Renewable Energy for the Sustainability of Sports in Nepal

Om Krishna Prasain

A Thesis Submitted in Fulfillment of the Requirements for the Degree of Doctor of Philosophy in Environmental Management
Prince of Songkla University
2023

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Major Program	Sustainable Energy Management

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Acting Dean of Graduate School

This is to certify that the work here submitted is the result of the candidate's own investigations. Due acknowledgement has been made of any assistance received.

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(Mr. Om Krishna Prasain)
Candidate

I hereby certify that this work has not been accepted in substance for any degree, and is not being currently submitted in candidature for any degree.

…….. Signature
(Mr. Om Krishna Prasain)
Candidate

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Major Program Environmental Management

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ABSTRACT

The goal of this research is to make more use of renewable energy in the field of Nepali sports. As the inconsistency between human advancement and natural upkeep is progressively prominent, sustainability has become an altogether critical objective for future improvement. In a country like Nepal in the Southern Hemisphere, it can be speculated that if renewable energy can be used and used in sports infrastructure, it can lead to sustainability in development.

This paper investigates the awareness and perception of players on the use of renewable energy in sports, energy consumption of stadiums and factors influencing, existing situations of sports events and activities, key sustainability initiatives that are currently being implemented in the sports sector of Nepal and key challenges for implementing the renewable resources in sport. Both qualitative and quantitative methods were used for this research. Data is analyzed through subjective strategies, geographical, theme, and contents basis to distinguish topics to the current status of the use of renewable energy for the sustainability of sports.

The analysis of results provides valuable insight into the determinants of sports player's attitudes towards the implementation of renewable energy sources. This valuation research reveals that the vast majority of the respondents knew renewable energy is an energy derived from natural source which is right and few responded wrong. Many key informants also are unaware of the RE on sports. It is obvious that there is a great need for raising awareness of all sports players, leaders, officials and policy makers by continuous and focused campaigns regarding the use of RE on sports. It was found that the perception of people in rural area was different from urban area regarding RE. So, the supportive policies and favorable investment frameworks for RE is necessary in

order to achieve the market dispersion required for fulfilling the demand of energy requirements and sustainability targets.

Therefore, this study is expected to be useful in spreading understanding among general people about the application of renewable energy by obtaining data of sports player knowledge and perceptions which might influence the general people.

Keywords: Nepal, Renewable Energy, Sports, Sustainability, Perception, Awareness

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Om Krishna Prasain

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AD	:	Anno Domini
AEPC	:	Alternative Energy Promotion Centre
BC	:	British-Columbia
BMO	:	Bank of Montreal
BS	:	Bikram Sambat
CO_2	:	Carbon dioxide
Covid 19	:	Corona Virus Disease 2019
CTEVT	:	Council for Technical Education and Vocational Training
EU	:	European Union
FIFA	:	Federation International de Football Association
FY	:	Fiscal Year
GDP	:	Gross Domestic Product
GW	:	Gigawatt
HIDCL	:	Hydropower Investment Development Company
ID	:	Identity
IMF	:	International Monetary Fund
IOE	:	Institute of Engineering
IOM	:	Institute of Medicine
IRENA	:	International Renewable Energy Agency
KII	:	Key Informant Interview

KU	:	Kathmandu University
KVA	:	kilo-volt-amperes
KWH	:	Kilowatt-Hours
LED	:	Light Emitting Diode
LPG	:	Liquid Petroleum Gas
m.	:	meters
MW	:	Megawatts
NAST	:	Nepal Academy of Science and Technology
NGOs	:	Non-governmental Organizations
PhD	:	Doctor of Philosophy
PV	:	Photovoltaic
RE	:	Renewable Energy
RECAST	:	Research Centre for Applied Science and Technology
ROR	:	Run-Off-River
SDG	:	Sustainable Developments Goal
SMART	:	Specific, Measurable, Achievable, Relevant, and Time-Bound
SPSS	:	Statistical Package for Social Sciences
sq Km.	:	square kilometer
TU	:	Tribhuvan University
TV	:	Television
TWH	:	Terawatt hours

U.S.A.	:	United States of America
UAE	:	United Arab Emirates
UN	:	United Nations
USD	:	United States Dollar
WB	:	World Bank
WCED	:	World Commission on Economic Development
WHO	:	World Health Organization
WWEA	:	World Wind Energy Affiliation

CHAPTER 1: INTRODUCTION

1.1 Background

Sports always played a significant role throughout history, defending peace and unification people. Now, as human faces a climate crisis- exactly its biggest challenge ever sport must once, again and again, grow up to the occasion. Sports in common and major sports occasions in specific have a vital role to plays in promotion and supporting sustainability(Mandela, 2000). Over the past few decades' sports have developed exceptionally quickly in terms of social significance and prominence. In social terms Sports has been a key driver within the quick development of the mass media, especially television and mass media administrations at national and transnational levels (Giulianotti, 2015). Sports is mandatory an imperative enabler of feasible advancement. we recognized the developing commitment of sports to the realization of advancement and peace in its advancement of tolerance and regard and the commitments it makes to the strengthening of women and youthful individuals, people and communities as well as to welling, instruction and social inclusion goals (Voituriez et al., 2017). Numerous tourism businesses combine sports to pull in more clients to encourage the advancement of the economy and advancement of nearby culture. Be that as it may, it is a critical assignment to set up a comprehensive tourism assessment system for economical sports tourism (Yang et al., 2020).

Sports and development are normally complementary forms that can empower the government and other partners of economic improvement to construct distant better; a much better; a higher; a strong; an improvement a much better world. Sport is powerful social change, a strong social connector and a good presenter that brings people of different socio-cultural, multi-ethnic and multi-lingual diversities together. Sports is effectively utilized to advance social incorporation which gives rest with in the periods of conflict, builds belief and build up bridges between bunches in strife; it too contributes to peace building in the post struggle circumstance and advances a culture of youth strengthening (Nwankwo et al., 2016). Sports activities and venues can have a major effect on the environment, there's a common connection between sports and natural preservation (Blankenbuehler & Kunz, 2014).

To combat air pollution to maintain social prestige, through sports, to maintain peace and tolerance, to maintain social inclusion, to develop sports tourism, to develop culture, to

educate the youth, to transform society, to achieve social success, sustainability can be achieved by renewable energy.

Although development and sport complement each other, it is physical construction must be done properly. Sports infrastructure is also affecting the environment, but while preparing to build infrastructure, it should be environment friendly. Considering the environment, the use of renewable energy can be the basis of the sustainability of sports.

The world is quick getting to be a town due to the expanding everyday requirements of energy by all populace over the world whereas anything in its form cannot alter. Returning to renewable to assist moderate climate is a fabulous approach that needs to be feasible in arrange to meet the energy requests of future eras**.** (Owusu & Asumadu-Sarkodie, 2016a)**.** Energy is material science and the capacity for doing work. It may exist in potential dynamic, warm, electrical, chemical, automatic or other different shapes. There are besides, warm and exchange may end up warm energy, whereas work done may show itself within the frame of mechanical energy (Blankenbuehler & Kunz, 2014). The researcher characterizes energy is the capacity to do work. There are many different types of energy. Heat, Light, Chemical, Motion, Electrical and Gravitational are the major types of energy (Maros & Juniar, 2016). Renewable energy is created utilizing normal assets that are always supplanted and never run out. Just as there are numerous characteristic sources of power, same numerous renewable energy advances(H., 2016) Renewable energy sources counting biomass, geothermal, sea, sun power, and wind energy, as well as hydropower-have a tremendous potential to supply energy administration for the world(FONA, 2020). Renewable energy is contributing essentially to fulfill the persistently increasing energy request of the world due to tremendous innovative improvement in arrange to form human life more affluent and maintainable. Solar energy, Wind energy, and Bio energy are the most contributing renewable energy. Sun powered energy is the fundamental source of renewable energy and has main potential to meet the energy request of the world (Kale, 2017).

The meaning of sustainability is the consideration of how common frameworks work, stay assorted and create everything it needs for the biology to stay in adjusts. It too recognizes that human civilization takes assets to support our advanced way of life(Schmidt, 2006). The concepts of sustainability not only prefer the aspect of environment but also deal the economic and social development. There are three pillars of the sustainability are the economic, environmental and social sustainability. Sustainability is solely based on meeting

human mandatory by balancing the natural resources on which the economy and society relay (Santhana Laxmi & Samydoss, 2020).

In a country like Nepal in the Southern Hemisphere, it can be speculated that if renewable energy can be used and used in sports infrastructure, it can lead to sustainability in development. The Kathmandu Valley has one universal level stadium and some other playgrounds, some small stadium as well as some covered halls. There is regional level stadium in all seven the provinces of the Kingdom of Nepal, which has become a powerhouse for sports in South Asia. The level of a craze in sports is very high in Nepal. Despite its geographical complexity and diversity, it can be developed nationally through sports. And for the development of sustainability, renewable energy can be a boon in the field of sports.

The 21st century is seeing energy problems all over the world. The energy crisis is not just in one place, it is globally. There are problems globally, regionally and nationally to identify the energy problem closely. In fact, the problem of energy is all over the world. Energy is limited, it is expensive, it is so complicated, it is very difficult to achieve. The current energy base is fossil base. It is currently using more and more fossil-based energy in the world and this is unsustainable. The energy of the fossil base is unsustainable even from an environmental point of view. It is also beyond the reach of everyone. Renewable energy is effective in tackling these problems. Nowadays, the utilization of renewable energy which could be a good alternative to fossil fuels has been acknowledged in numerous nations of the world.

The utilization of renewable energy expanding, and in numerous nations, a surprising portion of the specified energy is provided by renewable energy. Human exercises in later a long time with over-the-top outflow of greenhouse gasses have had a negative impact on the increment in worldwide temperature c

There are many studies and research on renewable energy and in the world. There have been some studies and researches, especially in the American country, Asian countries and European but this is not enough. In the case of Nepal, too, little research has been done on renewable energy, and all that has happened is inadequate. In a country like Nepal, not much research has been done on renewable energy. This knowledge and technology have also been used to a lesser extent. Renewable energy and solar energy are used very little in the context of Nepal, even if it is 0% in the sports sector. There is no concept in the study or

research to use the knowledge of solar energy. It is almost impossible to put it into practice. If we can supply sustainable energy in sports continuously, sports programs can be conducted in all regular.

Nepal is in an energy emergency. Nepal has around 703 MW of era capacity, comprising 53.41 MW warm ventures, 100 KW of sun-based venture and the rest from hydro controls projects. In spite of the diffraction political environment for the changes and advancement exercises, Nepal's GDP grew by 3.8 percent every year on normal from FY2005-FY2009.2. The energy necessary for the in general economy has expanded numerous folds and will increment advance in see of the anticipated future development power and people (Banerjee et al., 2011).

Renewable energy, which has immense potential, has been researched in some countries of the world and its knowledge has been used, but due to the lack of research in the field of sports in Nepal and its knowledge has not been used, the topic of energy research can become one of today's hottest research issues. Renewable energy is a worthy subject to be researched. It is suitable as well as innovative. In the case of Nepal, it will be completely new and fruitful. If this subject is well researched and studied, some new knowledge and contribution can be given. Every sport venue needs a big amount of power, in specific on match days when lighting, air-conditioning and video screen all electricity, along with a vast multitude of other energy-intensive demands. The potential for incorporating renewable energy technology into sports venues and the surrounding areas provide a big opportunity for diminishing nursery gas emission.

1.2 Statement of the problem

The 21st century is seeing energy problems all over the world. The energy crisis is not just in one place, it is globally. There are problems globally, regionally and nationally to identify the energy problem closely. In fact, the problem of energy is all over the world. Energy is limited, it is expensive, it is so complicated, it is very difficult to achieve. The current energy base is fossil base. It is currently using more and more fossil-based energy in the world and this is unsustainable. The energy of the fossil base is unsustainable even from an environmental point of view. It is also beyond the reach of everyone. Renewable energy is effective in tackling these problems. Nowadays, utilize of renewable energy which could be good an elective to fossil fuels has been acknowledged in numerous nations of the world.

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The energy necessary for the in general economy has expanded numerous folds and will increment advance in see of the anticipated future development power and people (Banerjee et al., 2011). As natural mindfulness develops, feasible sports offer a stage from which to address hot issues and contribute to a feasible future. The current center on the environment in sports is anticipated to proceed due to social values and desire of partners, government intercession, and required prerequisites for certain certification.

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and fruitful. If this subject is well researched and studied, some new knowledge and contribution can be given.

1.3 Research Objectives

i. To explore the awareness and perception of player on use of RE in sports.
ii. To determine the energy consumption of stadium and factors influencing sustainability.
iii. To find out the existing situations of RE use of sports events and activities.
iv. To investigate and document the key sustainability initiatives that is currently being implemented in the sports sector of Nepal.
v. To identify the key challenges for implementing the renewable resources in sport

1.4 Research question

i. What are the awareness and perception of player on using of RE in sports?
ii. What is the energy consumption of stadium and factors influencing sustainability?
iii. What are the existing situations of RE use of sports events and activities?
iv. What are the key sustainability initiatives that are currently being implemented in the sports sector of Nepal?
v. What are the key challenges for implementing the renewable resources in sport?

1.5 Research Gap

Energy has been used traditionally for a long time. With the development of society new invention of technology are taking place. The modern world has started using renewable energy. Different types of energy are being used. With the developing of other things, of new dimension has been added to renewable energy. British-American engineer James Francis first installed hydroelectric power in 1882 to generate electricity. At the same time there have been a number of studies and research on energy related to renewable energy, initially in the United States, British and European countries, and gradually in South American countries.

Thus, with the passage of time, various studies and researches on alternative energy have been carried out, hydropower, solar energy, wind energy, biomass and geothermal

energy like this has become not only popular but also indispensable today. Conventional fossil fuels are gradually being replaced by alternative energy. The problem of energy is all over the world. It is expensive, it is so complicated, it is very difficult to achieve. The current energy base is fossil base. It is currently using more and more fossil-based energy in the world and this is unsustainable. The energy of the fossil base is unsustainable even from an environmental point of view. It is also beyond the reach of everyone. Renewable energy is effective in tackling these problems. Nowadays, utilize of renewable energy which could be good an elective to fossil fuels has been acknowledged in numerous nations of the world. The energy crisis is not just in one place, it is globally. There are problems globally, regionally and nationally to identify the energy problem closely. There are many studies and researches on renewable energy and in the world.

