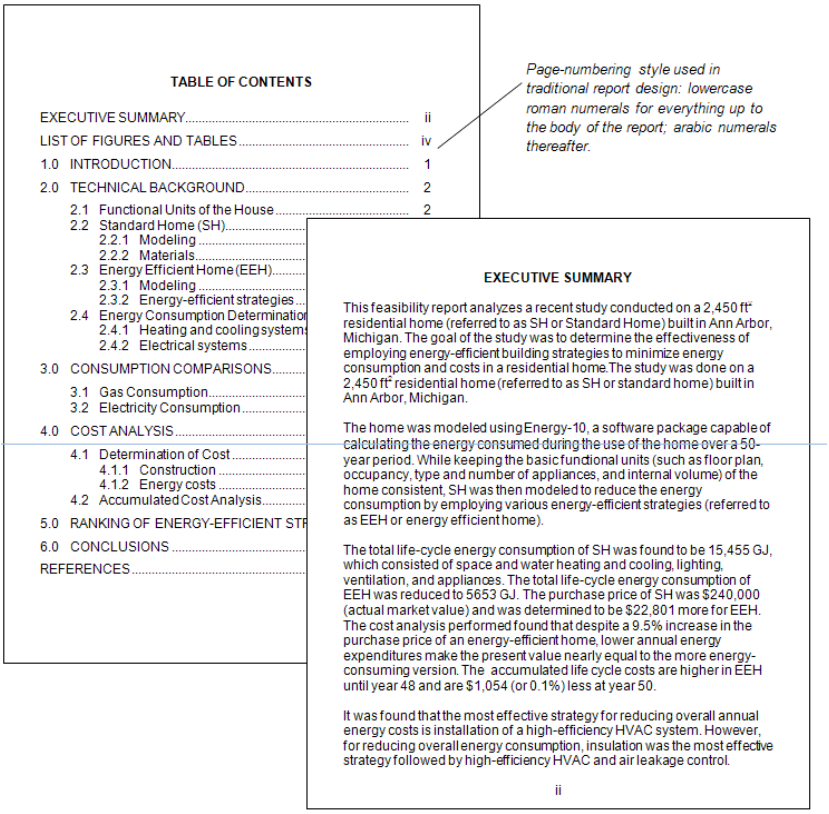

TABLE OF CONTENTS

Page-numbering style used in traditional report design: lowercase roman numerals for everything up to the body of the report; arabic numerals thereafter.

EXECUTIVE SUMMARY

This feasibility report analyzes a recent study conducted on a 2,450 ft² residential home (referred to as SH or Standard Home) built in Ann Arbor, Michigan. The goal of the study was to determine the effectiveness of employing energy-efficient building strategies to minimize energy consumption and costs in a residential home.The study was done on a 2,450 ft² residential home (referred to as SH or standard home) built in Ann Arbor, Michigan.

The home was modeled using Energy-10, a software package capable of calculating the energy consumed during the use of the home over a 50-year period. While keeping the basic functional units (such as floor plan, occupancy, type and number of appliances, and internal volume) of the home consistent, SH was then modeled to reduce the energy consumption by employing various energy-efficient strategies (referred to as EEH or energy efficient home).

The total life-cycle energy consumption of SH was found to be 15,455 GJ, which consisted of space and water heating and cooling, lighting, ventilation, and appliances. The total life-cycle energy consumption of EEH was reduced to 5653 GJ. The purchase price of SH was $240,000 (actual market value) and was determined to be $22,801 more for EEH. The cost analysis performed found that despite a 9.5% increase in the purchase price of an energy-efficient home, lower annual energy expenditures make the present value nearly equal to the more energy-consuming version. The accumulated life cycle costs are higher in EEH until year 48 and are $1,054 (or 0.1%) less at year 50.

It was found that the most effective strategy for reducing overall annual energy costs is installation of a high-efficiency HVAC system. However, for reducing overall energy consumption, insulation was the most effective strategy followed by high-efficiency HVAC and air leakage control.

