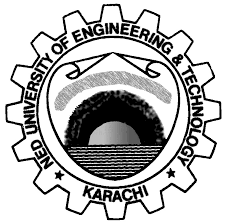
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**DEPARTMENT OF ELECTRICAL ENGINEERING**

NED University of Engineering & Technology

2023

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Thesis Submitted in Fulfilment of the Requirements for the Degree of

Postgraduate Study / Masters of Engineering / Masters of Engineering Management (Power System/ Smart Grid)

Submitted by:

<**Name in Block Letters**>

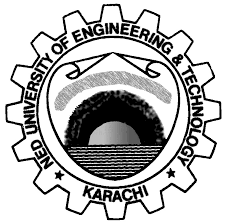
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Supervised by:

<**Name in Block Letters**>

<**Designation**>

<**Department**>



**Department of Electrical Engineering**

**NED University of Engineering & Technology**

<**YEAR**>

ABSTRACT

This study evaluates the effectiveness of carbon dioxide mitigation strategies in reducing greenhouse gas emissions. The study analyzes various carbon dioxide mitigation strategies, including carbon capture and storage, renewable energy, and energy efficiency measures. The study also examines the potential environmental impacts and economic costs associated with these strategies. The research methodology involves a review of existing literature, as well as case studies and simulations to evaluate the effectiveness of different carbon dioxide mitigation strategies. The results of the study indicate that a combination of carbon capture and storage, renewable energy, and energy efficiency measures can significantly reduce greenhouse gas emissions. The study also finds that the potential environmental impacts and economic costs of these strategies vary depending on the specific mitigation approach. Overall, the study suggests that carbon dioxide mitigation strategies can be effective in reducing greenhouse gas emissions and that careful consideration of the potential environmental impacts and economic costs is necessary when implementing these strategies.

Guidelines for writing an abstract:

1. Keep it concise: An abstract should be a brief summary of the thesis, usually between 150-300 words. Make sure to keep the abstract concise and to the point.
2. Follow a structure: The abstract should have a clear structure, including an introduction, methods, results, and conclusion. Make sure that the abstract follows the same structure as the thesis.
3. Use clear language: Avoid using technical jargon or complex terminology in the abstract. Use clear and simple language that is easy to understand for a broad audience.
4. Highlight the main findings: The abstract should highlight the main findings of the thesis. This should include the research question, methods used, and the key results.
5. Avoid new information: Do not include any new information or data that is not already presented in the thesis. The abstract should summarize the main points of the thesis.
6. Edit and proofread: Make sure to edit and proofread the abstract carefully to ensure that it is free of errors and grammatical mistakes.
7. Follow the formatting guidelines: Make sure to follow any formatting guidelines provided by your institution or supervisor, such as font size, spacing, and margin requirements.

ACKNOWLEDGEMENT

This is a template/ guidance only, you need to change the wordings. I would like to express my heartfelt gratitude to all those who have supported and encouraged me throughout the course of this research. I would like to extend my sincere thanks to [Name of Advisor], who has been an inspiration and a constant source of encouragement. Their guidance and expertise have been invaluable in shaping this thesis.

I would also like to thank [Name of Department/Institute], for providing me with the resources and support I needed to complete this study.

I am deeply grateful to my family and friends, who have been my source of strength and motivation throughout this journey. Their love and support have been a constant source of comfort, and I am deeply thankful for their unwavering encouragement.

Finally, I would like to express my gratitude to all the participants who generously gave their time and cooperation, and made this research possible.

Thank you, one and all.

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LIST OF ABBREVIATIONS

|  |  |
| --- | --- |
| **NEPRA** | National Electric Power Regulatory Authority |
| **DISCOS** | Distribution Companies |
| **AI** | Artificial Intelligence |
| **CNN** | Convolutional Neural Network |
| **EED** | Electrical Engineering Department |
|  |  |
|  |  |
|  |  |
|  |  |

*\*The above is a table without borders. You can add rows. Click on the table, go to Layout at the top right corner. Use Insert Below or Above for adding Rows.*

*This is a table, for your convenience you may switch-n hidden lines of the table, later you must switched them off and follow the template.*

# INTRODUCTION

This chapter describes………

## Background

An abstract is a short summary of a longer work (such as a dissertation or a research paper). The abstract concisely reports the aims, method, and outcomes of your research so that readers know exactly what the research work/paper is about.