In common, the renewable energy frame work (PV and sun powered collectors) can over al building energy needs for building power and hot water, from April to September and the power excess can be sold to the network. But amid the other months, most of the energy is conveyed by the network. After the leading situations 3 (energy-efficient measures combined with the renewable energy source), the retrofitting of the current sports lobby will be accomplished to gotten to be an about net-zero and plus-energy building (the renewable energy innovations in total supply around 85.5%of the amount of the energy require). In the event that the foremost energy-efficient measures are connected and all financially curiously measures are taken to decrease energy utilize. These enhancements are in any case seen at the cost of time, asset, and financial point of see. For energy saving of sports all and stadium, further research is preferred: deeper studies can investigate different renovation solutions regarding new building design technologies and artificial intelligence. Warm and moisture supply in hard physical training will be investigated specifically for different exercise activities(Al-Husinawi, 2017).

Antalya stadium is Turkey’s first solar-energy stadium. The stadium was built in around 2015 within the trust that Turkey would secure the 2024 “European championships” and incorporates a capacity of the 32,000 individuals. The roof is nearly16,000 square meters, and 75% of this is secured with sun-based boards. In add up to there are 6000 boards, sufficient to produce 7,200-kilowatt-hours (kWh) of power a day. When the stadium isn’t in utilized, the control is counterbalanced somewhere else(Farmer, 2022).

Owing to the determinedly advancing power circumstances in Nepal, and the later advance in renewable power advances, this thinks about points to supply an up to date of view on the current power in Nepal. The main concern delayed and overpriced hydro energy projects, outdated and insufficient energy infrastructure, transmission and distribution losses, energy management, lack of energy conversation, low efficiency of equipment unsustainable energy pricing strategies, and unsatisfying energy market regulations. The recent approaches and venture activities of the Nepalese government to bolster green and maintainable energy are discussing. The renewable energy sources copiously show in Nepal are actually the key potential arrangement for the show energy emergency. Be that as it may, making the proper energy blend for Nepal is still subject to talk about (Poudyal et al., 2019).

The energy blend design of Nepal appears that 87.1 percent of the overall energy comes from fuel wood. Fuel wood does not give the sort of energy required for working, perusing, communication, and other essentials administrations fundamental for made strides in quality of life. There are still over four million family units out of around five and a half million families that still require getting to clean energy choices for cooking, lighting, and warning in Nepal(AEPC, 2018).

Renewable Energy in Nepal

About 6,000 rivers, with a total length of approximately 45,000 km with an annual discharge of 200 billion cubic meters of water are accessible in the country (Shrestha, 2014).

Table 1: Type of fuel used for cooking in Nepal

	Total Households	**Firewood**	**Cow dung**	**Firewood+ Cow dung**
Nepal	5,423,297	3,470,224	563,126	4,033,350
% Share		64%	10.4%	74.4%
Mountain	363,698	344,843	1,517	346,360
Hill	2,532,041	1,696,376	2,810	1,699,186
Terai	2,527,558	1,429,005	558,799	1,987,804

Source: National population and housing census (CBS, 2012)

Based on the study of different literatures, it can be said that there have been many studies and researches on energy and renewable energy using different methods in different geographies of the world but there are few countries in the world with such geographical conditions. Only such ecology and environmental studies have not been done for renewable energy. There are many studies and researches on renewable energy and in the world. There have been some studies and researches, especially in the American country, Asian countries and European but this is not enough. In the case of Nepal, too, little research has been done on renewable energy, and all that has happened is inadequate. In a country like Nepal, not much research has been done on renewable energy. This knowledge and technology have also been used to a lesser extent. Renewable energy and solar energy are used very little in the context of Nepal; very little research has been done in the field of sports on how to use renewable energy for sustainable development. There is no concept in the study or research to use. We know about the importance of sports and its impact on the basics of previous literary studies, but also about the importance of sports and renewable energy for sustainable development, for the sustainability of sports, what policies should be formulated for the sustainable development of sports, what are the problems should be studied thoroughly and conclusion should be drawn.

Due to the fact that Nepal is in the Southern Hemisphere, solar radiation can be achieved from 24 hours to 15 hours. In The context of Nepal Solar energy can be obtained from dawn to dusk. Plenty of solar energy can be used even during the rainy season. In addition, power can be obtained from solar radiation for about 9 months out of 12 months. Therefore, solar power is a sustainable and continuously renewable power. Within the long-term exposure to sunlight in Nepal, it is possible to consume 9-10 months of sunlight in 12 months. Therefore, in the context of Nepal, solar energy can be given first priority. Studies conducted many years ago have shown that more than eighty-three thousand megawatts of hydropower can be used to generate energy in Nepal. They are not complete. There is still a lot of research to be done. There is no research on renewable energy and sports, so sports and renewable energy are completely new, not only for Nepal but also for the worldwide community.

1.6 Limitations of the study

This study highly focuses on the preview of the research question and objectives. This research is limited to the scope of research questionnaires and research objectives. This scope

of this study is limited i.e., the kingdom of Nepal only field of study, so this research cannot be generalized in other countries, since it has research in a specific location, specific environment and specific context, it cannot be generalized by comparing it with other places. If the same context has the same environment and the same geography, it can be used in a generalized way with some modification.

1.7 Signification of the study

This research will be great benefit to various college students, university students, academic personalities, researcher, policy maker, and people from all walks of life implementing the policy. Findings this research can be useful for policymakers and policy implementations alike.

The main purpose of this research, as previously stated, has been doing develop conceptual frameworks applicable to sustainability in sports development so as to address identify the weakness of current policy research gap and practical approaches to the subject. The two-frame works examined here, pertaining to definitions of sports sustainability and renewable energy in sustainable development respectively, have been developed by synthesizing concepts in the literature on sustainability of sports and adapting them to the particular context of sports development through the literature review. The main objectives of this research will be on how to bring sustainability to the overall sustainable development of Nepal by using renewable energy in sports infrastructure sports program projects, and management.

Sports development and sustainability present a research challenge that needs to be solved with the help of renewable energy sources. With the focus on sports development increasingly focused on long-term outcomes, understanding whether and how sports development programs can contribute to sustainable development is a vital role in the improvement of diplomacy and practice.

1.8 Conceptual Framework of the study

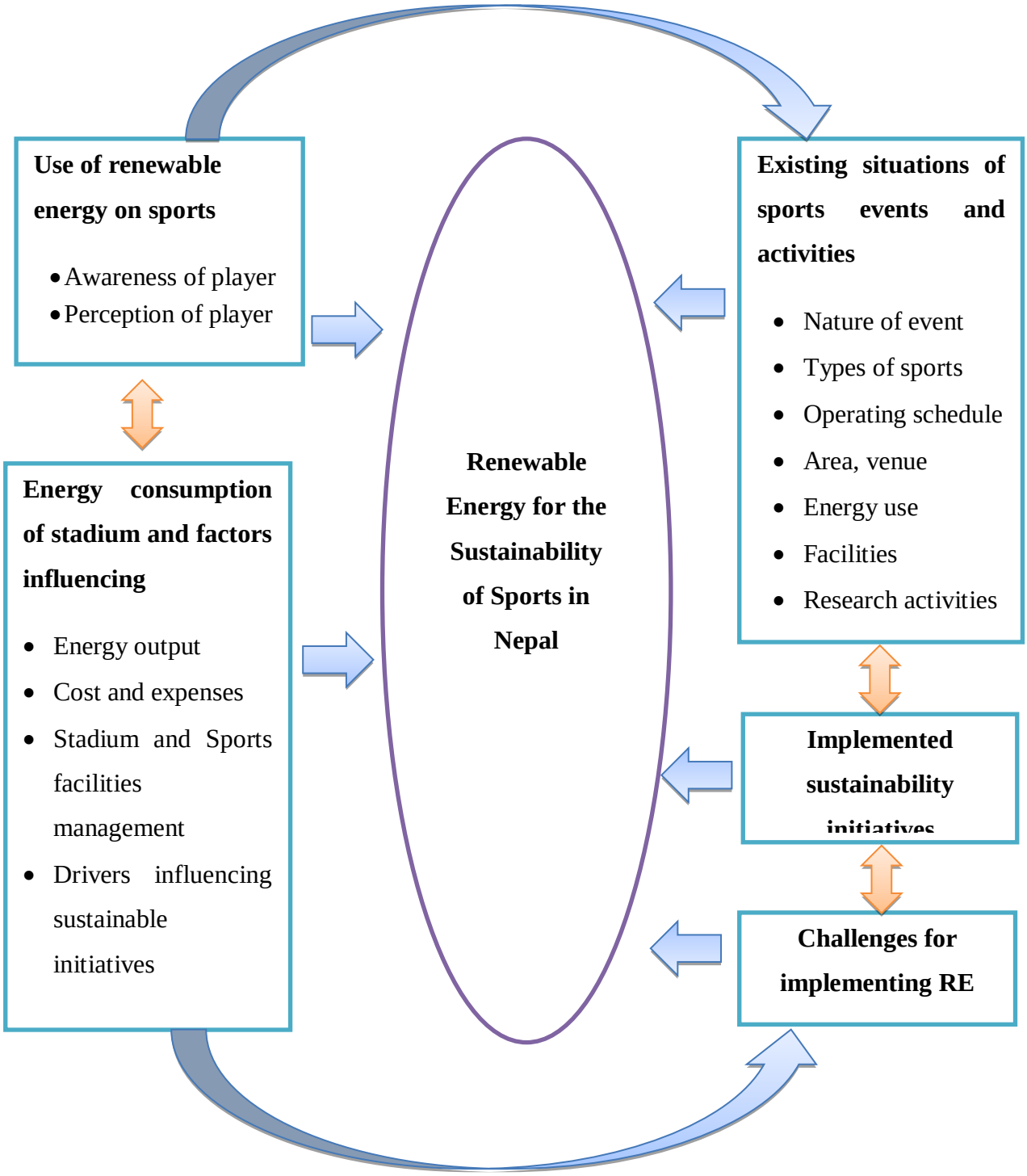
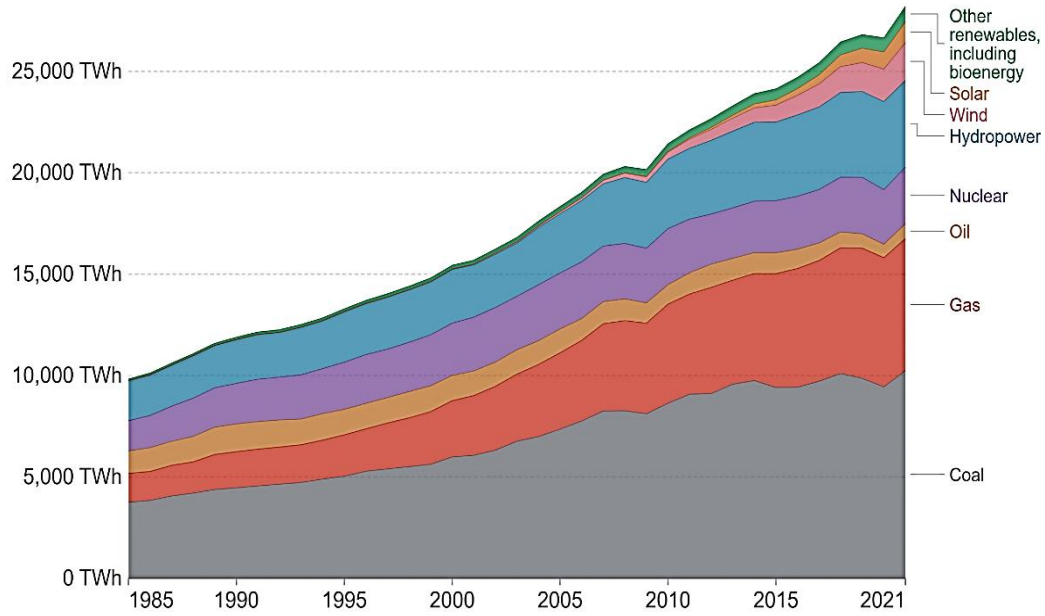


Figure 1: Conceptual Framework of Renewable Energy for the Sustainability of Sports in Nepal

CHAPTER 2: LITERATURE REVIEW

2.1 Definitions of Renewable Energy

The world is quick getting to be a town due to the expanding daily requirements of energy by all populace over the world whereas anything in its form cannot alter. The requirement for energy and its related administrations to fulfill human social and financial advancement, welfare and wellbeing are expanding. Returning to renewable to assist moderate climate to alter is a fabulous approach that needs to be feasible in arrange to meet the energy request of future eras (Owusu & Asumadu-Sarkodie, 2016b). The research characterizes energy is the capacity to do work. Cutting edge civilization is conceivable since individuals have learned how to alter energy one shape to another and after that utilized it to do work. Individuals utilize energy to do walk and bike, to move cars, along streets and vessels through water, to cook nourishment on stoves, to create ice in coolers, to light our homes and workplace, to make items, and to send space explorers into space. There are many different types of energy. Heat, Light, Chemical, Motion, Electrical and Gravitational are the main types of power (Maros & Juniar, 2016).



Source: (World Economic Forum, 2022)

Figure 2: Electricity production by source from 1985-2021

What can be said from the research done so far on energy and renewable energy, renewable energy is contributing essentially to fulfill the persistently increasing energy request of the world due to tremendous innovative improvement in arrange to form human life more affluent and maintainable. Nowadays, utilize of renewable energy which could be good an elective to fossil fuels has been acknowledged in numerous nations of the world the renewable energy generation in numerous nations. Solar energy, Wind energy, and Bio energy are the most contributing renewable energy. Sun powered energy is the fundamental source of renewable power and has main potential to meet the power request of the world. From the use of bicycle to launching rockets into space, renewable energy is used. The above chart shows how much the demand for renewable power is increasing in world day by day.