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Table of contents (which comes first) then the executive summary. In a technical writing course, ask your instructor if the decimal-numbering style for the table of contents and headings is required.

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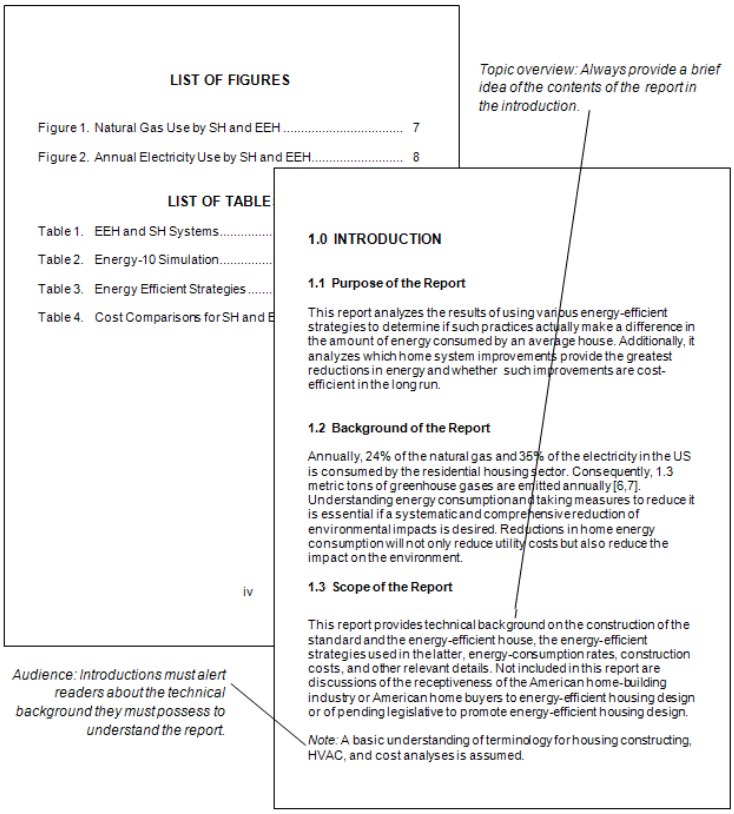
10.5: List of figures and tables

If your document has more than two figures or tables create a separate list of figures. The list of figures has many of the same design considerations as the table of contents. Readers use the list of figures to quickly find the illustrations, diagrams, tables, and charts in your report.

Complications arise when you have both tables and figures. Strictly speaking, figures are illustrations, drawings, photographs, graphs, and charts. Tables are rows and columns of words and numbers; they are not considered figures.

For longer reports that contain dozens of figures and tables each, create separate lists of figures and tables. Put them together on the same page if they fit, as shown in the illustration below. You can combine the two lists under the heading, "List of Figures and Tables," and identify the items as figure or table as is done in the illustration below.



List of figures and tables followed by the introduction. If there are no tables, make it "List of Figures." In a technical writing course, ask your instructor if the decimal-numbering style for headings is required.

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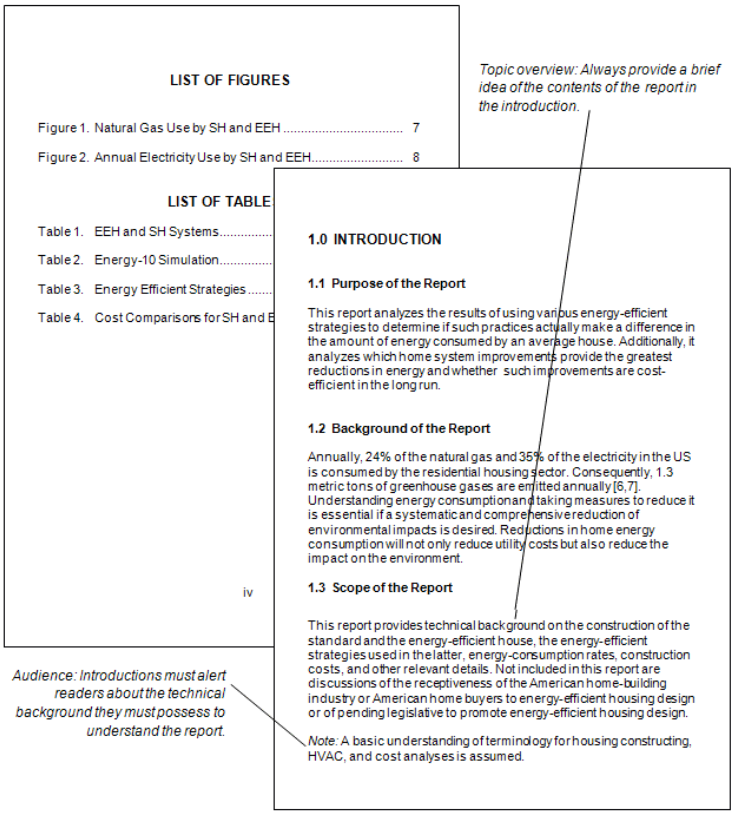
10.6: Introduction

