

# **NREL Report—Full Guidance Document**

Nicholas Hamilton<sup>1</sup>, Chioke Harris<sup>1</sup>,  
Author Four<sup>2</sup>, and Author Five<sup>3</sup>

<sup>1</sup>National Renewable Energy Laboratory

<sup>2</sup>Another affiliation

<sup>3</sup>A third affiliation

This is a temporary cover page. A final cover page will be generated by comms with current style and formatting.

**v2.0.2, April 2022**

## Executive Summary

This document is a guide to writing documents for publication by NREL using the LaTeX document preparation system. LaTeX is not WYSIWYG and has different reviewing and editing tools compared to typical word processing software. For this reason special care has to be taken when preparing NREL documents in LaTeX.

This document serves both as a guide to implementing NREL's style and formatting guidelines in LaTeX, and as a template. This document is intended for people with some familiarity with LaTeX.

## Acknowledgments

Updates to this template are made by Nicholas Hamilton with support and style guidance from Sheri Anstedt, Kimberly Austin, Deanna Cooke, and Chioke Harris.

The original document and the NREL LaTeX class file were developed by staff at the National Wind Technology Center, including Andrew Platt, Andrew Clifton, Andrew Ning, Mike Lawson, and Paul Fleming. Alexandra Lemke provided support relating to NREL communications. A first demonstration of an NREL class file was created by Chuck Booten from NREL's Electricity, Resources, and Building Systems Integration group, which inspired this effort. The class file and this template were developed as part of work on several NREL reports, journal articles, and conference publications.

We thank members of the TeX – LaTeX StackExchange site for useful suggestions concerning LaTeX and typography (Anon. 2014). This report was typeset using the LaTeX typesetting system originally developed by Leslie Lamport, based on TeX created by Donald Knuth. It was revised in 2014 by A. Clifton, A. Platt, M. Dennis, P. Fleming, and M. Lawson. The class file and examples were revised again in 2021 by N. Hamilton.

## List of Acronyms

DOE Department of Energy

NREL National Renewable Energy Laboratory

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# 1 Dummy chapter

## 1.1 Creating Content

### 1.1.1 Front, main, and back matter

NREL's convention is to have Roman numerals in the front matter, and then arabic numerals in the main matter of the document (after the tables of contents, figures and tables). Tables and figures in the front matter are also numbered differently (Table A, B, C, ...) than in the main matter (Table 1, 2, 3, ...).

This change in page and float numbering is implemented using the

```
\frontmatter
```

```
,
```

```
\mainmatter
```

```
, and
```

```
\backmatter
```

commands at the start of these sections of the document:

```
\begin{document}
```

```
\maketitle
```

```
\frontmatter
```

```
...
```

```
\tableofcontents
```

```
\clearpage
```

```
\listoffigures
```

```
\listoftables
```

```
\mainmatter
```

```
...
```

```
\backmatter
```

```
\end{document}
```

## 1.2 Creating a file structure

Your main file should be called *main.tex*. This helps editors and coauthors identify where to start. Then, use `input` to import other files into your main file at compilation.

For example, each of the chapters in this report is in separate files, called *WhatIsLatex* (Chapter 1), *NRELRequirements.tex* (Chapter 2), *LatexAtNREL.tex* (Chapter 3), and so-on. In the example available on Github, they are stored in the *files* directory. *main.tex* then looks like this:

```
...
```

```
\begin{document}
```

```
% content
```

```
\input{files/WhatIsLatex}
```

```
\input{files/NRELRequirements}
```

```
\input{files/LatexAtNREL}
```

```
...
```

## 1.3 Best practice in writing a document in LaTeX

**Create a structure before you get too far.** Authors will find it easier to write documents and make changes if they separate the content of the document from the structure.

1. Each new LaTeX document should be placed in its own directory.
2. Create a main LaTeX file that just contains the preamble, custom commands and uses `input` to call the content. See Section 1.2 for an example where each `chapter` is contained in its own file. In an article, each `section` could be contained in its own file.
3. Keep the number of packages used to a minimum. If authors feel that something is desperately missing, they can contact the maintainers of the *nrel.cls* file. Not all packages can be used as they lack compatibility.

**Focus on content, not appearance.** Don't spend hours trying to adjust fonts, headers or spacing between lines.

1. The document produced should meet NREL's requirements if it is compiled using *nrel.cls*.
2. Don't throw in lots of `clearpages` or other commands to push material around. LaTeX is designed to handle that.
3. Resist the temptation to add or subtract space, change lengths or do other things to modify the layout.
4. Write!

