

OBSERVATIONS AND RESEARCH THRUST AREA OUTCOMES IN THE LITERATURE REVIEW OF ENERGY UTILIZATION

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Abstract: Energy Management principles have produced various outcomes in the World. This is due to the increase in energy demand and the scarcity of energy resources. The conventional energy resources are depleting at high rate. Its impact on today has been a critical factor nowadays in the academia and research areas. Very large amount of literature is available now to investigate about the crisis affecting the entire World regarding energy. Energy efficiency plays an important role in improving the economical and environmental aspects of energy. Optimal energy efficiency can be attained by the optimum utilization of resources. This energy condition reduces the energy losses. There fore to attain an eco-friendly and economical energy resource potential, the role of Energy Management is very high. This particular research paper aims at finding out various observations in the literature of Energy Management and its possible outcomes. It will definitely increase the chances of a researcher to go through the advanced aspects pertaining to Energy Management and energy efficiency.

KEY WORDS: LITERATURE REVIEW, ENERGY, ENERGY EFFICIENCY, ENERGY MANAGEMENT, OUTCOME, OPTIMUM

1. INTRODUCTION

The major concern among the policy makers of energy and power sector is the pressure envisaged by the global energy consumption; where the majority of energy consumption is from fossil fuels, that is increased more than 25% in the last 20 years and a further 30% is expected by 2030(IEA 2014). The manufacturing and power sector accounts for 40% of the global primary energy consumption which make out 42% of the direct and indirect CO₂ emissions.

Right from the year 2000, the increasing concern about the climate change, lack of resources and energy supply has a major impact on the attitudes of society and industry towards the environment. Large Industrial units and power sector units are affected by the impact of growing energy prices, environmental regulations, customer demand and environmental awareness. Due to the abrupt shift towards Energy Management in power sector and manufacturing; due to the global and industrial drivers; the issue of improving energy efficiency, effectiveness; power produced and decrease in heat input gains more and more importance. Thus, manufacturing and power sector industries began to think about the determinants of environmental performance for their manufacturing processes. Therefore, energy efficiency began to be the new topic of interest for the industry and academia as it can both reduce the economical and environmental impacts related to the consumption of energy.

The literature on Energy Management in manufacturing and energy sector is gradually growing. It is better to provide the current knowledge in this research field to provide directions for policy makers and enabling it for the future research work. In order to accomplish this, a detailed analysis of the research literature on Energy Management now comprising of 300 articles published from 1986 to 2020 in a variety of research journals is being carried out. Not only this research paper includes a research framework that

considers various aspects of Energy Management but it also provides a framework to how energy efficiency can be achieved in order to conserve economical and environmental aspects of energy.

The proposed paper provides significant importance for

1. Providing an overview of Energy Management for both academia and industry.
2. Supports the researcher in deriving out new research focus from the existing one.
3. Classify the existing research in the field of Energy Management.

This research work is an integrated approach to provide depth analysis of the current state of the pertinent literature combined with provision for finding out newer aspects in this research field still missing. The objectives of this research paper are to

1. Investigate the observations of current research in the field of Energy Management.
2. Provide an overview and classification of the literature to guide the researchers for identifying the critical areas of energy and correlate its information.
3. Design a framework to co ordinate the aspects of Energy Management.
4. Explore the future work to improve the energy efficiency, effectiveness, power produced and to reduce the energy losses.
5. Solve out new methodologies to optimize and correct the parametric relations of energy.

The structure of this paper is as follows:

Section 2: Analyze the existing review of literatures and highlight the contributions in the field of Energy Management.

Section 3: Methodology of research work.

Section 4: Describes the results of the review by providing classification of the analyzed paper.

Section 5: Provide a framework of Energy Management and concludes the paper by highlighting the main finding and outcomes of the study.