An essential element of any report is its introduction—make sure you are clear on its real purpose and contents. In a technical report, the introduction prepares the reader to read the main body of the report.

See this example of an introduction:



List of figures and tables followed by the introduction. If there are no tables, make it “List of Figures.” In a technical writing course, ask your instructor if the decimal-numbering style for headings is required.

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10.7: Body of the report

The body of the report is of course the main text of the report, the sections between the introduction and conclusion. Illustrated below are sample pages.

Headings

In all but the shortest reports (two pages or less), use headings to mark off the different topics and subtopics covered. Headings are the titles and subtitles you see within the actual text of much professional scientific, technical, and business writing. Headings are like the parts of an outline that have been pasted into the actual pages of the document.

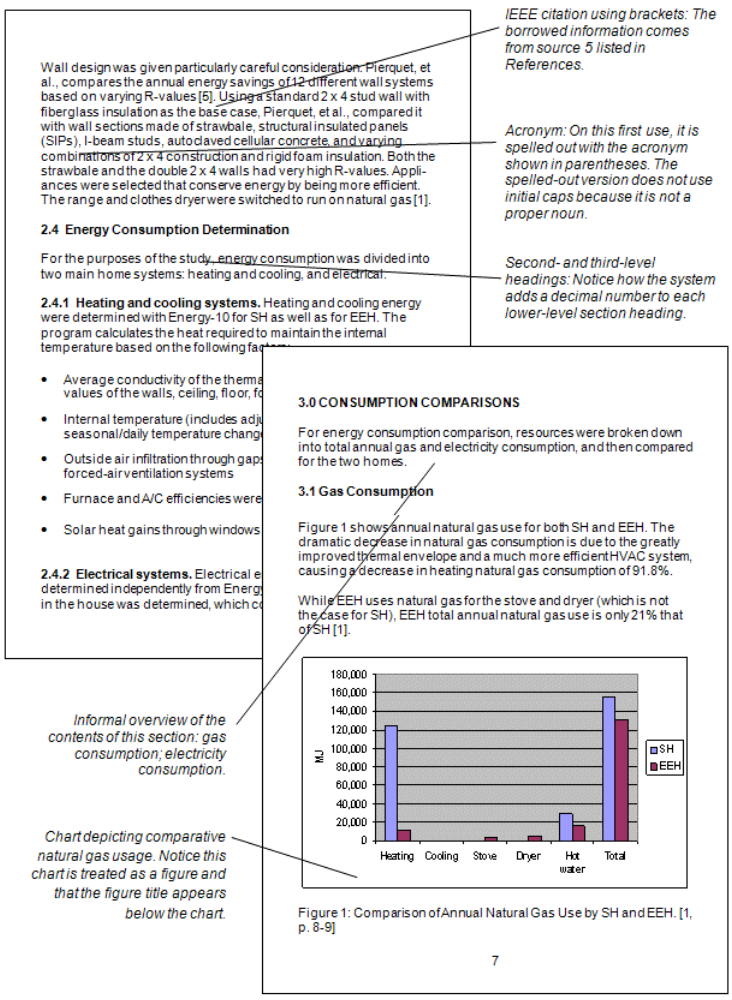
Headings are an important feature of professional technical writing: they alert readers to upcoming topics and subtopics, help readers find their way around in long reports and skip what they are not interested in, and break up long stretches of straight text.