## 1.4 Dummy section

Fusce mauris. Vestibulum luctus nibh at lectus. Sed bibendum, nulla a faucibus semper, leo velit ultricies tellus, ac venenatis arcu wisi vel nisl. Vestibulum diam. Aliquam pellentesque, augue quis sagittis posuere, turpis lacus congue quam, in hendrerit risus eros eget felis. Maecenas eget erat in sapien mattis porttitor. Vestibulum porttitor. Nulla facilisi. Sed a turpis eu lacus commodo facilisis. Morbi fringilla, wisi in dignissim interdum, justo lectus sagittis dui, et vehicula libero dui cursus dui. Mauris tempor ligula sed lacus. Duis cursus enim ut augue. Cras ac magna. Cras nulla. Nulla egestas. Curabitur a leo. Quisque egestas wisi eget nunc. Nam feugiat lacus vel est. Curabitur consetetur.

Suspendisse vel felis. Ut lorem lorem, interdum eu, tincidunt sit amet, laoreet vitae, arcu. Aenean faucibus pede eu ante. Praesent enim elit, rutrum at, molestie non, nonummy vel, nisl. Ut lectus eros, malesuada sit amet, fermentum eu, sodales cursus, magna. Donec eu purus. Quisque vehicula, urna sed ultricies auctor, pede lorem egestas dui, et convallis elit erat sed nulla. Donec luctus. Curabitur et nunc. Aliquam dolor odio, commodo pretium, ultricies non, pharetra in, velit. Integer arcu est, nonummy in, fermentum faucibus, egestas vel, odio. Aitken et al. 2014; Vömel et al. 2018

Morbi luctus, wisi viverra faucibus pretium, nibh est placerat odio, nec commodo wisi enim eget quam. Quisque libero justo, consetetur a, feugiat vitae, porttitor eu, libero. Suspendisse sed mauris vitae elit sollicitudin malesuada. Maecenas ultricies eros sit amet ante. Ut venenatis velit. Maecenas sed mi eget dui varius euismod. Phasellus aliquet volutpat odio. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Pellentesque sit amet pede ac sem eleifend consetetur. Nullam elementum, urna vel imperdiet sodales, elit ipsum pharetra ligula, ac pretium ante justo a nulla. Curabitur tristique arcu eu metus. Vestibulum lectus. Proin mauris. Proin eu nunc eu urna hendrerit faucibus. Aliquam auctor, pede consequat laoreet varius, eros tellus scelerisque quam, pellentesque hendrerit ipsum dolor sed augue. Nulla nec lacus. Advantages of latex.nrel.gov include:

1. No need to maintain a local version of LaTeX
2. Everyone uses the same version of LaTeX
3. Editors and reviewers can work in a user-friendly environment
4. There is an always-on "track changes" feature
5. Secure hosting of documents within the NREL domain
6. Ability to download source documents for archiving

## 2 Another dummy chapter

Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique, libero. Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae, placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus. Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa. Wildmann, Kigle, and Gerz 2018; Klein et al. 2015; Jagdish et al. 2018 See note below for more information.<sup>1</sup>

- Meteorological masts and in-situ point measurements
  - Sonic anemometers
  - Pressure-temperature-humidity
- Remote sensing
  - Sodar and radar radio acoustic sounding system)
  - Ka-band and X-band radar
  - A diversity of lidars (e.g., ground-based, nacelle-mounted, scanners, profilers)
  - Field-particle-image-velocimetry-type systems
  - Satellite imaging
- Other instruments
  - Radiosondes and sounding systems (difficult with the Federal Aviation Administration; labor-intensive)
  - Eddy covariance (surface flux stations) both upwind and throughout the wind plant
  - Ceilometer for planetary boundary layer heights
  - SCADA (performance/operational data, loads)
  - Upwelling/downwelling radiation sensors
  - Sensors for surface properties (e.g. soil moisture/temperature, surface albedo,...)
  - Tethered lifting systems
  - Airborne measurement systems and unmanned aerial vehicles
- Other advice
  - Plan for backup units, (re)calibration of instruments, maintenance/downtime, data formatting, and time synchronization.

---

<sup>1</sup>This is a just a footnote to have an example in the text.



## 3 Yet another dummy chapter

### 3.0.1 Citations

Use `bibtex` to organize references and store them in a single file (e.g.

```
/Documents/bibliography/bibliography.bib
```

). The bibliography will then contain entries with ‘keys’ for each source, like `Lamport_1986_a`.