## Abstract/ Summary

[maximum 300 words] An abstract is a short summary of a longer work (such as a dissertation or a research paper). The abstract concisely reports the aims, method, and outcomes of your research so that readers know exactly what the research work/paper is about.

## Keywords

Keywords are important words/concepts found in your research question or thesis. A quick way to pull keywords from a proposal/ research question/ thesis is to choose the most important nouns; all other words are irrelevant.

Use at-least three keywords, one keyword at each line, separated with semi-colon (;) for example.

**Protection; Over current relays; Modelling**

## Background / Specific Literature Review

(Use 2000 words maximum excluding tables, captions and equations)

The background has to provide the context of the proposed study. It has to talk about

1. The **broader** research area,
2. What the current literature says about the research area/ research problem,
3. What are some of the gaps in existing studies, and how this led to the gap or need you intend to examine in your study.

The background for a proposal must provide a solid start and foundation to the proposal. Therefore, it helps to cite relevant literature and provide necessary statistics to show why your study is needed.

You can use Figures, Tables and Equations in your literature review.

Be sure that the symbols in your equation have been defined before or immediately following the equation.

Use “Eqn. (1)” to refer equation in the text. Figure 1 to refer figure in the text and Table 1 to refer table in a text. Remember

***All equations must be referred in the text.***

***All figures must be referred in the text.***

***All tables must be referred in the text.***

|  |  |
| --- | --- |
|  | Eqn. (1) |

\*Hide the table lines (No Borders) once you have done the formatting.

Equation should be centred, and equation no. should be right aligned. It will look like

|  |  |
| --- | --- |
|  | Eqn. (1) |

Table 1: Type Styles

| Table Head | Table Column Head | | |
| --- | --- | --- | --- |
| Table column subhead | Subhead | Subhead |
| Copy | More table cop |  |  |

Text, logo

Description automatically generated

Figure 1: Example of a Figure Caption

All Figures and Tables must be discussed within the text and must be referred in the text before the Figure and Table appeared. For Figure and Table caption, use 10 font size, Times New Roman and bold. Use words rather than symbols or abbreviations when writing Figure axis labels to avoid confusing the reader.

For a good review;

Add journal and conference papers (published in last 5 years)

Add summary tables

Use quantitative results of the papers.

All research papers (published literature) must be new (published within last 5 years).

Use end-note® for citations. Use APA 6th format of citation.

Do not cut paste table and figures of the existing research papers (unless very much necessary).

### Dos and Do-not

Table : Considerations about the Literature Review

|  |  |
| --- | --- |
| Dos | Do not |
| Writing a good literature review is an art and this should be coordinated, like a story writing. | Literature review heading should be “Literature review of …..(mention topic)”  e.g. Literature review of voltage stability, Deep learning, standards. |
| The research question should be clear and crisp, preferably one that can be analyzed quantitatively. | All figures and Table must be cited properly. |
| Picking up the right articles is an art, and one should have clear inclusion and exclusion criteria to perform a relevant review. | Do not include irrelevant paper for increasing the number of pages. |
| Citations should be recent and relevant in the current context. | Do not add ranges of papers (e.g. [10-17]) just to increase the number of papers/ references. |
| Citations should include not only those studies with clear-cut outcomes or inferences, but this could also include those papers or articles that are inconclusive or require further research. This is required for better understanding, avoiding bias, and defining further scope for research. | Citations that are old and outdated in the current context are to be avoided. |
| Critical appraisal of the studies cited with an analytical review of the same is to be done. | Bias in citations that intentionally quote only those that are congruent in their conclusions to the current study should be avoided. |
| Adequate number of citations is often defined by the journal and that needs to be followed. | Not weighing the studies under consideration for the quality of research result in inclusion of poor-quality literature that make the outcomes unreliable. |
| Organize and document the data in a format that best suits and justifies the research study. | Too few or too many citations fail to convey the crux in the correct proportions. |
| Read your write up again and again for improvement or give your write up to some relevant person for comments on your write up. | Data organized in a haphazard manner becomes inconclusive and does not interest the reader and sends a wrong message about the quality of the study. |
| Similarity Index must be less than 19%. | Do not copy paste the existing papers or review articles. |

One of the example of citation are as follows, (M. M. Aman, Jasmon, Mokhlis, & Bakar, 2012) (Muhammad Mohsin Aman, Jasmon, Khan, Bakar, & Jamian, 2012) (Kirby & Kang, 2008) (Muhammad Mohsin Aman, Ahmed, & Qazi, 2011).