Headings are also useful for writers. They keep you organized and focused on the topic. When you begin using headings, your impulse may be to slap in the headings after you've written the rough draft. Instead, visualize the headings before you start the rough draft, and plug them in as you write.

Your task in this chapter is to learn how to use headings and to learn the style and format of a specific design of headings. Here are a number of helpful tips:

- Make the phrasing of headings self-explanatory: instead of "Background" or "Technical Information," make it more specific, such as "Physics of Fiber Optics."
- Make headings indicate the range of topic coverage in the section. For example, if the section covers the design and operation of a pressurized water reactor, the heading "Pressurized Water Reactor Design" would be incomplete and misleading.
- Avoid "stacked" headings—any two consecutive headings without intervening text.
- Avoid pronoun reference to headings. For example, if you have a heading "Torque," don't begin the sentence following it with something like this: "This is a physics principle….."
- When possible, omit articles from the beginning of headings. For example, "The Pressurized Water Reactor" can easily be changed to "Pressurized Water Reactor" or, better yet, "Pressurized Water Reactors."
- Don't use headings as lead-ins to lists or as figure titles.
- Avoid "widowed" headings: that's where a heading occurs at the bottom of a page and the text it introduces starts at the top of the next page. Keep at least two lines of body text with the heading, or force it to start the new page.

If you manually format each individual heading using the guidelines presented in the preceding list, you'll find you're doing quite a lot of repetitive work. The styles provided by Microsoft Word, OpenOffice Writer, and other software save you this work. You simply select Heading 1, Heading 2, Heading 3, and so on. You'll notice the format and style are different from what is presented here. However, you can design your own styles for headings.



Excerpt from the body of a technical report. In a technical writing course, ask your instructor if the decimal-numbering style for headings is required. Also, a different documentation system may be required—not the IEEE, which is for engineers.

Bulleted and numbered lists

In the body of a report, also use bulleted, numbered, and two-column lists where appropriate. Lists help by emphasizing key points, by making information easier to follow, and by breaking up solid walls of text. Always introduce the list so that your audience understand the purpose and context of the list. Whenever practical, provide a follow-up comment, too. Here are some additional tips:

- Use lists to highlight or emphasize text or to enumerate sequential items.
- Use a lead-in to introduce the list items and to indicate the meaning or purpose of the list (and punctuate it with a colon).
- Use consistent spacing, indentation, punctuation, and caps style for all lists in a document.
- Make list items parallel in phrasing.
- Make sure that each item in the list reads grammatically with the lead-in.
- Avoid using headings as lead-ins for lists.
- Avoid overusing lists; using too many lists destroys their effectiveness.
- Use similar types of lists consistently in similar text in the same document.

Following up a list with text helps your reader understand context for the information distilled into list form. The tips above provide a practical guide to formatting lists.

Graphics and figure titles

In technical report, you are likely to need drawings, diagrams, tables, and charts. These not only convey certain kinds of information more efficiently but also give your report an added look of professionalism and authority. If you've never put these kinds of graphics into a report, there are some relatively easy ways to do so—you don't need to be a professional graphic artist. For strategies for adding graphics and tables to reports, see the chapter on Creating and Using Visuals. See the chapter on visuals for more help with the principles for creating visuals.

Conclusions

For most reports, you will need to include a final section. When you plan the final section of your report, think about the functions it can perform in relation to the rest of the report. A conclusion does not necessarily just summarize a report. Instead, use the conclusion to explain the most significant findings you made in relation to your report topic.