Renewable energy, regularly alluded to as clean energy, comes from common sources of forms that are always recharged. For illustration, daylight or wind keep sparkling and blowing, indeed in case their accessibility depends on time and climate. Nonrenewable or “dirty” energy incorporates fills such as oil, gas and coal. Nonrenewable energy highly is booming, as innovation brings down costs and starts to deliver on the promise of a clean energy future. Sun energy and wind energy are breaking records and being coordinates into the national power grid without compromising unwavering quality.

Renewable energies are ways to produce energy from boundless common assets. These assets are either accessible with no time limit or recharge more rapidly than the rate at which they are expended. The fossil fuels' coals, natural gas, and oil stocks are very limited and non-renewable in the human timescale. Renewable energies are created from renewable energy sources. Renewable power is normally preferred of as opposed to fossil fuel energies.

Renewable power is too frequently referred to as "green energies" or "clean energies". This does not mean that, this renewable power is not hurtful to the environmental and has zero affect. In any case, they have a less natural affect compared to fossil fills.

Here are a few sorts of renewable energy that are created by distinctive sources such as the sun, wind or water. This information appears, these renewable' energy utilization has been developing over the final year (Fournier, 2020).

Creating and using renewable energy sources utilizing advanced change innovations can be exceedingly responsive to national and worldwide approach objectives defined since of natural, social, economic opportunity, targets and concern.

Some Advantages of Renewable Energy

- Renewable energy is very useful for reducing dependence on and minimizing spending investing on imported fuels.
- Renewable energy for the affected differentiating energy carries for the generation's fills, power and warm; improving energy security; and decreasing the long-run cost of fills from routine sources.
- Mitigating greenhouse emissions down to levels that can be affected.
- Reducing controversy related to the mining and utilized of limited available natural resources.
- For the diminishing contamination, natural outflow, and security dangers from customary energy sources that harm human wellbeing, normal frameworks, crops, and materials.
- Adjusting the utilization of fossil fuels, sparing them for other applications and for future generations.
- Impelling financial improvement, making modern occupations and nearby business, particularly in provincial regions, as most renewable energy advances can be

connected in little, medium, and large-scale frameworks in distributed and centralized applications.

- Making strides get to clean energy sources and transformation advances, in this manner making differences to meet the thousand year's advancement objectives (MDGs) whereas taking advantages of the nearby accessibility of renewable.

The renewable energy plays a basic part within the accomplishment of maintainable improvement, since it is moderately cleaner comparing with fossil powers.

2.2 Types of Renewable Energy

The most popular renewable energy sources currently are:

1. Solar energy
2. Wind energy
3. Hydro energy
4. Geothermal
5. Biomass energy

1. Solar energy

Sun energy is one of our planet's most plenteous and openly accessible energy assets. The sum of sun-based energy that comes to the earth's surface in every hour is more than the planets add up to energy prerequisites for an entirety year. In spite of the fact that is sound like an ideal's renewable energy source, the sum of sun-based energy we are able utilize shifts concurring to the time of day and season of the year as well as geological area. Solar energy continues to be received as long as the sun remains. In fact, solar energy is our planet's latest and most renewable asset.

Sun based energy is the foremost inexhaustible renewable asset on our planet. In show disdain towards this wealth, as it were 0.04%of the basic control utilized by people comes specifically from solar sources since employing a photovoltaic (PV) board costs more than burning fossil powers. Naturals materials have as of late been expectation examined for PV application, the era from natural photovoltaic (OPV) materials will take a toll impressively less than other PV advances (Moulé et al., 2012).

Examples of Solar Energy in the World

- It has a nearly total generation capacity of 1000MW and over 4 million solar panels installed in the Kurnool ultra-solar park in India.
- The Longyan Xia Sun based park in China that includes an add up to capacity of 850MW and covers approximately 25sq Km.
- It has all total capacity of 648MW and covers 10sq Km Kamuthi solar facility in India(Fournier, 2020).

2. Wind energy

Wind may be an inexhaustible source of clean power. To saddle power from wind power, turbine is utilized to drive generators which at that point that bolster power in to the national network. Based on other energies, wind energy is still new energy. The wind energy is utilized to produce electricity using the kinetic energy created by air in motion. Various studies and researches show that 6% of the world's power comes from wind and in the ten years from 2008 to 2012, unimaginable wind turbines were produced. From the table above it is known that in 2019 the world's wind power generation capacity has grown from an average of three million to more than six million. There are a few sorts of wind renewable energy: onshore wind turbines, off-shore wind turbines and even floating wind turbines. But the working standards are essentially the same for all these sorts of wind-generated energy.

Wind power is one of the fastest developing renewable power technologies. Worldwide introduced wind generation capacity inland and seaward has expanded by a calculate of nearly 75 within the past two decades, hoping from 7.5 Gigawatt (GW) in 1997 to a few 564 GW by 2018, concurring to IRENA’s most recent information numerous parts of the world have solid wind speeds, but the leading areas for producing wind control are in some cases inaccessible ones. Seaward wind control offers huge potential(IRENA, 2022).

Some examples of wind energy

- The Gansu Wind Farm in China is going to build and it will be able to produce 20,000MW of power by 2021.
- The Onshore Muppandal Wind farm in India which is capacity of 1,500MW and nearly 3,000 turbines.
- The Alta Wind power Center in the U.S.A with a total capacity of 1,548MW that’s expected to reach 3,000MW by 2040(Fournier, 2020).

3. Hydro Energy

As a renewable energy asset, hydro control is one of the foremost commercially created by building a dam or obstruction, an expensive store can be used to make a controlled stream of water that will drive a turbine, producing power. Hydroelectric control comprises within the change of the active energy of the water (from rivers, dams, marine current or tide) into mechanical energy by turbines.

Hydropower has a few preferences over most other sources producing electrical control. In expansion, hydropower does not produce waste that causes corrosive rain and greenhouse gases, numerous hydropower plants are found in conjunction with supplies, which give water, surge control, and diversion benefits to the community. (Liu et al, 2013). Hydropower projects do more than fair create power; they create natural life, bolster solid fisheries, give water supply, control surges, water arrive for nourishment generation and create recreational opening for individuals(World Bank Group, 2018).

This energy source can frequently be more durable than sun oriented or wind control (particularly on the off chance that it's tidal instead of stream). Hydropower has the extra capacity to alter yield rapidly. Hydropower project is successful in terms of tourism, naturally green, do not produce waste, and have basic features that can control the distribution of water.

Some Examples of hydro-electric power

- The world largest Three Gorges Dam in China introduced capacity 22,500MW.
- The Sihwa Lake Tidal Control Station in South Korea is typically the world's biggest tidal control establishment and it features a capacity of 254MW.
- The Rance Tidal Control Station in Brittany, France, Includes a 240MW capacity.

4. Geothermal energy

The Earth produces and stores geothermal power. In other words, radioactive materials rotting interior the soil is transmitting power. Power could be made utilizing straightforwardly or by implications this energy, depending on the innovation actualized. There are three fundamental path to utilize geothermal power.

a) Creating warm specifically from heat water bubbling on the earth surface.
b) Producing power straightforwardly from the earth's warm
c) Utilizing pumps over shallow ground to warm buildings.

Such energy can usually be extracted from the hot steam obtained from the ground. Such environmentally friendly energy may not be available everywhere. Turkey is one of the leading countries in producing and consuming energy through geothermal energy.

Renewable energy to get the developing power needs and permit the innovative advancements without damaging the long term of our planet, the climate the environment geothermal power which is one of these energies, has awesome significance for a few parts of the worlds for the illustration, turkey has exceptionally wealthy geothermal energy assets and it is poisoned fifth within the world after China, Japan, The USA, and Iceland (Yuksel, 2013).

Example of Geothermal Energy in the World

- The Hellisheidi Geothermal Energy Station in Iceland has a capacity of 400MW of thermal energy
- The Salton Sea Geothermal plants in the U.S.A have a capacity around 340MW.

5. Biomass Energy

Biomass energy is made up natural materials from plants or creatures that contain put away energy. The combination of these normal materials creates renewable power. This can be the change of strong fuel made from plant materials into power. In spite of the fact that on a very basic level, Biomass includes burning natural materials to deliver power, this can be not burning natural materials to deliver power, this can be not burning wood, and these days typically a much cleaner, more energy-efficient handle. For biomass powers, the foremost common feedstock's utilized nowadays are corn grain (for ethanol) and soya beans (for biodiesel).

By changing over agrarian, mechanical and household squander in to strong, fluid and gas, biomass creates control at a much lower temperate and natural fetched. The utilize of biomass energy has the potential to significantly diminish greenhouse gas outflow, reliance on remote oil, landfills, and at long last bolsters nearby agrarian and forest product business.

Useful biomass utilization can moreover be considered a portion of the earthbound carbon cycle the adjusted cycling of carbon from the climate into plants and after that into soils and the air amid plant rot. Other than all of biomass energy focal points, there are too few downsides to it. For illustration, biomass energy is an inadequate source of energy compared to fossils fills (Jagger & Kittner, 2017).

2.3 Importance of Renewable Energy

Any human movement, all energy sources have an effect on our environment. What can be said from the research done so far on energy and renewable energy, renewable energy is contributing essentially to fulfill the persistently increasing energy request of the world due to tremendous innovative improvement in arrange to form human life more affluent and maintainable. Nowadays, utilize of renewable energy which could be good an elective to fossil fuels has been acknowledged in numerous nations of the world the renewable energy generation in numerous nations. Solar energy, Wind energy, and Bio energy are the most contributing renewable energy. Sun powered energy is the fundamental source of renewable energy and has main potential to meet the energy request of the world. From the use of bicycle to launching rockets into space, renewable energy is used.

Advantages of renewable energy:

- Renewable power radiates emits no or low greenhouse gases. It is good for the environment.
- Renewable power emits low air pollutants, which is better for health.
- Renewable power costing is very less. Every people can affordable.
- Renewable energy ha huge potentiality creates jobs opportunity, which is beneficial for the local community.
- Renewable energy makes the energy system flexible and easy, which is important to prevent power storages.
- Renewable energy is attainable to all, which is fruitful for development.
- Renewable energy is safety, which is good for sustainability(REN21, 2019).

2.4 Renewable Energy National Overview

2.4.1 Some glimpses of renewable energy in Nepal

- The major energy asset base in Nepal comprises biomass, hydroelectricity, petroleum items, normal gas, and coal.
- Nepal does not have reserves of oil or gas.
- Nepal includes a tremendous potential of hydropower, but less one and a half percent of the potential around 83,000 MW of hydropower is right now tackled.
- Without environmental effect, here 42,000 MW feasible.
- Nepal's First hydropower was made in 1911.
- 82% of the populace utilizes strong powers such as coal, fertilizer, and wood as cooking energy.
- 78% of individuals have got to network associated energy.
- Current production approximately 1,300 MW.
- Up to July 2019, the peak load is 1160 MW.
- Per capital energy utilization 245 K WH and expected to be 1,500 KKW within the other five years.
- In the final year, Nepal went through nearly twenty Billion bringing in power from India, and Rs 90 billion in petroleum (Ramachandra et al., 2016).

The energy blend design of Nepal appears that 87.1 percent of the overall energy comes from fuel wood. Fuel wood does not give the sort of energy required for working, perusing, communication, and other essentials administrations fundamental for made strides in quality of life. There are still over four million family units out of around five and a half million families that still require getting to clean energy choices for cooking, lighting, and warning in Nepal(AEPC, 2018).Owing to the persistently advancing energy circumstances in Nepal, and the later advance in renewable energy advances, this thinks about points to supply an up to date of view on the current energy in Nepal. The main concern delayed and overpriced hydropower projects, outdated and insufficient energy infrastructure, transmission and distribution losses, energy management, lack of energy conversation, low efficiency of equipment unsustainable energy pricing strategies, and unsatisfying energy market regulations. The recent approaches and venture activities of the Nepalese government to bolster green and maintainable energy are discussing. The renewable energy sources copiously show in Nepal is actually the key potential arrangement for the show energy emergency. Be that as it may, making the proper energy blend for Nepal is still subject to talk about (Poudyal et al., 2019). Nearly 6,000 rivers, with a total length of about 45,000 km with

an annual discharge of 200 billion cubic meters of water are available in the country (Shrestha, 2014).

Table 2: History of Load Shedding in Nepal

Year	Max Load Shedding During Dry Season
2020 BS/1964 AD	Low voltage (around 140 VAC)
2057 BS /2000 AD	Heavy Load Shedding
2062 BS /2005 AD	2 hrs/day
2063 BS/2006 AD	3 hrs/day
2064 BS/2007 AD	8 hrs/day
2065 BS/ 2008 AD	16 hrs/day (expected 9 hrs/day)
2066 BS /2009 AD	18 hrs/day
2067 BS/2010 AD	14 hrs/day
2068 BS/2011 AD	12 hrs/day
2069 BS /2012 AD	10 hrs/day [as of 2069/08/09 BS(9 Dec 2012)]
2070 BS /2013AD	12 hrs/day
2071 BS /2014 AD	8 hrs/day[as of 2071/02/21 BS(4 June, 2014)]

Source: (Shrestha, 2014)

SECTORIAL COMMITMENT IN NATIONAL ELECTRICITY GRID IN NEPAL

Table 3: Energy status in 2019

Source	No. of Projects	Capacity (MW)
Hydro NEA	16	563

Hydro IPP	62	560
Diesel	2	53.4
Solar	2	1.68
Import from India	2	340

Source:(NEA, 2020)

Nepal faced a devastating control deficiency for a decade 2006-2016. In 2014 winter session, Nepalese people were persevering 14-18hours of control load shedding each day. However, Nepal has formally reported the disposal of load shedding in Nepal from May 2018.

STATUS OF RENEWABLE ENERGY IN NEPAL

S. No.	**Particular**	**Capacity (MW)**
1	Major Hydro (NEA)- Grid Connected	559.50
2	Total Small Hydro (NEA)- Isolated	4.50
3	Total Hydro (NEA) (A)	564.0
	Total Hydro (IPP)(B)	560.0
4	Under construction Hydropower	1017.10
5	Planned and Proposed	2920.20

Source:(NEA, 2020)

Due to the fact that Nepal is in the Southern Hemisphere, solar radiation can be achieved from 24 hours to 15 hours. In The context of Nepal Solar energy can be obtained from dawn to dusk. Plenty of solar energy can be used even during the rainy season. In addition, power can be obtained from solar radiation for about 9 months out of 12 months. Therefore, solar energy is a sustainable and continuously renewable energy. With the long-term exposure to sunlight in Nepal, it is possible to consume 9-10 months of sunlight in 12 months. Studies conducted many years ago have shown that more than eighty-three thousand megawatts of hydropower can be used to generate energy in Nepal. Nepal includes a tremendous potential

of hydropower, but less than one and a half percent of the potential around 83,000 MW of hydropower is right now tackled. Without environmental effect, here 42,000 MW is feasible. Therefore, in the context of Nepal, solar energy and Hydroelectricity can be given first priority.