Section 6: Concluding remarks

Section 7: References

2. REVIEW OF LITERATURE IN ENERGY MANAGEMENT

This section defines review of literature from the year 1986 to 2020 in various international journals related with energy, energy policy, energy efficiency, energy conversion and management, applied energy, renewable energy Sources and other important topics of energy. Finally, it was decided to take reviews from 300 articles. From this literature review it was understood that, in Engineering applications, effective power transmission holds a major designing aspect regarding Energy systems. Various Energy systems find application in vast area of Mechanical Engineering from gear drives through aerospace technologies. In the design of energy systems, parametric correlations provide accuracy during Energy and power production and its transmission through different mechanical elements by reducing error in power and energy. The losses in such applications with respect to power and energy impart an increase in rated power and efficiency. So, while designing energy systems, some important correlations should be newly defined for improving the accuracy of calculations of efficiency and power production. Parametric correlation is a statistical correlation in which it defines the degree to which each variable moving relative to one another. There are two types of variables. One is the dependent variable and another is independent variable. The theoretical model equations are derived out from these two sets of variables.

The correlations of power transmission have to be derived out from the basic equations and principles. The set of data for further calculations can be formed from these correlations. A perfect fit of variables can be tested with the regression analysis. According to the R^2 value we can say that the equation is perfect fit. This literature can be provided as a framework to give a resolution for power transmission in the design of energy systems.

Table 1: Summary of relevant articles by source and year

Year	Energy	Energy Policy	Energy Efficiency	Energy Conversion and Management	Applied Energy	RE Sources	Others	SUM
1986	3	2	3	2	3	2	5	20
1987	2	0	0	2	3	3	0	10
1988	1	0	2	3	0	1	0	7
1989	3	2	1	3	2	2	2	15
1990	2	2	1	1	2	2	2	12
1991-92	2	3	3	3	2	5	2	20
1993-94	1	1	3	4	5	5	1	20
1995	2	3	3	3	3	4	2	20
1996-99	3	3	2	3	2	4	3	20
2000-02	4	4	4	4	3	2	3	24
2003-05	3	5	3	2	2	5	5	25
2006	2	3	2	1	2	3	1	14
2007-08	5	5	5	4	3	4	5	31
2009-15	4	4	4	3	4	4	3	26
2016-20	8	5	10	5	4	2	2	36

Some of the reviews from the literature of Energy Management is as follows:

Neighborhood scale model is designed by the urban planners help in developing business scale models which uses the simulation CitySim software for estimating energy demands (Abdullahi, et al., 2015).

CitySim software study several cases and conduct surveys for gathering information and determine the factors influencing the energy demands pf the buildings (Ascione, et al., 2014).

Using the renewable sources of energy, fossil fuels such as oil, natural gas and coal support the reduction in the consumption of energy (Jusuf, et al., 2017).

The utilization of gas in the domestic sector is 58% of those fuels and sectors which foresee a declination (Mauree, et al., 2018).

The second largest sources for the production of domestic energy will be overtaking gas as well as oil by 2020 (Moghadam, et al., 2016).

By 2040, India's energy intensity of GDP will be 37% lower than in 2016 while the intensity of carbon usage will decline by 13% (Perez, et al., 2011).

The SA systems have dis advantages like low capacity factor, excess battery costs and finite capacity to store electricity forcing to throw away the extra energy generated (Kaundinya, 2009).

Technology is the pivotal force in the economic growth of any country (Bhalla, 1987).

For the proposed research work, articles from the below journals are considered for literature review. Some of these journals are GI Science & Remote Sensing, Applied Energy, Journal of cleaner production, Energy Policy, PLOS ONE, Energy Procedia, Procedia- Social and Behavioral sciences, Energy and Buildings, Elsevier, Renewable Energy and Sustainable Buildings, Energy, Renewable and Sustainable Energy Reviews, HVAC & Research, Journal of Building Performance simulation, Material Research Express, American Journal of Mechanical and Industrial Engineering, European Journal of Marketing and Economy, The Asia Pacific Journal, European Research Studies Journal, Think Asia, World Resources Institute Journal etc.