Authors can then insert citations to this key throughout their document, using different styles of citation. Citations are generated using the `biblatex` package, which also formats references in the correct style. Ways to generate citations are described in the `biblatex` documentation, and include:

- `\cite{moriarty2020american}`  
prints Moriarty et al. 2020.
- `\citep{moriarty2020american}`  
prints (Moriarty et al. 2020).
- `\citeta{moriarty2020american}`  
prints Moriarty et al. (2020).
- A more complex case:  
`\parentext{\citeta{moriarty2020american} and \citep{fernando2019perdigao}}`  
prints (Moriarty et al. [2020] and [Fernando et al. 2019])

To cite URLs, use the ‘misc’ style. For example, the `bibtex` entry for `http://tex.stackexchange.com` Anon. 2014 looks like this:

```
@misc{texstackexchange ,
      Author = {Anon.} ,
      Howpublished = {Accessed July 21, 2014: \url{http://tex.stackexchange.com}},
      Title = {\TeX -- LaTeX Stack Exchange} ,
      Year = {2014}}
```

This format will allow you to include the date on which a URL was accessed.

The citations should work with journal articles (Clifton et al. 2013), books (Knuth 1984; Lamport 1986; “The Chicago Manual of Style” 1982), technical reports (Other and Nother 2014), and URLs (Anon. 2014). Any unknown publication types will be formatted using the ‘misc’ type.

### 3.0.2 Including computer code

The `listings` package has been loaded. Note: this does not work if the ‘Draft’ document option is used.

To change the syntax highlighting use

```
\lstset{language=[dialect]language, columns=fullflexible, keepspaces=true}
```

before each listing where the language changes. For more details see the `lstlisting` documentation.

### 3.0.3 NREL-style bibliographies

NREL uses “Chicago A” style-references. The `nrel.cls` file uses `Biblatex` to produce these references automatically.

To include a bibliography in the document give the bibliography file location in the preamble, and insert the bibliography at the appropriate location:



Figure 1. Very pretty picture Debnath et al. 2017; Brock et al. 1995; Krishnamurthy et al. 2017

```
% give the bibliography file location
\bibliography{ files / bibliography . bib }
...
\begin{document}
...
% insert the bibliography into the document
\cleardoublepage
\label{sec:Bib}
\printbibliography
...
\end{document}
```

Vivamus eu tellus sed tellus consequat suscipit. Nam orci orci, malesuada id, gravida nec, ultricies vitae, erat. Donec risus turpis, luctus sit amet, interdum quis, porta sed, ipsum. Suspendisse condimentum, tortor at egestas posuere, neque metus tempor orci, et tincidunt urna nunc a purus. Sed facilisis blandit tellus. Nunc risus sem, suscipit nec, eleifend quis, cursus quis, libero. Curabitur et dolor. Sed vitae sem. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Maecenas ante. Duis ullamcorper enim. Donec tristique enim eu leo. Nullam molestie elit eu dolor. Nullam bibendum, turpis vitae tristique gravida, quam sapien tempor lectus, quis pretium tellus purus ac quam. Nulla facilisi.

Duis aliquet dui in est. Donec eget est. Nunc lectus odio, varius at, fermentum in, accumsan non, enim. Aliquam erat volutpat. Proin sit amet nulla ut eros consectetur cursus. Phasellus dapibus aliquam justo. Nunc laoreet. Donec consequat placerat magna. Duis pretium tincidunt justo. Sed sollicitudin vestibulum quam. Nam quis ligula. Vivamus at metus. Etiam imperdiet imperdiet pede. Aenean turpis. Fusce augue velit, scelerisque sollicitudin, dictum vitae, tempor et, pede. Donec wisi sapien, feugiat in, fermentum ut, sollicitudin adipiscing, metus.

Donec vel nibh ut felis consectetur laoreet. Donec pede. Sed id quam id wisi laoreet suscipit. Nulla lectus dolor, aliquam ac, fringilla eget, mollis ut, orci. In pellentesque justo in ligula. Maecenas turpis. Donec eleifend leo at felis tincidunt consequat. Aenean turpis metus, malesuada sed, condimentum sit amet, auctor a, wisi. Pellentesque sapien elit, bibendum ac, posuere et, congue eu, felis. Vestibulum mattis libero quis metus scelerisque ultrices. Sed purus.

Donec molestie, magna ut luctus ultrices, tellus arcu nonummy velit, sit amet pulvinar elit justo et mauris. In pede. Maecenas euismod elit eu erat. Aliquam augue wisi, facilisis congue, suscipit in, adipiscing et, ante. In justo. Cras lobortis neque ac ipsum. Nunc fermentum massa at ante. Donec orci tortor, egestas sit amet, ultrices eget, venenatis eget, mi. Maecenas vehicula leo semper est. Mauris vel metus. Aliquam erat volutpat. In rhoncus sapien ac tellus. Pellentesque ligula.