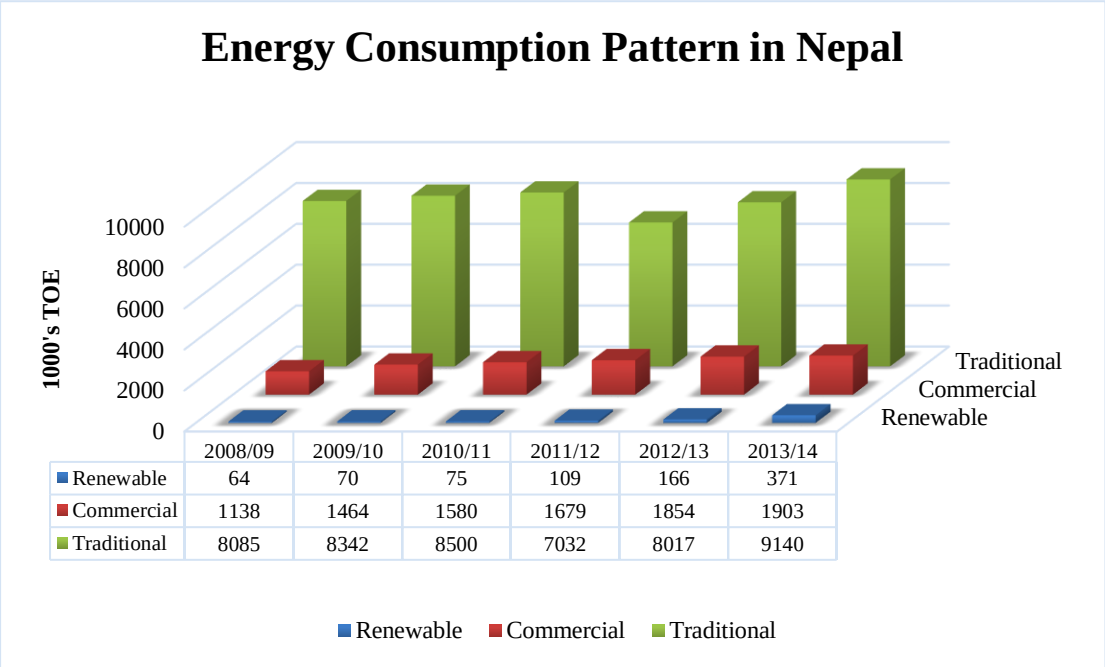
2.5 Hydropower Global Overview

Worldwide hydropower introduced capacity come to 1,308 Gig watts (GW) in 2019, as 50 nations and domains completed Greenfield and upgrade projects. The nations with the most noteworthy increments in 2019 were Brazil (4.92GW), China (4.17GW), and Laos (1.89 GW). The local to include the foremost capacity was East Asia and the pacific, followed by South America and after that South and Central Asia. An add-up to of 15.6 GW in introduce capacity was included in 2019, down on the 21.8 GW record in 2018. Speaks to a 2019, rise of 1.2 percent. India has surpassed Japan as the fifth biggest world hydropower maker with it is add up to introduce capacity presently standing at over 50 GW. The report appears power era hit a record 4,306 terawatt hours (TWH) in 2019, the single most noteworthy commitment from a renewable energy source in history(IHA, 2020).

Hydropower is a clean and renewable power source. Considering the financial, specialized and natural beneficial of hydropower, most nations pride a need for its improvement.

- Hydropower's 'fuel' is compulsory boundless and isn't finished amid the generations of power. Hydropower facilities essentially saddle the characteristic energy of streaming and falling water to produce water.
- Hydropower employment water to create power. It is climate friendly and does not deliver discuss contamination or make any harmful by-product.
- Hydropower is the foremost productive way to create power.
- Hydropower can from zero control to greatest yield quickly and typically. This makes hydropower especially great at assembly changing request for power and giving auxiliary electrical administrations that keep up the adjust between supply and request.
- Hydropower has the extra capacity to alter yield rapidly. It's interesting voltage control, load-following, and cresting capabilities are critical for electric grid stability.

Hydropower projects do more than fair create power; they create natural life, bolster solid fisheries, give water supply, control surges, water arrive for nourishment generation and create recreational opening for individuals(World Bank Group, 2018). Hydropower is produced utilizing the mechanical energy of streaming water by constraining it through channeling called a penstock, which at that point turns a generator in arrange to deliver power. Hydropower has a few preferences over most other sources producing electrical control. In expansion, hydropower does not produce waste that causes corrosive rain and greenhouse gases, numerous hydropower plants are found in conjunction with supplies, which give water, surge control, and diversion benefits to the community (Liu et al., 2013).



Source:(Shrestha, 2014)

Figure 3: Energy Consumption Pattern in Nepal (2008-2014)

According to the various journal, articles, and thesis published by 2020 and on the basis of literature review, the current hydro production capacity in the world is 1308 Gig Watt (GW). Hydropower is considered as a national pride. Hydropower has the power or ability to convert energy instantly. Hydropower projects are successful in terms of tourism, naturally green, do not produce waste, and have basic features that can control the distribution of water. Human activities in later a long time with over-the-top outflow of

greenhouse gasses have had a negative impact on the increment in worldwide temperature. The utilization of renewable energy expanding, and in numerous nations, a surprising portion of the specified energy is provided by renewable energy.

2.6 Solar Energy Global Overview

Sun power energy is a genuine renewable asset. Sun based energy is non-polluting, does not make greenhouse gasses, such as oil-based energy does not do, nor does it make squander that must be put away, such as automatic energy. Sun-powered energy frameworks too have an exceptionally small effect on the encompassing environment; in differentiating with a renewable energy source such as wind and hydroelectricity control. Sun based panels have no moving parts and require exceptionally small support past regular cleaning (Pogson et al., 2013). Sun based energy is the foremost inexhaustible renewable asset on our planet. In show disdain towards this wealth, as it were 0.04%of the basic control utilized by people comes specifically from solar sources since employing a photovoltaic (PV) board costs more than burning fossil powers.

Naturals materials have as of late been expectation examined for PV application, the era from natural photovoltaic (OPV) materials will take a toll impressively less than other PV advances (Moulé et al., 2012).Concentrating sun-oriented control employments the warm from the sun to deliver steam, which in turn powers a generator that creates power. This too has working costs and tall productivity and can create a solid supply of energy by utilizing warm storage(Lai et al., 2014). The era of power from renewable energy source has experienced a fast improvement in later a long time. All-inclusive 14 GW, sun oriented photovoltaic were introduce as of 200. In 2018, establishment comes to 512 GW, agreeing to preparatory insights. This is often an increment of 37 times in 10 a long time, an extraordinary improvement(TEROC & Sidén, 2016). Sun oriented energy remains as the foremost prominent source of energy because it is cost effective and natural friendly. The cost of fossil fuel and the power costs have risen persistently, since the final few a long time. Due to the normal human activities there’s a major cause a climate which is due to the over-the-top outflow of greenhouse gasses like carbon dioxide, methane and so on. In later a long time, natural issues have expectations for each person with in the world and the solar power era could be a strategy of tacking energy related issues that are picking up uncommon consideration. Compared with any other energy source, photovoltaic energy is non-polluted and abundant benefits (Kaliappan et al., 2019).

The sum of energy with the frame of warm and radiations called sun-based energy. Sun-powered energy is created by the day light could be a non-vanishing renewable source of energy which is free eco-friendly. The major advantages of sun-powered energy over other ordinary control generations is that the day light can be directly converted in to sun-based energy with utilize of the little photovoltaic (PV) sun based cells (Shaikh & Parikrama, 2017).

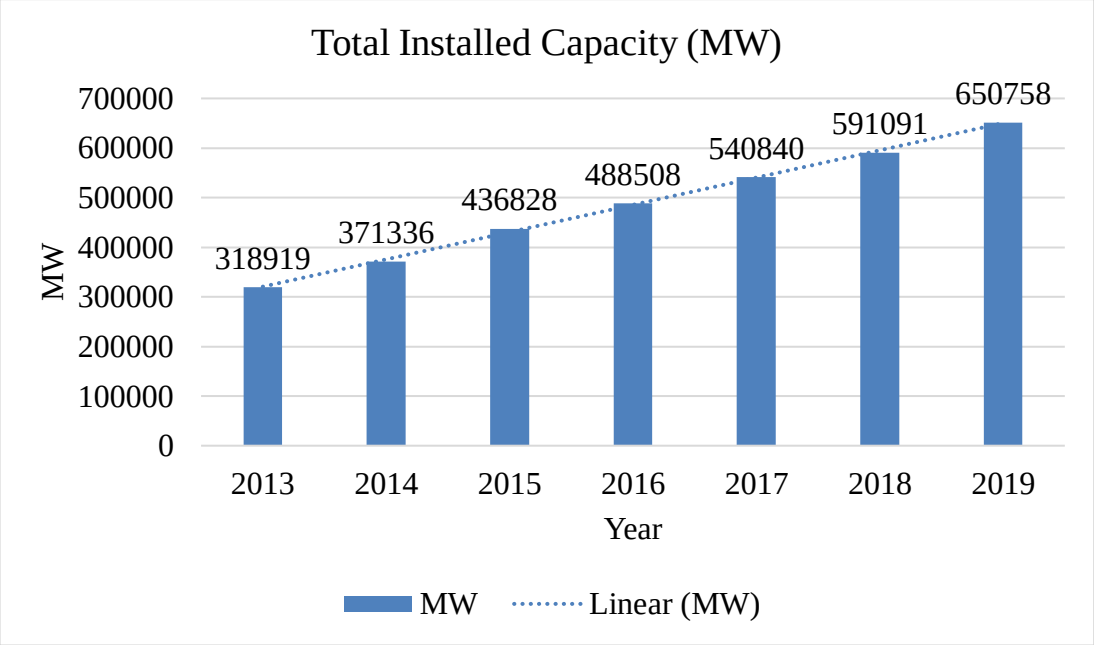
Solar energy is very beneficial than other renewable energy. Solar energy is a regular source of energy. Solar energy is a continuous and renewable energy. Solar energy continues to be received as long as the sun remains. In fact, solar energy is our planet's latest and most renewable asset. The popularity and utility of solar energy has grown so much that it has managed to produce up to 37 times in the last ten years.

2.7 Wind Energy Global Overview

Wind control has been tackled for thousands of a long time, but as it were within some decade has it created amount of commercial energy (Fetter, 2000). Wind control may be an exceptionally basic handle. A wind turbine changes over the dynamic energy (motion) of wind into mechanical energy that’s utilized to create power. The energy is encouraged through generator, changed over a moment time in to electrical energy(Lai et al., 2014). Wind energy is one of the fastest growing renewable energy technologies. Worldwide introduced wind generation capacity inland and seaward has expanded by a calculate of nearly 75 within the past two decades, hoping from 7.5 Giga Watt (GW) in 1997 to a few 564 GW by 2018, concurring to IRENA’s most recent information numerous parts of the world have solid wind speeds, but the leading areas for producing wind control are in some cases inaccessible ones. Seaward wind control offers huge potential(IRENA, 2022). The fully installed wind energy within the world was 121 GW in 2008. In 2018, the introduced control had expanded to 600 GW- a fivefold increment in 10 a long time. Wind control produced 6% of the worldwide electrical control supply(TEROC & Sidén, 2016).

Agreeing to insight displayed nowadays by the world wind energy affiliation (WWEA) amid a webinar. 59,667 Megawatt were included within the year 2019, considerably more than in 2018 when as it were 50,252 Megawatt got raised. 2019, was the moment most grounded wind year in terms of showcase measure, with a development rate of 10.1% higher than the 9.3% of the past year but lower than in 2016 and 2017. All wind

turbines introduced by the conclusion of 2019 can over more than 6% of the worldwide power request(WWEA, 2022).



Source: (WWEA, 2022)

Figure 4: Total Installed Capacity trend from 2013-2019

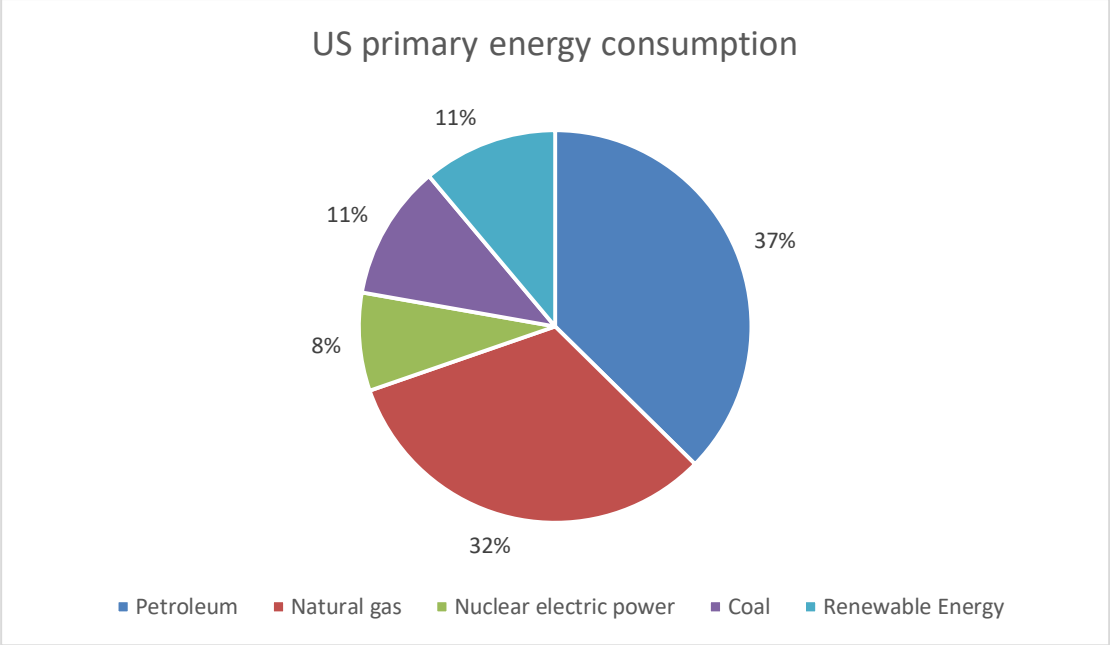
Based on other energies, wind energy is still new energy. The wind energy is utilized to produce electricity using the kinetic energy created by air in motion. Various studies and researches show that 6% of the world's energy comes from wind and in the ten years from 2008 to 2012, unimaginable wind turbines were produced. From the figure above it is known that in 2019 the world's wind power generation capacity has grown from an average of three million to more than six million.