**For heading, sub-heading-sub-sub-heading do not go more than 3 levels (e.g.**

**1.**

**1.1.**

**1.1.1.**

**If the fourth stage is very much necessary, use *a. b. c. d.* but these numbering (a. b. c. d.) should not be appeared in the ToC (Table of Content).**

All literature review including figure, text and tables must be cited. Use only APA 6th style format (Paithankar & Bhide, 2010).

## Problem Statement

(Not more than 150 words, defining your own problem)

A problem statement is a statement of a current issue or problem that requires timely action to improve the situation. This statement concisely explains the barrier the current problem places between a functional process and/or product and the current (problematic) state of affairs. This statement is completely objective, focusing only on the facts of the problem and leaving out any subjective opinions. To make this easier, it's recommended that you ask who, what, when, where and why to create the structure for your problem statement. This will also make it easier to create and read, and makes the problem at hand more comprehensible and therefore solvable.

## Objectives (maximum three objectives and maximum word count of 100 words)

Objectives specify what the research project proposes to accomplish (do, achieve, estimate, determine, measure, evaluate). In research proposals writing, specific objects are used. Specific objectives are a set or list of sub-objectives, each of which contributes to achieving the general objective.

Objective 1:

Objective 2:

Objective 3:

## Scope of Work

Mention the scope of work or limitation of your proposed work.

## Methodology (define your tasks as per your objectives)

In your proposal, you will have to discuss the methods you will use to do your research. The methodology section should generally be written in the past tense. But in case of synopsis, future tense will be used.

Academic style guides in your field may also provide detailed guidelines on what to include for different types of studies. For example, there are specific guidelines for writing an APA methods section. A single objective can be split into many tasks for formulating the Gantt chart.

Objective 1:

Task 1:

Task 2:

Objective 2:

Task 1:

Task 2:

Objective 3:

Task 1:

Task 2

Note: For the pages you want to keep in Landscape Orientation, create a new section (Layout 🡪 Break🡪 Section Break Next Page). And then change Orientation to Landscape (Layout 🡪 Orientation 🡪 Landscape)

Table 2: Gantt Chart

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Year 2022** | | | | **Year 2023** | | | |
| **Objectives** | **Jan-Feb** | **March-April** |  |  |  |  |  |  |
| Objective 1 | **To develop a Smart Switch providing time based, unit based and centralized controlling of system** | | | | | | | |
| Task 1 (Proposed) |  |  |  |  |  |  |  |  |
| Task 1 (Actual) |  |  |  |  |  |  |  |  |
| Task 2 (Proposed) |  |  |  |  |  |  |  |  |
| Task 2 (Actual) |  |  |  |  |  |  |  |  |
| Task 3 |  |  |  |  |  |  |  |  |
| Outcome of Objective 1 | Write in your words, what will you achieve after completion of objective 1, which can be gauged. | | | | | | | |
| Objective 2 | **Management of home or industrial appliances by developing the mobile application through which smart switches can be controlled** | | | | | | | |
| Task 1 |  |  |  |  |  |  |  |  |
| Task 2 |  |  |  |  |  |  |  |  |
| Task 3 |  |  |  |  |  |  |  |  |
| Outcome of Objective 2 | Write in words, what will you achieve after completion of objective 2, which can be gauged. | | | | | | | |

Update the proposed Gantt Chart by adding rows under each task to show the actual time taken (highlighted by cross lines).

\*Highlight cells, using following steps ….

Press right click of mouse 🡪 Table properties 🡪 Borders and Shading 🡪 Shading 🡪 Black Select 25%

Press right click of mouse 🡪 Table properties 🡪 Borders and Shading 🡪 Borders 🡪 Select Diagonal Lines (both) under Preview

## Beneficiary of the project

Project beneficiaries are those who will derive some benefit from the implementation of the project. Two types of beneficiaries can be defined: direct and indirect.

### Direct Beneficiaries:

Direct beneficiaries can be defined as those who will participate directly in the project, and thus benefit from its existence. Thus, all persons who will be employed by the project, supply it with raw materials or other goods and services, or who will use in some way the output of the project can be categorised as direct beneficiaries. Some of the examples are consultant, designers, medical doctors, specific industry, students or others.

### Indirect Beneficiaries:

Indirect beneficiaries are often, but not always, all those living within the zone of influence of the project. For example, a patient in a hospital due to a gadget designed for hospital or a doctor, a driver on a road due to some application designed for traffic management system.

## Targeted Sustainable Development Goals (SDGs)

Explain also how the selected goal will link to your research work?

