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**IESA Report**

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**BACHELORS**

**IN**

**COMPUTER SOFTWARE ENGINEERING**

**YEAR**

**2021-2025**

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Submitted to the Department of Software Engineering of Foundation University Islamabad, in partial fulfilment for the requirements of a Bachelor of Computer Degree in Software Engineering

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Any dedication should be given here. Paragraph Justified.

**ACKNOWLEDGEMENTS**

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|  |  |
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**ABSTRACT**

The Intelligent Energy Scenario Analysis (IESA) system is an AI-driven software solution designed to analyse, forecast, and optimize energy Related scenarios. The system focuses on both gas and electricity usage, enabling energy planners, IT administrators, and data operators to make informed decisions. IESA integrates historical data visualization, predictive modelling, and scenario-based analysis to address the increasing demand for energy efficiency and sustainable practices. Using advanced algorithms such as WisRule for cognitive association and Linear Regression predictive insights, the system allows users to evaluate multiple energy scenarios by adjusting variables like production capacity, imports, and consumption trends. The results are presented in user-friendly dashboards, enabling clear and actionable insights.

The project concludes that IESA is a DSS (Decision Support system), that provides a scalable and cost-effective solution for energy management, with significant potential for applications at regional and national levels. Findings include precise energy consumption predictions, and tailored recommendations for energy savings. The ability to evaluate multiple scenarios and compare outcomes allows decision-makers to select optimal strategies for energy resource planning.

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Chapter 1

# Introduction

* 1. **Introduction**

The introduction to this chapter given as an overview.

The Report provides an overview of the Intelligent Energy Scenario Analysis (IESA). It is designed to support decision making to optimize energy management and promote energy sustainability. This document is submitted to Faculty Engineering & Information Technology, Foundation University Islamabad. In today world where energy resources are under enormous pressure to full fill needs, where providing accurate predictions and actionable insights about different energy scenarios is crucial. IESA aims to empower users with actionable insights about different energy usage patterns of different scenarios and by leveraging advanced algorithms like WISRULE, Linear Regression and K means, it will also predict for future needs for best sustainable practices and cost efficiency.

Currently, there is no comprehensive digital platform that provides a unified solution for energy consumption forecasting, scenario analysis, and optimization tailored to individual needs. The IESA system will serve as an integrated platform to collect, analyze, and visualize energy data, offering predictions and personalized recommendations to users.

The first chapter introduces the project, including an analysis of existing systems, a literature review, and a problem statement that highlights the need for this solution. Additionally, it outlines user requirements, tools, and technologies employed in the system's development. A context diagram is included to illustrate the key modules and their interactions within the system.

* 1. **Existing System**

Give your text here [1]. All text must be in double line spaced justified font of size 12 and Times New Roman family.

Paragraphs can be included within a heading. All headings must be numbered.

* 1. **Literature Review**

Literature review goes here?

* 1. **Problem Definition**

Project problem statement goes here

* 1. **Context Diagram**

A diagram of a system

Description automatically generated

* 1. **User Needs**

Chapter 2

# Introduction to Proposed System

* 1. **Introduction**

The proposed system, Intelligent Energy Scenario Analysis (IESA), addresses the need for an advanced decision support system to optimize energy efficiency. The energy sector requires innovative approaches to ensure efficiency, reduce cost, and encourage best environmentally friendly practices. However, existing systems lack the capacity to provide detailed predictions and actionable insights based on historical energy data.

The Intelligent Energy Scenario Analysis (IESA) is designed to empower users to take advantage of detailed predictions and actionable insights to take the best decisions. It employs

Linear regression, WisRule, the World’s first cognitive algorithm for wise association rule mining, etc. and offer personalized recommendations and visualize trends. IESA stands as a pivotal tool in promoting sustainable energy practices on a national scale.

* 1. **Project Background or Overview**

Intelligent Energy Scenario Analysis (IESA) is an AI based business intelligence project that will revolutionize energy scenario analysis by utilizing WisRule**,** Linear regression, K Means Clustering etc. This would help in understanding different demand profiles, identifying inefficiencies, and targeting energy-saving interventions more effectively. IESA aims to predict future scenarios related to energy, such as gas and electricity production and consumption, as well as associations between energy import, generation, and production etc. IESA provides users with comprehensive business intelligence on total energy management, IESA is a DSS (Decision Support System) that enables optimal decision-making for sustainability and cost efficiency. The project will analyse historical energy data to predict future needs and offer personalized recommendations, helping users to make better future decisions

* 1. **Problem Description**

The increasing demand combined with inefficacies in its usage planning poses a significant challenge in terms of sustainability, resource management, and cost management.

Traditional methods and Existing Decision Support systems for energy planning and forecasting fail to account for complex variables and lack accurate forecasting and actionable insights for energy savings. These systems are quite expensive in terms of their licensing and are complex, making it difficult to learn about them. They are also unable to provide dynamic predictions and personalized recommendations. This leads to inefficient resource allocations, increased costs, and limited environmental benefits.