2.8 Biomass Energy Global Overview

The utilize of biomass power has the potential to significantly diminish greenhouse gasses outflow, reliance on remote oil, landfills, and at long last bolsters nearby agrarian and forest product business. For biomass powers, the foremost common feedstock's utilized nowadays are corn grain (for ethanol) and soya beans (for biodiesel also). Wood is still the biggest biomass energy asset nowadays, but other sources of biomass can moreover be utilized. These incorporate nourishment crops, green and woody plants, buildups from horticulture or ranger service, oil-rich green grown, and the natural component of civil and mechanical squanders. Indeed, the methane smolder from landfills can be utilized as a

biomass energy source. The most biomass feedstock for control is paper process buildup, stumble process scrap, and civil squander. Long terms plan incorporate developing and utilizing committed energy crops, such as fast-growing trees and grasses and green growth. These feed stocks can develop reasonably on arrive that will not back seriously nourishment crops. Another advantage of biomass it is capability to change over into a run of important powers, chemicals, materials and product much like rough oil(National Renewable Energy Laboratory, 2020). Useful biomass utilization can moreover be considered a portion of the earthbound carbon cycle the adjusted cycling of carbon from the climate into plants and after that into soils and the air amid plant rot. Other than all of biomass energy focal points, there are too few downsides to it. For illustration, biomass energy is an inadequate source of energy compared to fossils fills (Jagger & Kittner, 2017). Another natural effect of biomass energy is related to arrival disintegration since the evacuation of the green vegetation. (Pimentel et al, 1995). The government of Nepal is exceptionally sharp on creating renewable energy. The source of energy within the nation is hydropower and the nation's employments as it was 15%of the potential energy supply. There are some plans for creating the biomass potential of the nation. The governments started to extend on energy productivity targets the industrial sector. The government has to institutional capacity building and formulates a national energy approach. The nation is welcoming to investors to support the country require for energy effectiveness venture. Government authorities also want to know on the off chance that there has been effective execution on energy effectiveness, what kind of innovation is fitting for the nation, and the speculation fetched (Pagliaro, 2007).

Biomass energy is produced based on things like agriculture and forestry. Biomass can be a boon for underdeveloped and agricultural countries like Nepal. From the study of the above literature, it can be said that the Government of Nepal has invested heavily in biomass. The Government of Nepal has clearly stated in its policy on renewable energy.



Source: (EIA, 2020)

Figure 5: US primary energy consumption by energy source in 2019

2.9 Geothermal Energy Global Overview

The geothermal prepare includes catching warm underground, at that point building energy that rises close to the surface within the shape of warm. When this warm normally makes hot water or steam, it is tackled and after that utilized to run a steam turbine to produce power. Geothermal energy is amazingly kind to the environment. It offers a steady, proficient supply of clean energy with negligible effect on its environment (Geothermal Engineering Ltd, 2022).

Renewable energy to meet the developing energy needs and permit the innovative advancements without damaging the long term of our planet, the climate the environment geothermal energy which is one of these energies, has awesome significance for a few parts of the worlds for the illustration, turkey has exceptionally wealthy geothermal energy assets and it is poisoned fifth within the world after China, Japan, The USA, and Iceland (Yuksel, 2013).

Such energy can usually be extracted from the hot steam obtained from the ground. Such environmentally friendly energy may not be available everywhere. Turkey is one of the leading countries in producing and consuming energy through geothermal energy.

2.10 Sports Global Overview

Sports is mandatory an imperative enabler of feasible advancement. we recognized the developing commitment of sports to the realization of advancement and peace in its advancement of tolerance and regard and the commitments it makes to the strengthening of women and of youthful individuals, people and communities as well as to welling, instruction and social inclusion goals (Voituriez et al., 2017). Sport is the foremost precious product we are able to hand on the next generation (RPMF, 2014).

Sports is not only as it is the shape of work out; It's not fair a coordinate on the field or competitions in a karate mat, nor competitions on a dashing track, but it may to offer assistance in creating imaginative viewpoints and reorganization in our everyday lives and how we connected and how-to run-in society. We respect not as it is as entertainment form but moreover social betterment development. We endeavor to be a dependable brand that brings genuine esteem to the country and individuals from all strolls of life. Sports can bring individuals together beneath different circumstances and feelings counting diversion shared dreams solidarity, distress, and fellowship, both men and women alike. In addition, sports can offer assistance with the improvement of learning forms and refine one's intellect to buildup connections with each one another in families and society (TRUE CORPORATION, 2019).

Sports activities and venues can have a major effect on the environment, there's a common connection between sports and natural preservation (Blankenbuehler & Kunz, 2014). Sports always play a major role throughout history, safeguarding peace and unification people. Now, as human faces a climate crises-exactly its biggest challenge ever sport must once, again and again, grow up to the occasion. Sports in general and major sports events in particular, have a vital role to plays in promoting and supporting sustainability(Mandela, 2000). We outline, on one hand, how environmental issues impact (and may impact, in the future) sport and physical culture, and on the other hand, how sport and physical cultural activities impact (and may impact) the environment (Wilson & Millington, 2020).Sports in general and major sports events in particular, have a vital role to plays in promoting and supporting sustainability (Mandela, 2000). Sport is powerful social change, a strong social connector and a good presenter that brings people of different socio-cultural, multi-ethnic and multi-lingual diversities together. Sports is effectively utilized to advance social incorporation which gives rest with in the periods of conflict, builds belief and build up bridges between bunches in strife; it too contributes to peace building in the post struggle

circumstance and advances a culture of youth strengthening (Nwankwo et al., 2016). Sports is mandatory an imperative enabler of feasible advancement (Voituriez et al., 2017). Over the past few decades sports has developed exceptionally quickly in terms of social significance and prominence (Giulianotti, 2015). Major sports occasions devour impressive sums and power, much of which is created by burning fossils powers, such as coal and oil (People & Information, 2019).

The natural impacts of large-scale sports events have come under examination. For case, a major wear occasion, such as the FIFA world container of soccer, has energy affect proportionate to 3 million kilowatt-hours of energy (comparative to the utilizations required to meet the requests of 700 household's yeas in Europe (Schmidt, 2006).

A sport is the only force that has a lot of potential for social transformation. Sports and development are generally complementary forms that can empower the government. Sports are scientific not only physically but also mentally. In today's modern society, sports are considered as sports science. Sport is no longer just entertainment; it is the identity of the country and can also be seen as a means of creating employment. There is a saying that to understand the development status of any country, one has to look at the level of the country's game. Large amounts of energy are being used at mega sporting events, often using fossils fuels such as coal and oil, which have a major impact on the environment.

From the various literary studies done above, it is clear that renewable energy is being widely used even in the world's largest arenas. On this basic, even in the context of Nepal, renewable energy can be used to move forward for the sustainable development of sports.

2.11 Sports and Politics

Sport is not only an academic subject. It may be a practical capacity, a set of aptitudes and a part that's almost quality conveyance of opportunity. Sports improvement is around the advancement and arrangement of wearing conceivable outcomes to the populace. The past a long time have seen noteworthy development within the region of sports council activities. There have been numerous examples illustrations over a long time of sports being included in legislative issues, and of major universal clashes or contentions influencing the sports. Many more classical sports thinkers and modern sports wishers have felt that politics should not interfere in the sports sector because the sports is about some of the more philosophical

aspirations of the human race, while the exercise of lawmakers and legislative issues are less classy(Watt, 2003).

A sport is always above politics. Sports also play an effective role in inter-continental and inter-continental issues. Other strategically unresolved issues can be resolved through sports. At the same time, the conduct of sports can sometimes be disrupted, leading to fights at major championships and tournaments.

2.12 Definitions of Sustainability

In recent times, sustainability becomes the main destination of the organization. Due to the high demand of corporate social responsibility all sectors started focusing on the sustainability issues. The concepts of sustainability not only prefer the aspect of environment but also deal the economic and social development. Not only that, and for the development of sustainability, solar energy can be a boon in the field of sports it deals directly or indirectly associated with building competitiveness. The World Commission on Economic Development (WCED 1987), display the definition of sustainable development as "development that meets want of the display without compromising the capacity of future eras to meet their needs.'' There are three pillars of the sustainability are the economic, environmental and social sustainability. Sustainability is solely based on meeting human mandatory by balancing the natural resources on which the economy and society relay upon (Santhana Laxmi & Samydoss, 2020).

The concepts of sustainability not only prefer the aspect of environment but also deal the economic and social development. Sustainability relates as it is to the natural measurement genuine sustainability moreover incorporates both the social a financial measurement beneath the umbrella of what is commonly named triple foot line sustainability. In spite of the fast that there has been much talk over the final decade with respect to the requirements for sustainability, the elemental significance of the issue has truly as it is come to the fore over a final couple a long time in line with the unmistakable quality given to the issues of climate change.

Now globally recognition of the importance that sports and sustainability play in the worldwide in terms of economic and social contributions as well as its potential for growth. It is crucial that the two-way relationship between sports and renewable energy and sustainability is understood. This is valuable from an ethical perspective to understand the

impact that sort and energy has on the external environment so that this effect can be more effectively managed, this is also important that the impact of changes in the external environment on the sustainability of sport and energy are understood.

There are four different types of sustainability.

(1) An organization run by foreign aid: Such plans are made in any corner of the world and are applicable all over the world like IMF, WB, and UN.
(2) To be operated by national plan: Any country makes its own kind of plan like let's, build our own village in Nepal, happy Nepali, prosperous Nepal.
(3) Programs and plans at the local level: The local bodies work according to the limited geographical conditions and the needs of the local people.
(4) Community level plans: The work done by the community for its own benefit, in which neither the government nor foreign aid is extended. Such things are don oneself for oneself, such as building roads, making ponds, making an aging home, etc.

2.13 Importance of Sustainability

There are three pillars of the sustainability are the economic, environmental and social sustainability. Sustainability is solely based on meeting human mandatory by balancing the natural resources on which the economy and society relay upon (Santhana Laxmi & Samydoss, 2020).An ecosystem, a lifestyle, or community that is sustainable is one that supports itself and its surroundings (H., 2016).

Sustainability itself can be characterized by three center components, each of which must be carefully considered in connection to the others:

- Environmental Protection
- Social Development
- Economic Development

Supporting and making a sustainable biological system must, of course, put a critical center on natural protection. Natural assurance involves looking at how utilize the environment influences it, and ready to guarantee that negative impact is minimizing and

behaviors that emphatically affect the environment are emphasized. Human well-being is being ensured; with they appreciate a great quality of life inside a maintainable environmental is basics. Sustainability without financial advancement basically cannot succeed-in arranges to persuade people, communities, and organizations to contribute their assets in sustainability; there must be motivations over and past the long-term preference. Social improvement is additionally an imperative viewpoint of sustainability-and social improvement requires (among numerous other things) financial assets as well.

If, we cannot keep up our quality of life as human creatures the difference of life on soil, or earth's environments unless we grasp it. There are signs from all quarters and from the littlest to the biggest scale that sustainability is something we must address.

2.14 Interrelations between Sports and Sustainability

Sport is powerful social change, a strong social connector and a good presenter that brings people of different socio-cultural, multi-ethnic and multi-lingual diversities together. Sports is effectively utilized to advance social incorporation which gives rest with in the periods of conflict, builds belief and build up bridges between bunches in strife; it too contributes to peace building in the post struggle circumstance and advances a culture of youth strengthening (Nwankwo et al., 2016). Sports activities and venues can have a major effect on the environment, there's a common connection between sports and natural preservation (Blankenbuehler & Kunz, 2014). Major sports occasions devour impressive sums and power, much of which is created by burning fossils powers, such as coal and oil(People & Information, 2019).In the field of sports, relatively few researchers have examined the effect of on the natural ecology or the environmental sustainability of current sport management practices. An indeed little body of work has examined the effect of natural alter on sports(Little et al., 2016).

Sports and the environment are closely connected so that natural contamination influences the wellbeing and effectiveness of people amid preparing of competitors. It is additionally the nature of a few sports that take off a gigantic impression on the environment. In case we inspected natural, social and financial benefits and natural motivations, ready to found that proficient sport organizations field proper emphasis on ecological increasing awareness amongst viewers as well as attracting new visitors. As the inconsistency between human advancement and natural upkeep is progressively prominent, sustainability has gotten

to be an altogether critical objective for future improvement. Not only the development of the sports sector, but also the sustainability of the overall sector very improvement.

2.15 Interrelations between Sports Management and Sustainability

There is a close relationship between sports and environment. Sport is like all other human movement, is set within the physical environment and is bound to have impact on it and be influenced by it. The roots of worldwide natural issues are to be found in local natural conditions, and in this context the interaction of the sporting communities with the environment inside which its exercise is performed out to be analyzed. The effect of environment on sports is more sustainable and coordinate which impacts the planning of certain doing occasion concurring to the reasonableness of the climate and the physical environment.

Worldwide sports presently speak to the rational of worldwide capitalism. Promoting and notice are colossally significant for the victory of a specific occasion or the specific sport for per se. Cut-throat competition is the arrange of the day and it has cleared overall all partners extending from the competitors, groups, and clubs to supports, sports administration firms, unit producers, promoters' and advertisement. Establishment for the improvement of a comprehensive understanding of natural sustainability over the sports industry is instruction.