The 17 sustainable development goals (SDGs) to transform our world are represented in Figure 2.



Figure : Sustainable Development Goals (SDGs) by United Nations

Table : Targeted Sustainable Development Goals

|  |  |  |
| --- | --- | --- |
| **GOAL #** | **Sustainable Development Goal (SDG)** | **Selected Goals – Add a ✓** |
| Goal 1 | No Poverty |  |
| Goal 2 | Zero Hunger |  |
| Goal 3 | Good Health and Well-being | **✓** |
| Goal 4 | Quality Education |  |
| Goal 5 | Gender Equality |  |
| Goal 6 | Clean Water and Sanitation |  |
| Goal 7 | Affordable and Clean Energy |  |
| Goal 8 | Decent Work and Economic Growth |  |
| Goal 9 | Industry, Innovation and Infrastructure |  |
| Goal 10 | Reduced Inequality |  |
| Goal 11 | Sustainable Cities and Communities |  |
| Goal 12 | Responsible Consumption and Production |  |
| Goal 13 | Climate Action |  |
| Goal 14 | Life Below Water |  |
| Goal 15 | Life on Land |  |
| Goal 16 | Peace and Justice Strong Institution |  |
| Goal 17 | Partnerships to achieve the Goal |  |

At least 1 SDG should be targeted. Maximum SDGs targeted by your work can be 3.

Description of the Selected Goals: (Describe the link of the selected goals with your work.)

### Goal # 3 Good Health and Well-being

Description of the targeted goal.

## Resources

(covering available resources and required resources- software as well as hardware)

The budget is a representation of the expenses associated with the proposal project. The Budget Justification contains more in-depth detail of the costs behind the line items, and sometimes explains the use of the funds if not evident.

Table : Resources of the Project

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No.** | **Item/ Resources** | **Estimated Cost** | **Remarks\*** |
| Available items/ resources | | |  |
| 1. | Hardware, Meters, Software, consultant, Labs |  |  |
| 2. |  |  |  |
| 3. |  |  |  |
| 4. |  |  |  |
| Unavailable Items | | |  |
| 1. | Hardware, Meters, Software, consultant, Labs |  |  |
| 2. |  |  |  |
| 3. |  |  |  |
| 4. |  |  |  |
| 5. | Data gathering (Travelling) |  |  |
|  |  |  |  |

**\*(If resource is available - mention the location where the resource is available.**

**If resource(s) are not available- how will you manage them?)**

Succinctly put, the chapter should cover the following:

* Background of the study
* Statement of the problem
* Purpose of the study
* Research questions/hypotheses
* Significance of the study
* Scope and delimitations
* Definition of terms

# LITERATURE REVIEW OF …….

The chapter reviews the available literature in the context of ……………….. . Section 2.1 describes / discusses overview of relevant literature, theoretical framework, synthesis of previous studies. Are these sub-headings or just structure?

## Artificial Intelligence

### Analytical Methods to Solve Network Reconfiguration Problems

## Deep Learning

## Smart Grid

# PROPOSED METHODOLOGY FOR…..

The chapter describes ………………

## Proposed Methodology / System for….

* Research design
* Participants
* Data collection procedures
* Data analysis methods
  + - 1. *What is a thesis research methodology?*

A thesis research methodology explains**the type of research performed**, **justifies the methods** that you chose by linking back to the [**literature review**](https://www.enago.com/thesis-editing/blog/how-to-write-complete-literature-review-for-your-thesis-dissertation), and describes the **data collection and analysis** procedures.

*What should the research methodology section in your thesis include?*

* The **aim** of your thesis
* An outline of the research methods chosen (**qualitative**, **quantitative**, or **mixed methods**)
* **Background and rationale** for the methods chosen, explaining why one method was chosen over another
* Methods used for **data collection**and **data analysis**
* **Materials and equipment** used—keep this brief
* **Difficulties encountered**during data collection and analysis. It is expected that problems will occur during your research process. Use this as an opportunity to demonstrate your problem-solving abilities by explaining how you overcame all obstacles. This builds your readers’ confidence in your study findings.
* A brief **evaluation of your research** explaining whether your results were conclusive and whether your choice of methodology was effective in practice
  + - 1. *What should not be included in the research methodology section of your thesis?*
* **Irrelevant details**, for example, an extensive review of methodologies (this belongs in the literature review section) or information that does not contribute to the readers’ understanding of your chosen methods
* A description of **basic procedures**
* **Excessive details about materials and equipment used.** If an extremely long and detailed list is necessary, add it as an appendix
* **Raw data- Add to appendix**

The thesis work usually belongs to one of the following types:

* Hardware based
* Simulation Based
* Data analytics/ Survey based (study based)
* Hardware + software
* Design - based on some standards (Drawings)

Based on the nature of work, the different parts of report can focus on different aspects as per need. You may refer to the Table 5 for guidance.