Table 2: Key words used for excluding non-relevant data

Energy Production	Solar Energy	Power Generation	Energy Economics	Energy Management
Energy	Photovoltaics	Solar	Energy Cost	Energy Efficiency
Combustion	PV Array	Thermal	Fuel Cost	EMM
Fossil fuels	Hybrid Systems	Hydroelectric	Power production cost	Effectiveness
Thermodynamics	Solar Cells	Energy Balance	Renewable Energy	Energy Losses
Gas cycle	MPPT	Wind	Optimum cost	Energy Audit
Electrical Energy	Solar Power	Energy System	Process Steam Cost	Energy Conservation

3. RESEARCH METHODOLOGY

The literature review can be done in different depths by any researcher. Any academic research work is being comprised of a piece of literature review as a small part or as an ingredient to the introduction of methodology or discussion of results. A literature review is a fully integral approach to justify one's research design, objective or methodology. It enhances the systematic evaluation of the thorough knowledge on a particular research subject. Therefore, the literature review serves the purpose of investigating and evaluating the observations in the existing body of knowledge in a particular field and also introduces the potential thrust areas of further research.

The objective of this particular literature review is to categorize and evaluate the current state in the field of Energy Management and to identify research potential opportunities in this area. The major question particular to the review is "What are the main research elements in the Energy Management literature to be considered for successful integration of energy efficiency in the field of manufacturing and power production?"

The steps followed during the process of content analysis consists of four main steps.

Step 1: Collection of review material which defines units and confirms potential.

Step 2: Analytical description-analyze characteristics and assess the material.

Step 3: Category Selection-Categories are analyzed and applied to the material.

Step 4: Material Evaluation-Analysis of the literature material according to different categories.

After filtering three times and execution, 300 articles were available in the database. The criteria used for the inclusion of articles is as follows:

Studies of Energy Management concept is the main topic.

Publications that are focused on energy policy.

Studies that contribute to energy efficiency.

Papers published in peer reviewed journals.

4. ANALYSIS OF LITERATURE REVIEW

The abstract of these papers was read and analyzed to create a classification based on

1. Content
2. Journal of publication
3. Year of publication

Finally, evaluation of results was carried out.

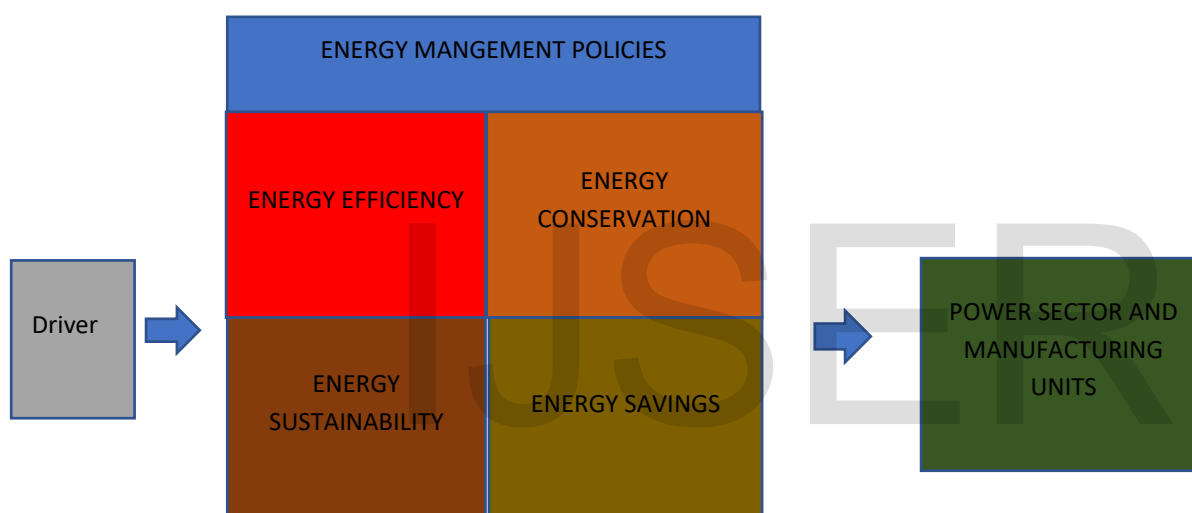


Diagram 1: Drivers of this literature review

The drivers of this literature review include the following.