Appendixes

Appendixes are those extra sections following the conclusion. What do you put in appendixes? Anything that does not comfortably fit in the main part of the report but cannot be left out of the report altogether. The appendix is commonly used for large tables of data, big chunks of sample code, fold-out maps, background that is too basic or too advanced for the body of the report, or large illustrations that just do not fit in the body of the report. Anything that you feel is too large for the main part of the report or that you think would be distracting and interrupt the flow of the report is a good candidate for an appendix. Notice that each one is given a letter (A, B, C, and so on).

Information sources

Documenting your information sources is all about establishing, maintaining, and protecting your credibility in the profession. You must cite ("document") borrowed information regardless of the shape or form in which you present it. Whether you directly quote it, paraphrase it, or summarize it—it's still borrowed information. Whether it comes from a book, article, a diagram, a table, a web page, a product brochure, an expert whom you interview in person—it's still borrowed information.

Documentation systems vary according to professionals and fields. For a technical writing class in college, you may be using either MLA or APA style. Engineers use the IEEE system, examples of which are shown throughout this chapter. Another commonly used documentation system is provided by the American Psychological Association (APA).

Page numbering

Page-numbering style used in traditional report design differs from contemporary report design primarily in the former's use of lowercase roman numerals in front matter (everything before the introduction).

- All pages in the report (within but excluding the front and back covers) are numbered; but on some pages, the numbers are not displayed.
- In the contemporary design, all pages throughout the document use arabic numerals; in the traditional design, all pages before the introduction (first page of the body of the report) use lowercase roman numerals.
- On special pages, such as the title page and page one of the introduction, page numbers are not displayed.
- Page numbers can be placed in one of several areas on the page. Usually, the best and easiest choice is to place page numbers at the bottom center of the page (remember to hide them on special pages).
- If you place page numbers at the top of the page, you must hide them on chapter or section openers where a heading or title is at the top of the page.

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10.8: Conclusions

We normally use the word “conclusion” to refer to that last section or paragraph or a document. Actually, however, the word refers more to a specific type of final section. If we were going to be fussy about it, the current chapter should be called “Final Sections,” which covers all possibilities.

There are at least four ways to end a report: a summary, a true conclusion, an afterword, and nothing. Yes, it is possible to end a document with no conclusion (or “final section”) whatsoever. However, in most cases, that is a bit like slamming the phone down without even saying good bye. More often, the final section is some combination of the first three ways of ending the document.

Summaries

One common way to wrap up a report is to review and summarize the high points. If your report is rather long, complex, heavily detailed, and if you want your readers to come away with the right perspective, a summary is in order. For short reports, summaries can seem absurd—the reader thinks “You’ve just told me that!” Summaries need to read as if time has passed, things have settled down, and the writer is viewing the subject from higher ground.

Figure 1: Summary-type of final section. From a report written in the 1980s.

VIII. SUMMARY

This report has shown that as the supply of fresh water decreases, desalting water will become a necessity. While a number of different methods are in competition with each other, freezing methods of desalination appear to have the greatest potential for the future. The three main freezing techniques are the direct method, the indirect method, and the hydrate method. Each has some advantage over the others, but all three freezing methods have distinct advantages over other methods of desalination. Because freezing methods operate at such low temperatures, scaling and corrosion of pipe and other equipment is greatly reduced. In non-freezing methods, corrosion is a great problem that is difficult and expensive to prevent. Freezing processes also allow the use of plastic and other protective coatings on steel equipment to prevent corrosion, a measure that cannot be taken in other methods that require high operating temperatures. Desalination, as this report has shown, requires much energy, regardless of the method. Therefore, pairing desalination plants with nuclear or solar power resources may be a necessity. Some of the expense of desalination can be offset, however . . .

“True” Conclusions

A “true” conclusion is a logical thing. For example, in the body of a report, you might present conflicting theories and explored the related data. Or you might have compared different models and brands of some product. In the conclusion, the “true” conclusion, you would present your resolution of the conflicting theories, your choice of the best model or brand—your final conclusions.

Figure 2: A “true”-conclusions final section. This type states conclusions based on the discussion contained in the body of the report. (From a report written in the 1980s.)