Table : Methodology Requirements for the Different Categories of Thesis Work

|  |  |
| --- | --- |
| **Nature of Thesis Work** | **Methodology** |
| Hardware-based Only | The complete design of hardware, components, schematics etc. can be added. The datasheets of components can be added to the appendices. |
| Simulation-based Only | Show simulation results, plots etc. Interpret them and discuss their importance. All graphs or plots must be perfectly labelled and visible. The axes should be labelled. Add legends. |
| Data Analytics / Survey-based | Proposed methodology in the case can be study-based. Qualitative / Quantitative Research  Source of data, how is it collected etc. Different types of plots can be used for data representation. |
| Hardware + Software-based | Divide your description of the proposed-method in 2 parts: Simulation and Hardware.  Also demonstrate the link between the two. |
| Design-based on some Standards | It may include drawings / layouts. Standard details can be added to the appendices. |

# APPLICATIONS OF THE PROPOSED METHOD / RESULTS AND DISCUSSIONS

The chapter reviews

## Introduction

## Results

* Summary of findings
* Tables and figures/plots to illustrate results

## Analysis / Discussions

* Interpretation of results
* Comparison with previous studies
* Implications of findings

~~Limitations of the study~~

~~Recommendations for future research~~

(Will be covered in the next chapter).

# CONCLUSION AND FUTURE WORK

The conclusion of a thesis is the final section that ties together the main findings, implications, and contributions of your study.

## Conclusion

**Here's how you can write a conclusion:**

I. Summary of Main Findings:

* Summarize the key results and findings of your study.
* Highlight the contributions and innovations of your work.

II. Implications of Findings:

* Discuss the significance of your results and their implications for theory, practice, or policy.
* Explain how your work contributes to a deeper understanding of the topic.

III. Limitations and Recommendations for Future Research:

* Acknowledge the limitations of your study and suggest areas for improvement.
* Provide recommendations for future research, based on the limitations of your study and the need for further investigation.

IV. Concluding Thoughts:

* Restate the purpose and research questions/hypotheses of your study.
* Emphasize the importance of your work and its contributions to the field.
* Conclude with a final thought or statement that reflects the essence of your study.

Example:

Conclusion

This study aimed to [statement of purpose]. The results have shown that [key findings]. These findings have important implications for [field of study], as they [implications].

The limitations of this study suggest the need for [future research recommendations]. However, despite these limitations, this study has made a significant contribution to the understanding of [topic of study].

In conclusion, this study has [final thought or statement]. It has [contributions to the field] and has [significance]. Further research is needed to [future research recommendations], but this study provides a foundation for continued investigation and advancement in the field.

## Future Work

**The "Future Work" section in a thesis provides a roadmap for future research related to the topic of your study. Here's how you can write a future work section:**

I. Introduction:

* Provide a brief overview of the main findings and contributions of your study.
* Explain why further research is necessary.

II. Directions for Future Research:

* Identify specific areas where further research is needed, based on the limitations of your study or gaps in current knowledge.
* Propose new research questions or hypotheses that could be investigated.
* Suggest new methods or approaches that could be used to address these questions.
* Discuss the potential impact and significance of this future work.

III. Conclusion:

* Summarize the key directions for future research.
* Emphasize the importance of continued investigation in this field.
* Express your hope for the future of this area of research and its potential to contribute to a deeper understanding of the topic.

Example:

Future Work

The results of this study have shown that [main findings]. However, there are several limitations that suggest the need for further research. In particular, [limitations of the study].

Future research could address these limitations by [proposed research question/hypothesis]. One approach to doing so could be [new method/approach].

This future work has the potential to [potential impact and significance]. By continuing to investigate this area, we can gain a deeper understanding of [topic of study] and contribute to the advancement of knowledge in this field.

REFERENCES

* Use Endnote for referencing, no other tool will be accepted.
* Use APA 6th style formatting only

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APPENDICES

Additional material relevant to the study, such as raw data, interview transcripts, date tables, pseudocode etc.

APPENDIX A

APPENDIX B

APPENDIX C