- Energy Management Policies
- Energy Efficiency
- Energy Conservation
- Energy Sustainability
- Energy Savings

The implementation of these drivers critically affects the power sector and manufacturing units. When energy efficiency projects are being undertaken in power sector and manufacturing units these drivers impart a severe impact and improve efficiency, effectiveness, power produced and net work done by the energy systems. How well the driver equips determines the energy cost and eco-friendly conditions.

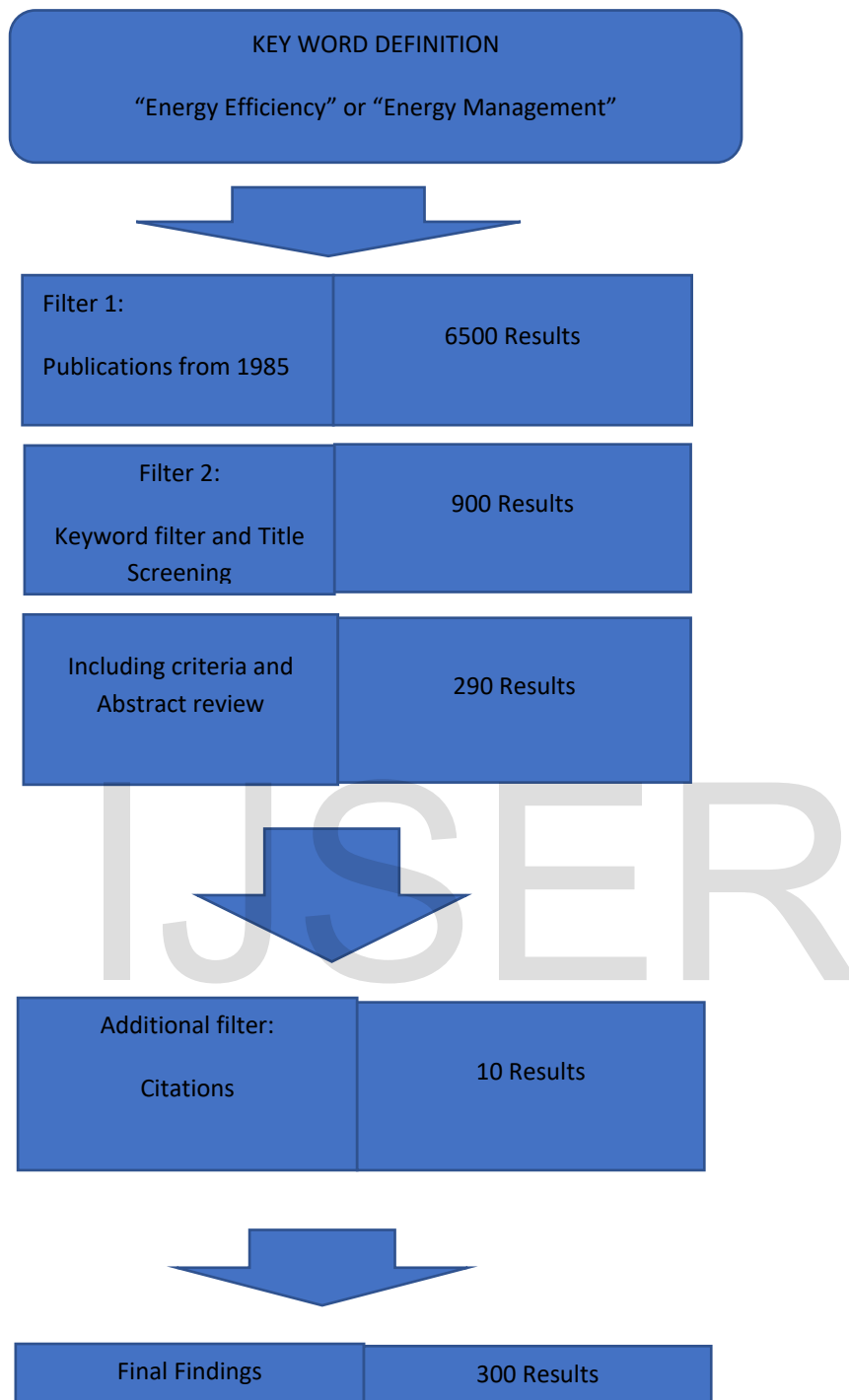


Figure 2: Application of Filters and available results as a Framework

Initially the key word given for getting the data base is "Energy Efficiency "or "Energy Management".