There is a need for an intelligent solution that provides accurate cost-effective and user-friendly solutions and IESA addresses these problems with personalized recommendations, and actionable insights, enabling users to optimize energy usage that supports the data-driven decisions.

* 1. **Project Objectives**

The Intelligent Energy Scenario Analysis (IESA) is a sophisticated business intelligence project designed to enable users to optimize gas and electricity usage. By helping to reduce energy wastage, lower costs, and contribute to a greener future on a national scale, IESA offers an impactful solution for sustainable energy management. The software utilizes historical data and employs the WisRule algorithm to analyze and visualize patterns of energy production and consumption-related scenarios, providing predictive insights. At the same time, K-Means Clustering will be used for grouping data based on similar consumption patterns, and Linear Regression will be used for forecasting energy usage and predicting future energy trends. IESA aims to predict future energy-related scenarios, such as gas and electricity production and consumption, as well as associations between energy import, generation, and production etc.

* 1. **Scope**

The Intelligent Energy Scenario Analysis (IESA) provides a comprehensive decision support system for energy management by providing detailed predictive analytics, and scenario-based insights, forecasting and optimization of different energy scenarios such as energy consumption and production.

As an advanced system, IESA captures historical consumption data, stores it, and makes it accessible for visualization and scenario analysis. Allows users to explore predictive trends, receive personalized recommendations for optimizing energy usage, and compare predictions using various algorithms. The System also promotes sustainability by offering actionable insights, helping organizations minimize energy wastage, reduce costs, and support eco-friendly practices.

* 1. **Project Features**

|  |  |  |
| --- | --- | --- |
| ID | Feature | Description |
| FT01 | Energy Data Acquisition | This feature interacts with user to get input data from user through csv/xml. |
| FT02 | Energy Data Storage | This units extracts data from csv/xml inputted by user and stores in Database. |
| FT03 | ETL | This Module extracts data from database transforms it and loads into our system. |
| FT04 | Scenario Analysis | The system must analyze historical data and generate patterns for production and consumption, as well as associations between energy import, generation, and production etc. |
| FT05 | Prediction Engine | The system must use WisRule, Linear Regression, K Means Clustering for prediction based on different scenarios |
| FT06 | Data Visualization | The system must visualize both historical data and predicted data on dashboard using graphs and charts. |
| FT07 | Reporting | The system must allow to share and print reports both in hard and soft form. |
| FT08 | Personalized Recommendations | The system must provide user with recommendations for future decision based on historical and predicted data. |

* 1. **Context Diagram**

A diagram of a system

Description automatically generated

Chapter 3

# Requirements Specification

2. 1. **Introduction**

This chapter refers to the requirement and specifications of IESA. Specifications include Functional Requirements, Quality Attributes, and Non-Functional Requirements of IESA. The purpose of this chapter is to give a deep understanding of the requirements, specification and functionality of product

* 1. **Functional Requirements**

|  |  |  |
| --- | --- | --- |
| ID | Description | Feature |
| FR01 | The system shall allow user to input historical data in form of csv/xml. | FT01 |
| FR02 | The System shall store input data in database. | FT02 |
| FR03 | The System shall extract data from database clean it and prepare it and load it into system | FT03 |
| FR04 | The system shall analyze historical data and generate patterns for different energy scenarios. | FT04 |
| FR05 | The system shall use WisRule, K mean cluster, Linear Regression and other algorithms to predict future energy related scenarios. | FT05 |
| FR06 | The system shall visualize both historical data, different scenarios and predicted data on dashboard using graphs and charts. | FT06 |
| FR07 | The system shall allow to share and print reports both in hard and soft form. | FT07 |
| FR08 | The system shall provide user with recommendations for future decision based on historical and predicted data. | FT08 |

* 1. **DFD level 0**

**Actors:**

* Energy Planner
* Input Entry Operator

A diagram of a system

Description automatically generated

* 1. **Graphical User Interface**

A screenshot of a computer

Description automatically generated

A screenshot of a computer

Description automatically generatedA graph of blue squares

Description automatically generated with medium confidence

* 1. **Data Model (ERD)**
  2. **Non-Functional Requirements**

The following table highlights Nonfunctional Requirements for IESA:

|  |  |  |
| --- | --- | --- |
| ID | NFR | Statement |
| NFR01 | Response Time | The system should generate energy scenario report with in 15 seconds after user input’s data. |
| NFR02 | Performance | The system should be able to handle up to 10 parallel user without and performance degradation. |
| NFR03 | Availability | The system should be available for user’s 24/7 |
| NFR04 | Ease of use | Thes system should allow user to perform most of the functionality within 5 minutes of first use |
| NFR05 | Maintainability | The system should be modular and well documented with easily updateable and maintainable components |