Sports create broad opportunities to promote ecological awareness, ability building and far-reaching actions for environmental, social and economic development across society. Utilize of renewable materials for fabricating sports attire is another such development. Leather products have given way to engineered items as the previous is extricated from creatures. Of late, sports organizers have ended up concern with decreasing the environmental impression and endeavors have been made to organize economical occasions, i.e., occasions which create as much energy as they expend through measures such as utilize off less carbon seriously innovation and introducing sun powered boards within the stadiums (Abhi, 2015).

2.16 The Use of Energy at Sports Complex

Major sports occasions devour impressive sums and power, much of which is created by burning fossils powers, such as coal and oil(People & Information, 2019). The natural impacts of large-scale sports events have come under examination. For case, a major wear occasion, such as the FIFA World Container soccer, has an energy effect proportionate to 3

million kilowatt-hours of energy (comparative to the utilizations required to meet the requests of 700 households in Europe(Schmidt, 2006).Some examples of the best stadiums for renewable energy: focus for the future.

2.16.1 Lusail Stadium, Qatar

The Lusail stadium in Qatar is organizing the 2022 World Cup final. It will have a capacity of 80,000 seats, when completed according to expert. The stadium will be sun-powered fueled, which in specific will be utilized to preserve temperatures interior the stadium. The solar oriented controlled will lower the stadiums CO_2 outflows by 40% solar energy generating from the car park and the surrounding areas when the ground is not use. This design inspired by the middle east's ancient tradition of craftsmanship.

Source:(FIFA, 2018)

Figure 6: Lusail Stadium, Qatar

2.16.2 Antalya Stadium, Turkey

Antalya stadium is Turkey's first solar-powered stadium. The stadium was built in 2015 within the trust that Turkey would secure the 2024 European championships and incorporates a capacity of 32,000 individuals. The roof is 16,000 square meters, and 75% of this is secured with sun-based boards. In add up to there are 6000 boards, sufficient to produce 7,200-kilowatt-hours (kWh) of energy a day. When the stadium isn't in utilized, the control is counterbalanced somewhere else.

Source: (Doublecheers FM, 2019)

Figure 7: Antalya Stadium, Turkey

2.16.3 Sardar Patel Stadium, India

Sardar Patel Stadium, with a seating capacity of 110,000, will be the world's biggest cricket stadium and the second-largest stadium within the world, which is in Motera, Ahmedabad

Source:(Interesting Engineering Inc., 2017)

Figure 8: Sardar Patel Stadium, India

2.16.4 Rungrado, the world's biggest stadium

Source: (Standard, 2020)

Figure 9: Rungrado Stadium

Pyongyang, North Korea's Rungrado is the world's biggest stadium by the capacity. The opened in 1989, the mayflower shaped field was built as a national of picture of control and degree and obliges 150,000 people. The scene holds various events, from football to diversions but is for the most part utilized for parades and shows up, most exceptionally the annual arrange mass recreations (Chambers, 2019).

2.17 Significance of Policy at Sports Management

There should be a clear policy for the sustainable development of any sector, if the policy itself is not sure, then sustainable development cannot be expected here. Sport is no longer just general. In fact, the field of sports is wide. It is a science in itself. Sports diplomacy, sports engineering, sports tourism, sports psychology, sports therapy, sports leadership, sports information technology, sports facilities management, sports administration, sports governance, sports sustainability, sports, sports medicine, sports finance, sports communication, sports marketing, sports event management, sports accessories management, and sports industry all are closed in sports sector. Sustainable development can be expected even if we can focus on formulating sports policy which is so important and has such a large area. In order for plans and projects to be successful, policy must be clear and implementation side must be equally successful.

Sports and government open approach in numerous nations have been inseparably connected, through the back of sports development-related exercise. The sports advancement arrangement of first class and mass support in Australia and Finland has shaped a conceptual system. Obviously, sustainability of sports policies involves a wide range of issues (Houlihan, 2016).

2.18 Policy on Sports and Energy in the Context of Nepal

As published in the vision 2025 bulletin of the ministry of youth and sports, the following provisions related to sports are included in the policy and implementation of the government.

- To upgrade the level of central stadium and play area so as to turn it to an international level standard, and to construct one central level stadium in every province level.
- One local level one playground: to local level playground for the young people.
- To supply supports materials to programs of national significance held at the local level (Ministry of Youth and Sports, 2020)

The government of Nepal has formulated some policies for sports infrastructure but does not seem to have succeeded formulating policies combining renewable energy. How to use renewable energy in the field of sports to realize the vision of "Happy Nepali, prosperous Nepal" not much research has been done on how to make the most of it and what role renewable energy plays in sustainable development, and no concrete programs have been included in government policy.

Nepal is a landlocked country located between China and India. It has a population of about thirty million and rich in natural resources. It is the second largest country in the world for hydropower potential. Hydropower, solar energy, wind energy, and biomass energy also have huge potential. With the long-term exposure to sun light in Nepal, it is possible to consume 9-10 months of sunlight in 12months.therefore, in the context of Nepal, solar energy can give first priority.

In a country like Nepal in the Southern Hemisphere, it can be speculated that if renewable energy can be used and used in sports infrastructure, it can lead to sustainability in development. The Kathmandu Valley has one international level stadium and some other

playgrounds, some small stadium as well as some covered halls. There is regional level stadium in all seven the provinces of the Kingdom of Nepal, which has become a powerhouse for sports in South Asia. The level of a craze in sports is very high in Nepal. Despite its geographical complexity and diversity, it can be developed nationally through sports. And for the development of sustainability, renewable energy may be a boon in the field of sports.

2.19Mega events in sports complex

In addition to all the hype, popularity, and importance, one of the main aspects to consider is the sustainability of the event, in a time in which environmental and social inclusion issues are sensitive topics of relevant significance before undertaking any large project of any kind (Talavera et al., 2019). The hosting of mega sports events has a tremendous effect on developing and emerging countries (Tavakkoli & Jose, 2013). Events potentially impact upon local ecosystem; utilize reserves of irreplaceable natural capital; and contribute to carbon emission- related to climate change (Collins et al., 2009). provided insights into the concept by stressing that an SME is a worldwide sports event that is extremely popular, of short-lived duration, with wide media global coverage, and long-lasting national and international significance, requiring long preparation and involving multiple dimensions including economic, social, environmental, and other structures (Talavera et al., 2019). The natural impacts of large-scale sports events have come beneath examination. For case, a major wear occasion, such as the FIFA world container of soccer, has energy affect proportionate to 3 million kilowatt-hours of energy (comparative to the utilizations required to meet the requests of 700 household's yeas in Europe (Schmidt, 2006).

Today, mega sports events are considered attractive tools for the urban development of cities for several reasons: they can confirm or create regional or global status of a city; they can be an opportunity for the construction of new buildings and parks; they can attract visitors and tourists; and they can legitimate a rapid program of infrastructure development. Mega-events have driven the urban transformation of cities such as Barcelona, London, Rio, Beijing, and Shanghai, but while the prospect of economic growth and urban development are the driving forces for staging a major event, the legacies that follow their hosting have been difficult to design and quantify (Azzali, 2020).

Organizing big games in stadiums consumes a lot of electricity. Floodlights, big screens, sound systems and many other types of power consuming materials are used. This

can have an environmental impact. Many stadiums are supplying electricity by generating electricity through petroleum products, but using solar system, wind energy, etc., can save time, save manpower and even help in air pollution.

The world's largest stadiums have burned floodlights using solar energy. Almost all the stadiums have ample open land and solar energy can be produced by placing a PV board on the roof of the stadium. When floodlights are not used, solar energy can also be used for other purposes. Most of the stadium also has ample open space and solar energy can be obtained by placing a PV board on the roof above the slope of the stadium. If this technology is adopted, it can be of great benefit to the environment as well as financially.

2.20 Benefits of Using Renewable Energy in Rural Sports

Renewable energy is not going to create a lot of jobs, but rather some additional employment opportunities in rural areas. Making a positive connection between RE development and local economic growth will require more coherent strategies, the right set of local conditions, and a place-based approach to deployment(Fullerton et al., 2008).Renewable energy technologies include, inter alia, the provision of electricity generated from renewable sources such as wind, solar, water, tide/wave, and geothermal, and the provision of other modern energy services that are powered by renewable sources for activities such as household heating, space conditioning, and water pumping(UNCTAD, 2010).

Renewable energy is being championed as a potentially significant new source of jobs and rural growth in the Organization for economic cooperation and development countries and a means of addressing environmental and energy security concerns. In most countries, governments have invested large amounts of public money to support Renewable energy development and are requiring significant quantities of it to be sold by energy providers(Fullerton et al., 2008). The local government has explored efficient utilization methods for the stadiums, and minimizing operational costs of the stadiums is considered as one of the most essential functions. With this trend, the local government of Busan Metropolitan City plans to install and use renewable electricity generation systems for Beams (Park & Kwon, 2018). Renewable energy indeed represents an opportunity for stimulating economic growth in hosting communities; it also requires a complex and flexible policy framework and a long-term strategy (Fullerton et al., 2008).

Fortunately, rural communities in many states have at their disposal a variety of policies and programs that can be used to foster local renewable energy development while overcoming inherent challenges. Any approach to transitioning to renewable energy sources should, however, acknowledge the limits of centralized, one-size-fits-all policies, and build strategies that adapt to local circumstances. This is best achieved through broad community participation, which is arguably a central tenet of any successful energy transition. (David L. Kay, 2011)

Most of the playgrounds in rural areas do not have central transmission line grid connected for electricity use. In the Stadium, covered halls, and playgrounds where the central power transmission grid is not connected, it is almost impossible to take training in the evening without electricity in the morning. Morning walks, evening walks and daily practice are almost impossible if there is no power supply in the playground. Electricity supply can be facilitated by using renewable energy like solar energy and wind energy. Thus, the use of renewable energy in rural playgrounds can have the following positive effects.

Positive Impact

Local revenue, environmentally friendly, Local jobs, Innovations, in products, processes and policies, Capacity building and local empowerment, Affordable and reliable energy

Therefore, in rural areas, more benefits can be reaped by using the right type of geographically appropriate renewable energy which can be more beneficial from an environmental point of view and from a human resource point of view, from an economic point of view as well as from all points of view.

2.21 Empirical Literature review

A study was conducted to assess the environmental sustainability in sports. The study highlighted that sports organizations were actively addressing the negative environmental impact of their actions making consequences such as increasing organizational lawfulness, prevention of legal recourse, money saving, and building stronger relationships with key stakeholders. The result showed that the challenges to the successful implementation of environmental programs were communication issues and available organizational resources. The study found that the trend for sports organizations was to expand and implement

environmental initiatives for sustainability. The study revealed that the focus on the environment based on sport was expected to remain because of the social values, expectations of stakeholders, government intervention, and obligatory necessities for standard certifications. The study suggested that sports organizations had to develop partnerships with industry experts within sports leagues to continue their efforts for sustainability (Trendafilova et al., 2014).

A study was conducted in Italy to identify the potential savings in terms of non-renewable primary energy consumption. The study showed that the heat energy needs for indoor pools without reduction of energy are about 5 times higher than the electricity on average. The study revealed that lower energy demand of the use of the thermal swimming pool covers can reduce heat losses by more than 50%, by reducing about 31% of total heat needs. However, the study showed that a non-renewable primary energy saving can range between 19% to 47% after the need reduction. The study suggested that energy-efficiency actions correlated to possible actions on the structures of houses, polls and, other energy needs such as room heating, and for electricity, the value can be doubled easily (Zuccari et al., 2017).

A case study was carried out in Sweden to reduce the energy use of a sports hall and to analyses a photovoltaic system to increase the use of renewable energy. The results showed that the installation of insulation materials to walls, roof and floor, adjustment of heating set point had an impact on reducing the energy demand in the sports hall, that meets the requirements of nearly zero and plus energy with earning money. The study revealed that the improvement of the building can reduce the heat demand and annual operational costs creating a better environment reducing CO_2emissions. The study highlighted that the installment of renewable energy system such as PV and solar collectors which covers all building energy needs for building electricity and hot water might surplus the electricity. The surplus electricity can be sold as it supplies approximately 85.6% of the quantity of the energy that was used in a sport hall. The study mentioned that PV solar energy has several advantages which makes it one of the most promising sources of renewable energy because of its non-polluting nature, and have no moving parts that could break down. The study further mentions that PV requires little maintenance, no supervision, no large-scale installation, low running costs with a lifespan of 20-30 years over wind power, thermal solar power and hydropower (Al-Husinawi, 2017).

A case study was conducted in Portugal on the incorporation of solar thermal technology in buildings. The study showed that the operation of renewable energy in cities offered to reduce energy dependence, decrease pollutant emissions and generate new employment opportunities. The study found that the addition of solar collectors can be accomplished in different ways that depend on the type of the building, space for the installation and the thermal requirement system. The study revealed that solar energy collectors can be installed on sloping roofs, building facades, flat roofs or surfaces. The result found that solar thermal technologies were a sustainable option which is economically viable, financially rewarding and environmentally friendly. The study suggested that solar energy can be used for domestic hot water systems and high thermal requirements. The study revealed that solar panels can be payback for 11 and 12 years with an internal rate of return of 7.1 % and 6.7%, respectively (Tomás et al., 2010).

A study was conducted in Australia, investigates the link between environmental with sports stadiums and social change. The study suggested that an individual or stakeholder have positive attitudes toward the perceived benefits. The study showed that USA had their 24% of the 82 ski resorts inactive, 10% reactive, 23% exploitive and 43% proactive with respect to improved environmental performance. The study revealed that the sport event merchandise, sporting goods and equipment requires natural resources. The study pointed out that sport event venues must construct with materials that cause minimal harm to the environment. The study suggested that the sport event venues must choose environmentally friendly air-conditioning facilities and utilize renewable energy resources for sustainability. The study highlighted that it is a long way to go for establishing standards and encourage the changes in event manager’s as well as consumer’s behaviors toward environmentally friendly sport events and venues (Sotiriadou & Hill, 2015).