Initial filtering produces 6500 results. On further filtering it reduces to 900 results. By the inclusion of criteria and review of abstracts, 390 results were obtained. An additional filtering by citations produces 10 results. Finally, there were 300 results. This number of findings was sufficient because there was an inclusion of appropriate research papers in the field of energy efficiency and Energy Management. The research findings,

observations and outcomes were found out from the potential thrust areas of the literature review. The literature was thoroughly studied and analysis were carried out for the observations.

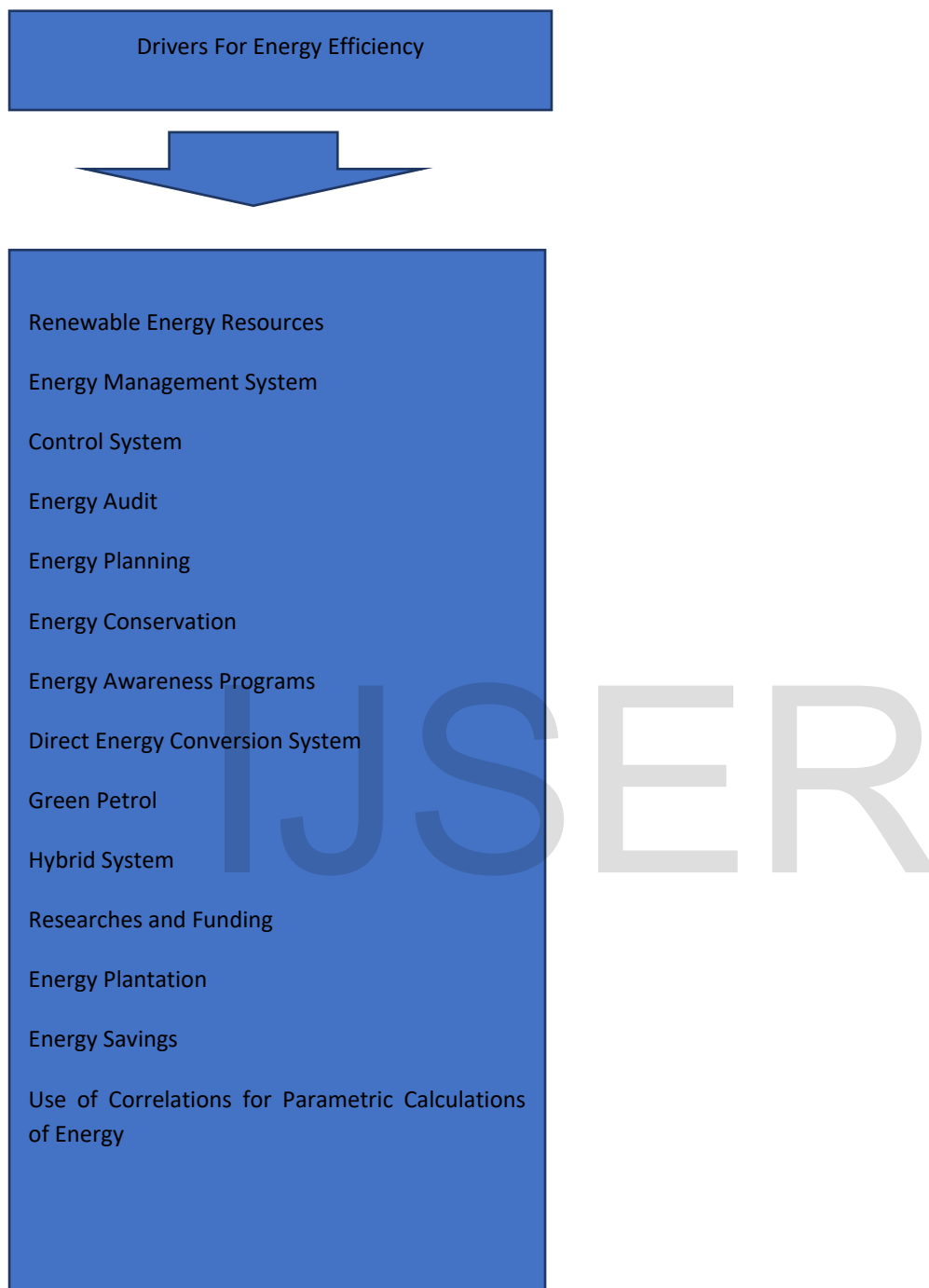


Figure 3. Drivers for Energy Efficiency

The above figure identifies the drivers for energy efficiency. These factors will drive the energy efficiency to an optimum value so that there can be high power developed, low heat input, high net work done and also reduces the energy as well as power transmission and energy losses. This give impetus for the optimum use of the resources. The drivers are identified from the extensive literature read out and examined during the different stages of the literature Review.