Cras dapibus, augue quis scelerisque ultricies, felis dolor placerat sem, id porta velit odio eu elit. Aenean interdum nibh sed wisi. Praesent sollicitudin vulputate dui. Praesent iaculis viverra augue. Quisque in libero. Aenean gravida lorem vitae sem ullamcorper cursus. Nunc adipiscing rutrum ante. Nunc ipsum massa, faucibus sit amet, viverra vel, elementum semper, orci. Cras eros sem, vulputate et, tincidunt id, ultrices eget, magna. Nulla varius ornare odio. Donec accumsan mauris sit amet augue. Sed ligula lacus, laoreet non, aliquam sit amet, iaculis tempor, lorem. Suspendisse eros. Nam porta, leo sed congue tempor, felis est ultrices eros, id mattis velit felis non metus. Curabitur vitae elit non mauris varius pretium. Aenean lacus sem, tincidunt ut, consequat quis, porta vitae, turpis. Nullam laoreet fermentum urna. Proin iaculis lectus.

Sed mattis, erat sit amet gravida malesuada, elit augue egestas diam, tempus scelerisque nunc nisl vitae libero. Sed consequat feugiat massa. Nunc porta, eros in eleifend varius, erat leo rutrum dui, non convallis lectus orci ut nibh. Sed lorem massa, nonummy quis, egestas id, condimentum at, nisl. Maecenas at nibh. Aliquam et augue at nunc pellentesque ullamcorper. Duis nisl nibh, laoreet suscipit, convallis ut, rutrum id, enim. Phasellus odio. Nulla nulla elit, molestie non, scelerisque at, vestibulum eu, nulla. Ut odio nisl, facilisis id, mollis et, scelerisque nec, enim. Aenean sem leo, pellentesque sit amet, scelerisque sit amet, vehicula pellentesque, sapien.

Sed consequat tellus et tortor. Ut tempor laoreet quam. Nullam id wisi a libero tristique semper. Nullam nisl massa, rutrum ut, egestas semper, mollis id, leo. Nulla ac massa eu risus blandit mattis. Mauris ut nunc. In hac habitasse platea dictumst. Aliquam eget tortor. Quisque dapibus pede in erat. Nunc enim. In dui nulla, commodo at, consectetur nec, malesuada nec, elit. Aliquam ornare tellus eu urna. Sed nec metus. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas.

Phasellus id magna. Duis malesuada interdum arcu. Integer metus. Morbi pulvinar pellentesque mi. Suspendisse sed est eu magna molestie egestas. Quisque mi lorem, pulvinar eget, egestas quis, luctus at, ante. Proin auctor vehicula purus. Fusce ac nisl aliquam ante hendrerit pellentesque. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Morbi wisi. Etiam arcu mauris, facilisis sed, eleifend non, nonummy ut, pede. Cras ut lacus tempor metus mollis placerat. Vivamus eu tortor vel metus interdum malesuada. **kasler2010wake**; Fernando et al. 2019; Banta et al. 2015



(a) subfigure on the left



(b) subfigure on the right

Figure 2. Another pretty figure, this time with two pictures.

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## Appendix A. Included packages

Nunc sed pede. Praesent vitae lectus. Praesent neque justo, vehicula eget, interdum id, facilisis et, nibh. Phasellus at purus et libero lacinia dictum. Fusce aliquet. Nulla eu ante placerat leo semper dictum. Mauris metus. Curabitur lobortis. Curabitur sollicitudin hendrerit nunc. Donec ultrices lacus id ipsum.

**Table 1. Packages loaded by the NREL classes.**

Package	Options	Functionality
amsmath, amssymb		supplies AMS fonts, which are useful for mathematics
babel	english	activates language-appropriate hyphenation rules
booktabs		improves the formatting of tables
caption		required to generate captions for floats
courier		changes fonts
fontenc	T1	enables direct typing of international characters
geometry		sets page size and margins
graphicx		graphics handling, including <i>.eps</i> figures
helvet	scaled=0.83	sets helvetica as the default sans-serif font, with correct scaling to match the serif font size
hyphenat		improves spacing and breaking of hyphenated words
listings		enables the inclusion of high-quality computer code listings
mathptmx		changes fonts
nag		checks that packages are up to date and looks for bad habits in LaTeX code.
parskip		required for better spacing
pdfcomment		required for tool-tips. Also calls the <code>hyperref</code> package
setspace		required for better spacing
subcaption		provides the <code>subfigure</code> environment to produce sub figures
tocloft		improved table of contents and list of files/tables in memoir documents
tocbibind	nottoc, notlot, notlof	Add bibliography/index/contents to Table of Contents in memoir documents
todonotes		inline and margin to-do notes
xcolor		Driver-independent color extensions for LaTeX and pdfLaTeX



## Appendix B. Supplemental Information

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