A study was conducted in Palestine to measure the level of university students' knowledge regarding renewable energy. The results showed that there is no relation between the students' knowledge of renewable energy with gender, educational level, and parental education level. However, the study found that, faculty choice and high school specialization had a strong correlation with the level of knowledge. The study revealed that students from vocational schools were more aware of renewable energy than other university students. The study showed that 45.6% of the students thought that their country had a high wind potential besides 40% of the participants believe that Palestine had a very high potential of solar

energy. The study revealed that only 22.8% of the students think that Palestine is making use of one of the renewable energy sources while 71.3% of the respondents believed that the investment in renewable energy projects is successful, and 70.4% of students confirmed using solar energy for water heating. The result found limited awareness and knowledge of students about renewable energy (Assali et al., 2019).

A study was conducted in Australia to understand issues of climate change for major sport stadium and the organizations that manage them. The results revealed that there were four primary climate change issues such as organizational ambiguity, management complication and cost risks related with water and energy resources, and waste outputs. The result demonstrated that the most physical impacts were manageable where the predominance of commercial and operational requirements determined the organizational responses. The study revealed that the government climate policy and direct signal to adapt to the climate change were manageable. The result showed that climate change impacts and responses are limited to non-sport and leisure industries. The study suggested that business researchers must cover the scope of climate change vulnerability, flexibility and adaptation to other climate-dependent areas of the sport sector such as professional sport stage and community-level sport (Dingle & Stewart, 2018).

A case study was conducted in Iran that aims to understand the factors influencing the acceptance and application of solar energy in the sport places. The study found that the factors influencing the accepting and implementation of solar technology in sport places were significant in line with technology. The study revealed that the managerial, economic, policy-making, attitudinal, educational, social, legal and finally technical factors were the most important factors influencing the accepting and implementation of solar technology. The study indicated that environmental dimensions can be exploited by making innovations and using solar energy is for cost saving, that helps the improvement of efficiency and prevent environmental pollution (Odolu & Yazdani, 2020).

A study was conducted to investigate the energy system of arena and energy efficiency measures. The result revealed that, the normal demand and the instances when the demand peaks and the magnitude of the peaks to simulate the heating demand for the arena. The study revealed that it was probable to simulate the cooling demand for the ice over lengthy time periods but could not identify demand. The study showed that it is beneficial for the system to install PV, instead of battery storage as it was very pricy for electricity. The

study revealed that the main obstacle was the impact of human behavior on the system, such as change in operating procedures when the arena was heated for activities demanding a warmer indoor climate, sudden loads which can be hard to predict, renovating of the ice and its impact on the cooling of the ice (Lind, 2018).

A case study was conducted in Hungary to investigate the potentials of development areas such as transport, energy, building in order to make the cost-efficient high-profile investments, and organize international sports events. The study highlighted that the buildings, sports arenas and related facilities, must be expanded and their usage must be prolonged with the existing low-carbon solutions. The study suggested that the management has to be pre-planned for the waste that is being left after the life cycle is worn out. The study suggested that these options help to decrease the greenhouse gas emissions from the sector's circular tenders. The study revealed that sector's circular tenders can be additionally combined with SMART energetic resolutions (Horváth & Fogarassy, 2017).

A study was conducted in Italy which aims to provide information that orients decision-makers towards wiser choices of two alternative configurations. The study demonstrated that highly-reflective coating guarantees a lower impact than Bi-PV plant in terms of economics and payback installing costs in a shorter time interval. The result showed that the emissions embodied for the Bi-PV panels accounted for up to 90% of their compensation potential. The study revealed that the higher costs accounted for the installing the Bi-PV plant was balanced by earnings from the electricity energy market. The study showed that by applying the highly-reflective plants to the building’s cover had contributed to lowering the urban temperature and helped in increase of the local economy (Manni et al., 2020).

A study was conducted in Queensland, Australia to examine the developmental barriers, targets, policies and actions recognized by organizations and stakeholder in the renewable energy industry sector. The study showed that the Queensland state provides 4% of the region’s electricity supplies from renewable energy. The result showed that renewable energy developments had faced a range of socio-technical barriers that require timely actions in the areas such as financial, infrastructure, regulation, community-centered developments, technology, workforce investments, informational and educational programs. The study highlighted that the of firms and stakeholder organizations preferred states and territories to work within the national renewable energy framework for improved sustainability outcomes.

The results showed that some firms and stakeholder had seen value in using renewable energy resources as a development channel in regional and remote areas (Martin & Rice, 2012).

A study was conducted in Serbia to identify the potential of renewable sources to raise ecological awareness and to be guide for potential investors in renewable energy in Serbia. The study showed that Serbia has the potential of solar energy resources above the average of European context. The study revealed that Serbia can use solar energy effectively and in a long term, as it has a very favorable seasonal schedule. However, the study found that renewable sources of energy were not used as its full potential. The study revealed that Serbia has the potential for biomass energy also for some country rich in forests and large farms for using biomass energy production but still not used in the proper way. The study revealed that Serbia have the potential for geothermal energy also as large number of geothermal resources existed in the country that were used in sports and recreational or health purposes but not as a source of energy production (Četović et al., 2015).

A study was conducted in Omen to address a change of temperature in designing the PV system for the sports complex. The study showed that the PV built on renewable system produces the energy of 78.568 MWh per year. The study revealed the design system could sell energy of 56.065 MWh per year back to the grid, this helps to produce additional revenue. The study highlighted the economic performance parameters of the design such as payback period of 10 Years, USD 120755 net value, 10% internal rate of return with 3.09 profitability index. The study showed the financial feasibility of the solar PV system for the sports complex. The study revealed that sports complex has no activities during the five months in a year during which, the energy demand is zero. The findings showed that the design system has the potential to generate and export power to the utility grid during no sport activities months. The result highlighted that in the month of January, the energy demand was 12.544 MWh, while the energy production by the PV was 9.624 MWh. The study demonstrated that the energy production does vary from month to month due to the variation in solar irradiance and due to the temperature fluctuations (Ahshan et al., 2019).

A study was conducted in Canada included 15 sport stadiums that hosted a professional team and their web-based stadium communications on renewable energy (SCORE). The study showed that the median age of the stadiums was 28 years, (mean 34.73 years). The result indicated that 4 of the stadiums involve in renewable energy strategies like

Air Canada Centre, BMO Field, BC Place Stadium, and Relax Place. The study revealed that the stadiums involved in renewable energy were utilizing both conventional and non-conventional strategies but no cases of geothermal renewable energy were found. The range of renewable energy projects included one large wind energy project with an associated small pilot project in solar energy at BMO Field, a small biomass/bio-fuel strategy at the Air Canada Centre, and the purchase of renewable energy offsets at BC Place (Chard & Mallen, 2013).

A study was conducted in Turkey which deals with situation and future prospect of renewable energy and the role of hydropower. The result showed that Turkey has great renewable energy potential to reduce the dependency on fossil fuels. The study revealed that the wind sector as a good example for increasing the generation of electricity with renewable resources. The study showed that Turkey has signed the Kyoto Protocol which requires the sustainable and logical profitable development of practical renewable energy options to achieve the modest environmental goals. The study pointed out that there was not enough for governments to support the development of renewable energy technologies due to technological and economic constraints, the application of renewable resources is still behind. The study showed that Turkey have estimated, additional 22,500 MW hydro, 19,000 MW wind and 420 MW geothermal capacity needs to be installed till 2023 to achieve the target. The study suggested that the combined-use of different renewable resources and shift from fossil fuels to renewable energy sources seems must be the sole alternative energy resource for Turkey (Yuksel, 2013).

A case study was done among five European stadiums to check the technical potential in practice. The study revealed that the renewable energy technologies if installed in the stadiums, it would reduce the electricity demand to zero and produce a surplus of electricity of between 1,500 to 5,000 MWh per year. The study showed that the stadiums can be self-sufficient and can provide additional electricity for 400 to 2,000 households. The study pointed out that, for this situation to make reality, the project spends total investment costs of 7 to 14 million Euros, dependent on the size of the stadium. The study revealed that the huge sum amount of money investment is a feasible in compared to the yearly revenues of the stadiums which was up to 300 million Euros including subsidies. The study highlighted the advantages of the projects as it has Payback Periods of 12-13 years in which energy savings measures and renewable energy technologies transformed stadium in a high energy producing

system. The results indicated that transforming a stadium in a renewable energy producing system is economically attractive as a Green Stadium (Smulders, 2012).

A descriptive study was conducted to investigate whether the United Arab Emirates (UAE) sports sector implanting the sustainability for competitive advantage. The study showed that the UAE sports sector was in the developing stage where the implementation of initiatives related to sustainability was relatively low. The study revealed that to improve the UAE sports sectors, the decision makers have to recognize and understand the concept of sustainability. The study found that lack of leadership skills for successful deployment of sustainability initiatives was the most important challenges where an urgent need was required to develop and deliver leadership training programs. The study showed that, improved and measured effective leadership skills was required to address for driving change towards sustainability (Almenhali, 2019).

A study was done by (Hudson, 2017), found that dams and reservoirs were the main source of greenhouse gas emissions driving force of the climate change. The study showed that about 20% of methane emission came from the manmade surface of reservoirs. The study revealed that 79% of the greenhouse gas emissions are methane, from reservoirs. The study highlighted that methane has 35 times more effect than carbon dioxide over the span of a century, but 86 times more powerful in rushing climate change over a decade. The study expressed that the global flourishing in construction of hydropower projects and reservoirs over the next 15 years lead to more than 90% of the world's rivers being disjointed and significantly increasing greenhouse gas emissions (Hudson, 2017).

A study was published in late 2016, aims to generate a global estimate of greenhouse gas emissions from reservoirs. The study determined that dams and reservoirs contribute 25% more to global warming than previously estimated. The study calculated that reservoirs were emitting the equivalent of one gigaton or one billion tons of carbon dioxide into the atmosphere every year. The study revealed that was more greenhouse gas production than the entire nation of Canada. the study showed that Brazil attributable to number 7 on the top-10 list of greenhouse gas emitters based on the amount of greenhouse gas emissions, behind China, the EU and the United States (Deemer et al., 2016).

Sports play an important role in raising awareness, influencing behaviors, and shrinking its carbon footprint around the world with its broad range crossing diverse human

interests, social backgrounds and geographical contexts. Sports contribute to creative, low-cost, high-impact solutions. Sports potential as a paradigm of sustainable development is recognized by the SDG 2030 and in UN General Assembly. It was broadly recognized that unsustainable practices in sports have further contributed to climate change although the influence of sporting organizations on climate is complex and hard to measure. Research has found that the global sports sector contributes the same level of emissions as a medium-sized country (United Nations, 2022).

A study was conducted to identify and explore public awareness of renewable energy in Malaysia. The result indicated that most of the respondents are informed about renewable energy which is gradually increasing in terms of sustainability awareness. The study revealed that 90.3% were concerns about the environment having negative impacts of pollution, simultaneously indicated a positive use of alternative energy. Though, the study showed that 98.8% had not implemented renewable energy and was not enhanced due to the expensive costs involved in installation (Zakaria et al., 2019) .

A study was conducted to investigate the UAE sports sector in embedding sustainability for competitive advantage. The study showed that the sustainability is an organizational process for enhance economic value, social welfare and to reduce environmental impacts. The study highlighted that the implementation of a sustainable management system is a cohesive and organized method that allows to formation of core business decisions. The result showed that the level of importance of key drivers for fulfilling sustainability initiatives are 3.9 in reducing operating costs, 3.7 in protecting organizational reputation, 3.6 in stakeholder's pressure, 3.5 in government legislation or regulation, 3.2 in culture of the organization, 3.1 in top management commitment and 3 in ethical responsibility. The study concluded that the UAE sports sector is still in the developing stage so, there is a need to reshape the UAE sports sector in order to gain sustainable competitive advantage. The most important challenges for the UAE sports organization are the lack of skills for fruitful arrangement of sustainability initiatives (Almenhali, 2019).

A study was conducted in Palestine to find the level of university students' knowledge regarding renewable energy. The results showed that there is no significant difference in students' knowledge of renewable energy considering gender ($p = 0.193$), educational level of study ($p = 0.3935$), and parental education level (mother's = 0.536 and father's $p = 0.49414$). The study revealed that the faculty choice and high school specialization had strong

correlation with the level of knowledge and students from vocational schools were more aware of RE than university students. The study showed that 45.6% of the students thought Palestine had high wind potential, 40% said solar energy and 22.8% thought that Palestine is making use of the renewable energy sources. However, 71.3% of the respondents believed that the investment in RE projects is successful, and 70.4% of students were using solar energy for water heating. The result revealed that the students' awareness and knowledge about renewable energy were limited (Assali et al., 2019).

A study was carried out in the Akola district of Maharashtra state in India to assess the awareness among the general people about renewable energy sources. The study found that 29% of the respondents felt that the renewable energy sources are non-polluting. The study found that the 29% of the respondents saw wind energy as the best option for generating energy and93%felt renewable energy as much better than fossil fuel. The results showed that the 34% respondents slightly agreed that government encouragement was necessary for the promotion of renewable energy and 42% of the respondents were positive on renewable energy, also,25% strongly agree with the use of renewable energy sources (Khambalkar et al., 2010).

A study was conducted in Nikaia, Greece to discover the factors shaping public opinion about renewable energy sources. The study showed that the 54% and 42% had good knowledge of solar and wind energy systems respectively. The result found that 95% of the respondents were using solar water heating, while 13% of the respondents had a solar PV system installed in their home. The study revealed that51.5% of the respondents chose the most important reason for investing in a renewable energy system is because of environmental protection. The study found that 52.4% were willing to pay for a wider dispersion of renewable energy sources into the electricity mix up to 26.5 Euros per four months a year of electricity bill (Ntanos et al., 2018).

A study was conducted in Turkey, it was expected that the demand for electric energy will be 300 billion kWh to 580 billion kWh from 2010 to 2020, in 10 years. The study revealed that the reason the demand nearly doubled was due to the growing energy demand of the young population, fast-growing urbanization, and economic development. The study showed that Turkey has been one of the fast-growing power markets in the world and was deeply dependent on expensive imported energy resources. The study highlighted that the imported energy resources have become a big burden to the economic and environment due

to air pollution. The study showed that Turkey was dominated by hydropower and biomass energy, but biomass use declined due to environmental causes and supply scarcity because of deforestation. The study revealed that Turkey has the potential of generating approximately 1% of the total world hydropower energy and potential for wind power development, geothermal ranks seventh worldwide, while only a small portion is economically feasible for the country (Bilgen et al., 2008; Yüksel, 2008).