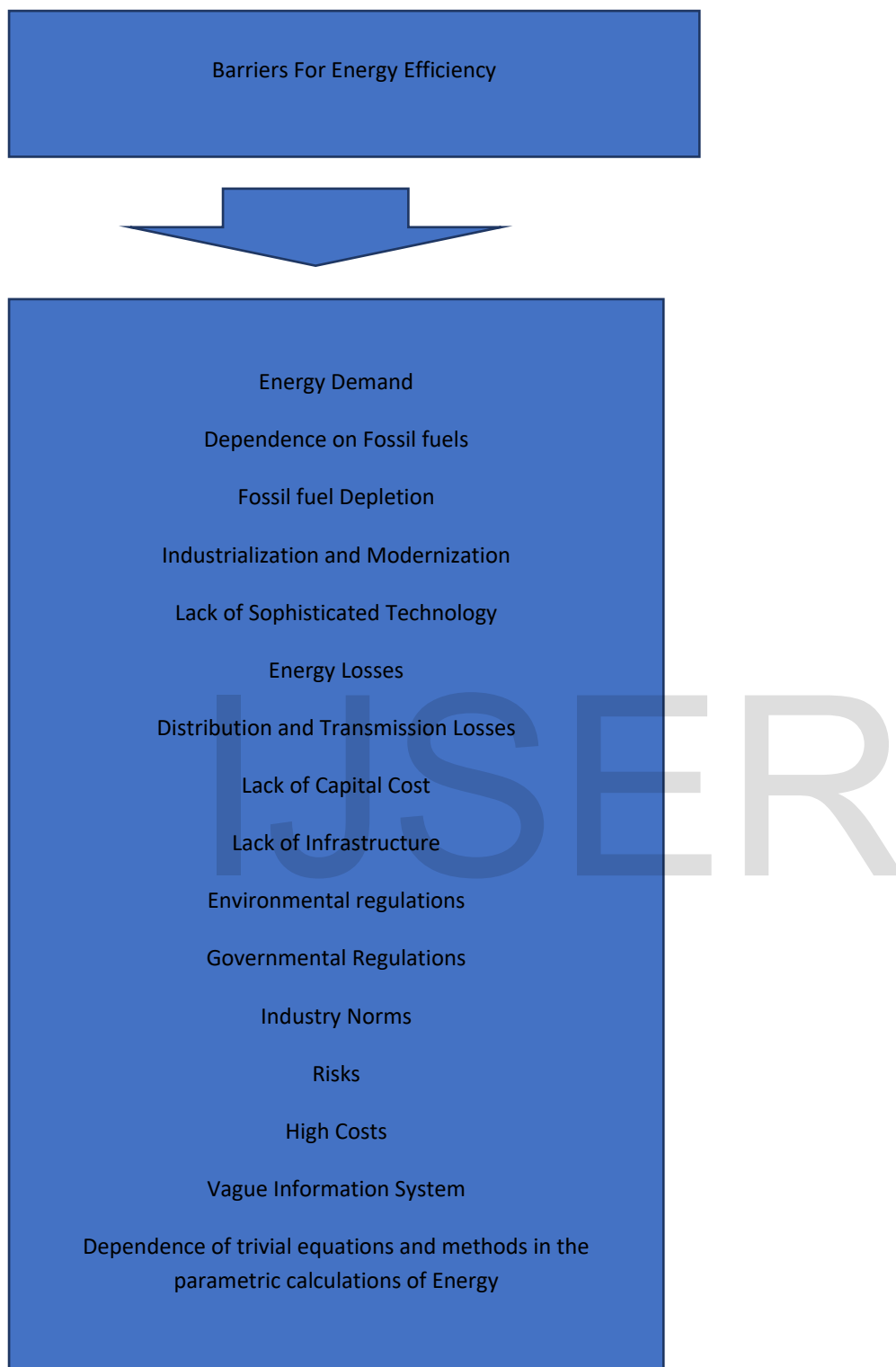


Figure 4. Barriers of Energy Efficiency

The above figure shows the barriers of energy efficiency. This diminishes the energy efficiency and increases the losses such as energy losses, power transmission and distribution losses etc.