V. CONCLUSIONS

Solar heating can be an aid in fighting high fuel bills if planned carefully, as has been shown in preceding sections. Every home represents a different set of conditions; the best system for one home may not be the best one for next door. A salesman can make any system appear to be profitable on paper, and therefore prospective buyers must have some general knowledge about solar products. A solar heating system should have as many of the best design features as possible and still be affordable. As explained in this report, the collector should have high transmissivity and yet be durable enough to handle hail storms. Collector insulation should be at least one inch of fiberglass mat. Liquid circulating coils should be at least one inch in diameter if an open loop system is used. The control module should perform all the required functions with no added circuits. Any hot water circulating pumps should be isolated from the electric drive motor by a non-transmitting coupler of some kind. Homeowners should follow the recommendations in the guidelines section carefully. In particular, they should decide how much money they are willing to spend and then arrange their components in their order of importance. Control module designs vary the most in quality and therefore should have first priority. The collector is the second in importance, and care should be taken to ensure compatibility. Careful attention to the details of the design and selection of solar heating devices discussed in this report will enable homeowners to install efficient, productive solar heating systems.

Afterwords

One last possibility for ending a report involves turning to some related topic but discussing it at a very general level. Imagine that you had written a background report on some exciting new technology. In the final section, you might broaden your focus and discuss how that technology might be used, or the problems it might bring about. But the key is to keep it general—don't force yourself into a whole new detailed section.

Figure 3: Afterword-type final section. The main body of the report discussed technical aspects of using plastics in main structural components of automobiles. This final section explores the future, looking at current developments, speculating on the impact of this trend.

VII. CONCLUSION: FUTURE TRENDS

Everyone seems to agree that the car of the future must weigh even less than today's down-sized models. According to a recent forecast by the Arthur Anderson Company, the typical car will have lost about 1,000 pounds between 1978 and 1990 [2:40]. The National Highway Traffic Safety Administration estimates the loss of another 350 pounds by 1995. To obtain these reductions, automobile manufacturers will have find or develop composites such as fiber-reinforced plastics for the major load-bearing components, particularly the frame and drivetrain components. Ford Motor Company believes that if it is to achieve further growth in the late 1980's, it must achieve breakthroughs in structural and semistructural load-bearing applications. Some of the breakthroughs Ford sees as needed include improvements in the use of continuous fibers, especially hybridized reinforced materials containing glass and graphite fibers. In addition, Ford hopes to develop a high speed production system for continuous fiber preforms. In the related area of composite technology, researchers at Owens Corning and Hercules are seeking the best combination of hybrid fibers for structural automotive components such as engine and transmission supports, drive shafts, and leaf springs. Tests thus far have led the vice president of Owen Corning's Composites and Equipment Marketing Division, John B. Jenks, to predict that hybrid composites can compete with metal by the mid-1980's for both automotive leaf springs and transmission supports. With development in these areas of plastics for automobiles, we can look forward to lighter, less expensive, and more economical cars in the next decade. Such developments might well provide the needed spark to rejuvenate America's auto industry and to further decrease our rate of petroleum consumption.

Combinations

In practice, the preceding ways of ending reports are often combined. You can analyze final sections of reports and identify elements that summarize, elements that conclude, and elements that discuss something related but at a general level (afterwords).

Here are some possibilities for afterword-type final sections:

- Provide a brief, general look to the future; speculate on future developments.
- Explore solutions to problems that were discussed in the main body of the report.
- Discuss the operation of a mechanism or technology that was described in the main body of the report.
- Provide some cautions, guidelines, tips, or preview of advanced functions.
- Explore the economics, social implications, problems, legal aspects, advantages, disadvantages, benefits, or applications of the report subject (but only generally and briefly).

Revision Checklist for Conclusions

As you reread and revise your conclusions, watch out for problems such as the following:

- If you use an afterword-type last section, make sure you write it at a general enough level that it does not seem like yet another body section of the report.
- Avoid conclusions for which there is no basis (discussion, support) in the body of report.
- Keep final sections brief and general.

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