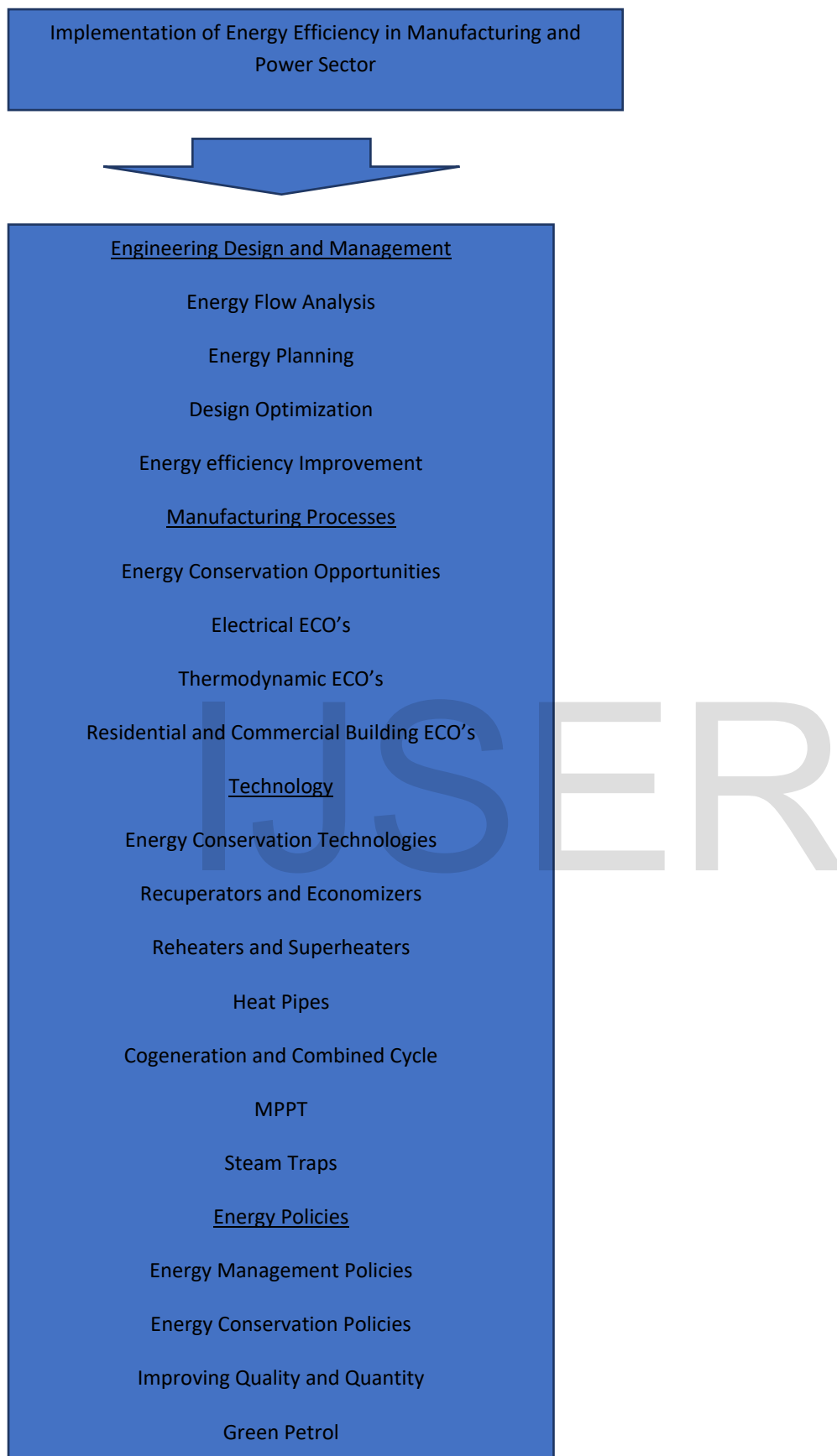


Figure 5: Implementation of Energy Efficiency

5. INSIGHTS AND SUGGESTIONS FOR FUTURE RESEARCH

The following insights and suggestions for future research are being found in this research work. They are

a. Drivers and Barriers

The analysis of drivers and barriers of energy efficiency is to be considered as a significant issue while running energy efficiency projects in power transmission system and manufacturing plants. The drivers improve the conditions of energy conservation better where as barriers deter the prospects of energy conservation. Drivers are useful while framing energy policies. The sustainability of energy can be envisaged while framing efficient energy policies for the future. Optimum conditions of energy efficiency can be achieved from the resources and conditions of design and implementation of energy policies.

b. Implementation of Energy efficiency in Manufacturing and Power production

Energy Management in Power plants confines a number of related parameters, data and various conditions. Identifying key areas of high energy consumption enhance the performances, monitor and control the factors for improving energy efficiency. The following key factors are identified in this research for engineering design and management. They are

Energy Flow Diagram

Energy Planning Measures

Design Optimization factors

Energy efficiency improvement measures

Optimum use of the resources for conserving Energy.

Regarding manufacturing processes, there are various energy conservation opportunities to achieve energy efficiency. It includes Electrical ECO's, Thermodynamic ECO's and Residential and Commercial Building ECO's. Newer technologies are to be identified to conserve energy. There can be widespread usages of recuperators, reheaters, economizers, heat pipes, cogeneration systems, combined cycle systems, MPPT techniques, use of super heaters, steam traps etc. for deriving out and implementing the policies of Energy Management for improving energy efficiency. Energy Management policies can be categorized as Energy Management policies, energy conservation policies; improving quality without diminishing quantity, green protocol etc. for improving energy efficiency.

c. Energy Performances

It is being identified in this research paper that there are various energy efficiency parameters and measurement. These key factors include

1. Specific Energy Consumption
2. Energy Cost
3. Per Capita Energy Consumption
4. Fuel Cost
5. Electrical Energy Production Cost
6. Thermal Energy produced
7. Net Power developed
8. Heat Input

9. Process Steam Cost etc.

These key factors enable in the researches to find out optimal performance calculations by effectively utilizing certain correlations along with basic equations such as Energy equation, Force equation, Momentum equation etc. in design calculations. The optimization techniques enhance with the identification of energy conservation characteristics, ANN model, soft computing techniques, Energy Management programs, energy audit measures, energy conservation techniques etc. These key aspects can be identified as a major research potential in this research paper while performing energy efficiency projects in manufacturing units or the power plants.

6. CONCLUDING REMARKS

The energy efficiency is an important aspect in power plants and manufacturing units. It can foster the economical and environmental performances, increase industrialization and improves innovations. Energy Management and framing of its policies are the major focus of the industry, policy makers and society. Industry and power plants are having the major role of achieving these targets. The power plant is a socio-economic system which comprises of factors such as labor, material, energy, information and machines for the production of electrical energy. This research paper provides a comprehensive analysis of the literature on Energy Management and identifies factors such as

Drivers and barriers of energy efficiency

Energy efficiency implementation techniques

Analysis of energy performance parameters for framing energy policies

Cost effective, highly productive and energy efficiency power production systems by modeling and optimizing energy consumption

Monitoring and control of performances for enhancing energy efficiency.

Beyond all these factors, this research paper focus in the opportunities of human beings in the energy production systems, eco-friendly and highly capable power production system that can determine successful transition to the society and making better the existing performances.

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