A study was conducted in Greece to examine the public acceptance of bio fuels. The result showed that 90.7% believed climatic changes are related to fossil fuel consumption. The study found that only 23.8% knew the difference between biodiesel and bio-ethanol. The results showed that 76.1% think energy saving should precede the use of an alternative source of energy while 27.3% preferred bio-fuels over other renewable energy. The study found that 49.9% think that the use of bio-fuels is effective against climatic changes and 53.9% believe bio-fuels were an effective solution to the energy problem. The study showed that 80.9% of the car owners were willing to use bio-fuels and about 44.8% are willing to pay the extra money of 0.06 hours per liter on an average amount was 0.079 hours per liter to the fuel market price (Savvanidou et al., 2010).

2.22 Conclusions

Based on the study of different literatures, it can be said that there have been many studies and researches on energy and renewable energy using different methods in different geographies of the world but there are few countries in the world with such geographical conditions. Only such ecology and environmental studies have not been done for renewable energy. There are many studies and researches on renewable energy and in the world. There have been some studies and researches, especially in the American country, Asian countries and European but this is not enough. In the case of Nepal, too, little research has been done on renewable energy, and all that has happened is inadequate. In a country like Nepal, not much research has been done on renewable energy. This knowledge and technology have also been used to a lesser extent. Renewable energy and solar energy are used very little in the context of Nepal, even if it is 0% in the sports sector. There is no concept in the study or research to use. We know about the importance of sports and its impact on the basics of previous literary studies, but also about the importance of sports and renewable energy for sustainable development, for the sustainability of sports, what policies should be formulated

for the sustainable development of sports, what are the problems should be studied thoroughly and conclusion should be drawn.

Due to the fact that Nepal is in the Southern Hemisphere, solar radiation can be achieved from 24 hours to 15 hours. In The context of Nepal Solar energy can be obtained from dawn to dusk. Plenty of solar energy can be used even during the rainy season. In addition, power can be obtained from solar radiation for about 9 months out of 12 months. Therefore, solar energy is a sustainable and continuously renewable energy. With the long-term exposure to sunlight in Nepal, it is possible to consume 9-10 months of sunlight in 12 months. Therefore, in the context of Nepal, solar energy can be given first priority. Nepal includes a huge potential of hydropower, but less than one and a half percent of the potential 83,000 MW of hydropower is right now tackled. Similarly, without environmental effect, Nepal can produce 42,000 MW is feasible. Nepal has been producing and using energy from biogas for more than four decades. Nepal has also started using energy from wind. Thus, solar energy, hydroelectricity, biomass, and wind energy are the main sources of energy for Nepal. There is still a lot of research to be done. There is no research on renewable energy and sports, so sports and renewable energy are completely new, not only for Nepal but also for the worldwide community.

Basically, the goal of this research will be to make more use of renewable energy in the field of Nepali sports. As the inconsistency between human advancement and natural upkeep is progressively prominent, sustainability has gotten to be an altogether critical objective for future improvement. The renewable energy plays a basic part within the accomplishment of maintainable improvement, since it is moderately cleaner comparing with fossil powers. It is beneficial in advantages the environment, increasing the diversity of fuels, ensuring stable power supply, and promoting globally, regionally and nationally for the economic development. In a country like Nepal in the Southern Hemisphere, it can be speculated that if renewable energy can be used and used in sports infrastructure, it can lead to sustainability in development.

Based on the study of various literatures, it can be said that possible if the potential of renewable power is used adequately in the field of sports, nation achieves easily sustainability. This preliminary study shows that it is possible to take Nepal towards prosperity by generating electricity from hydropower as well as solar energy, wind energy, and biomass.

CHAPTER 3: METHODOLOGY

The research method was both qualitative and quantitative. Interviews, deep investigation, and distributed archives were utilized within the analysis. Data is analyzed through subjective strategies, geographical, theme, and contents basis to distinguish topics to the current status of the use of renewable energy for the sustainability of sports. The sample data was used for specific around. The research was designed as per the research objectives and research questions.

The field of study now cover the whole of the kingdom of Nepal, but the main stadiums, covered halls, playground and all those associated and stakeholders with it was included in this research. There are about five thousand players in Nepal who are involved in various sports at the national level. There are about 184 associations registered in the National Sports Council, including official and non-official sports. Similarly, there are 27 sports participating in the Olympics. Out of which 108 was represented under the Olympic Games and 336 was represented by various national associations and a total of 444 delegates was represented. The research questions above demand both qualitative and quantitative tools. The research looks into the solution to the problems rather than methods.

3.1 Research Design

Research design is the framework of research methods and techniques that allows researchers to sharpen the research methods suitable for the subject matter and set up their studies (Question Pro, 2022).

Research design includes reliability, neutrality, validity and generalization. In Quantitative Research Design, various variables including numbers as well as statistics are analyzed and its findings are examined with the use of graphics, figures, pie charts for data collection measurement and meta-analysis. The Qualitative Research Design is explanatory in nature and mainly focuses on a specific theory and the respondent's answer which allows to draw a conclusion with proper findings (Edu, 2021).

The mixed method research design was used in this study which combines practices from qualitative and quantitative methods to answer the research questions. The use of mixed methods helps to neutralize or cancel out some of the limitations that come along with taking the only one method (Byrne & Humble, 2007).

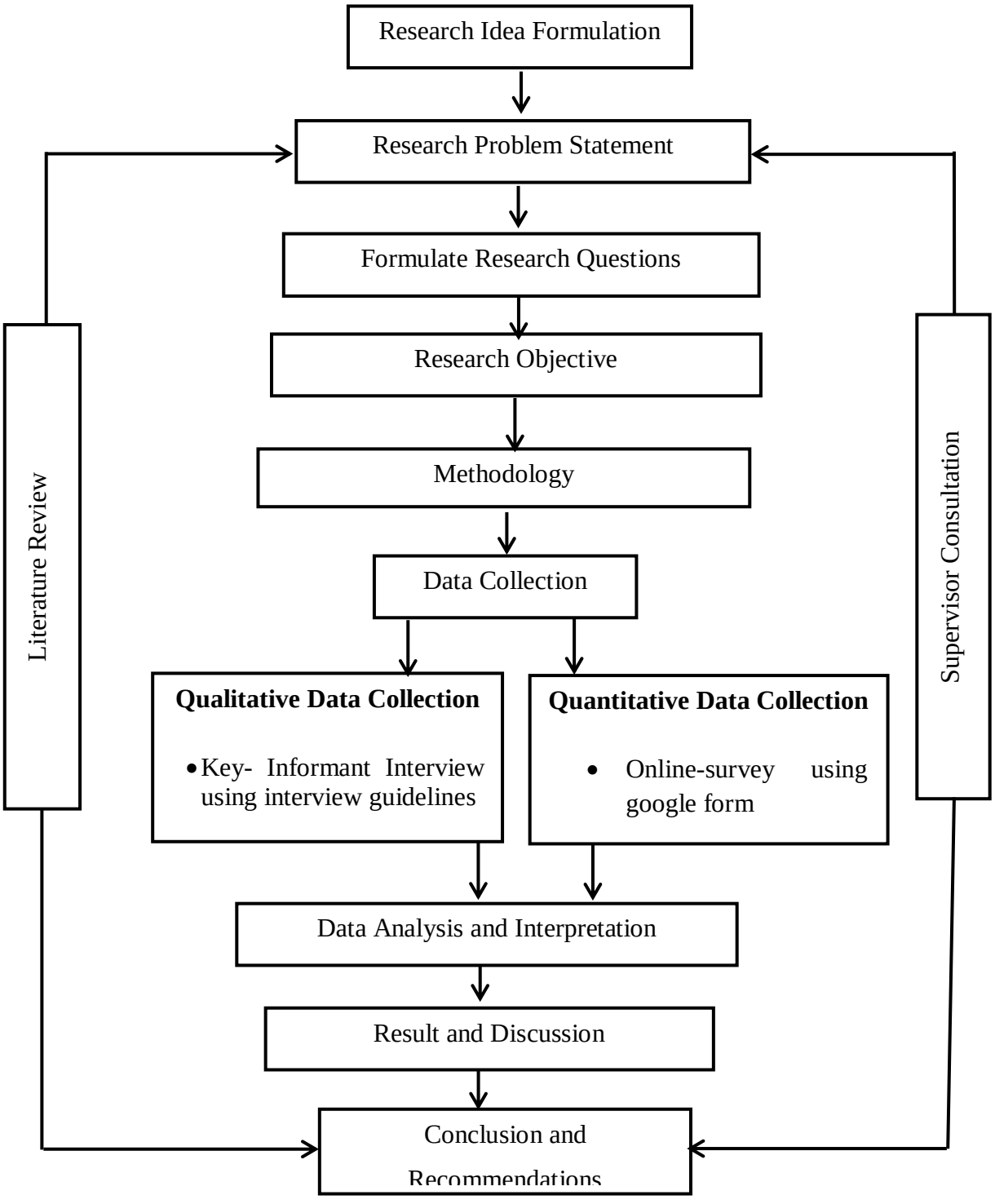


Figure 10: Research Design of the study

First of all, the researcher formulated the idea of research topic before writing the proposal. This is carried out by reviewing the previously published literature and reviewing various journals and articles. Through this, the research problem was identified which helps to set the research questions and research objectives. After this, research methodology was developed which incorporates study area, study sample, sample size and other necessary materials and methods used in research. A descriptive cross-sectional research design was used in this research. Then data collection was done after selecting the sample population and area. The mixed research design i.e., both quantitative and qualitative study was used. An online-questionnaire survey was prepared to collect quantitative data and an interview guideline was prepared to collect qualitative data through KII.

The primary data was collected using the online questionnaire survey which was distributed to the target populations via Emails, Messenger, Viber, and WhatsApp groups for quantitative data collection. Similarly, the face-to-face interview method was used to collect qualitative data using interview guidelines. After the collection of data, quantitative data was entered into SPSS and was analyzed accordingly. The qualitative data from KII was first transcribed by listening to the recordings taken and then translated into the English language. Then it was analyzed manually using the thematic method of qualitative data analysis method. After the analysis of data results and discussion were written. In the final part, the research findings were concluded and a recommendation was given to the stakeholders. This whole process of research writing was in under the guidance of a supervisor and a literature review was done all along the process.

3.2 Quantitative Methodology

Quantitative approach is outlined as a logical and scientific investigation of phenomena by gathering quantitative knowledge and playing applied math, mathematical, or process techniques. Quantitative analysis collects data from existing and potential customer's victimization sampling ways and causation out on-line surveys, on-line polls, questionnaires, etc., the results of which might be pictured within the type of numerical. When the careful understanding of those numbers to predict the longer term of a product or service and build changes subsequently.

3.3 Qualitative Method

Key Informant Interview was conducted with policy makers, sports research donors, players, coaches, managers, etc. From this, what are the weaknesses in terms of the policy, what is the strong point, weakness point, everything was studied in depth. There was also be a renewable energy feasibility study from this in-depth interview. This research looks at the strengths of this weakness in close collaboration with experts working with sustainable development, sports and renewable energy.

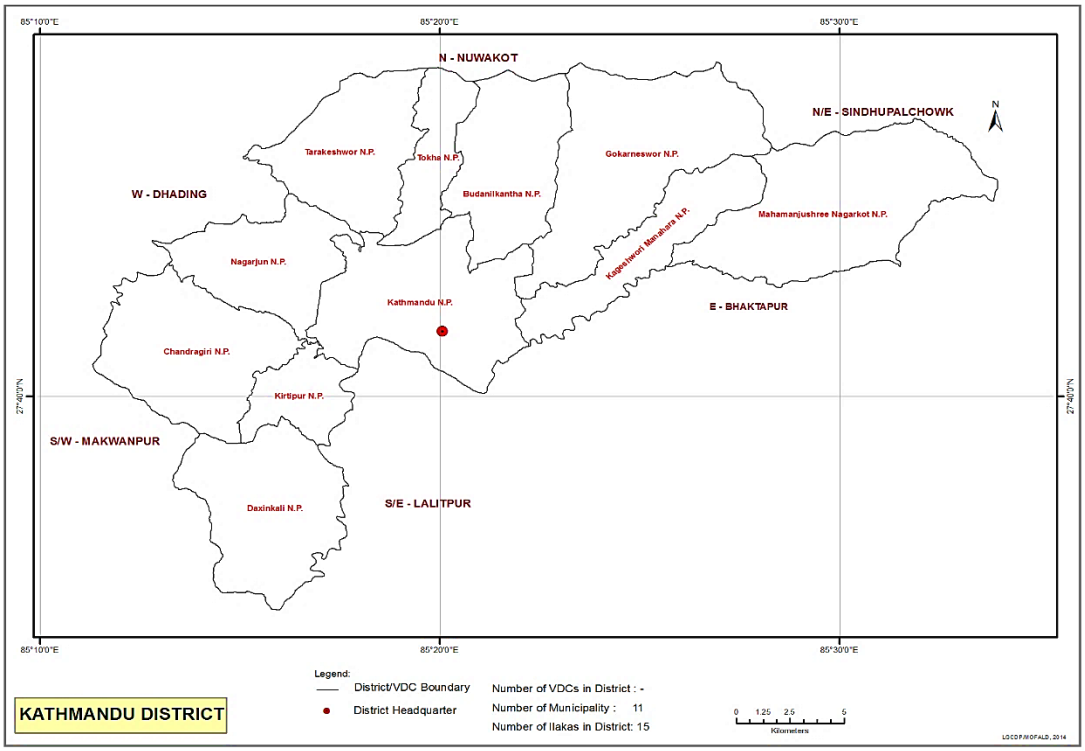
3.3Study site

Kathmandu was chosen as a study site for this study because being a capital city of Nepal, it is a home to National sports council and the Dasharatha stadium where all the nationals and international games are conducted. Most of the sports players also are trained for games in the capital city. Thus, the target populations were found in the capital city, so Kathmandu was chosen using a convenient method.

Source: Ministry of Foreign Affairs, (MOFA, 2022)

Figure 11: Map of Nepal

Nepal is one of the oldest countries in South Asia that shares territorial borders with two big entities India and China. Nepal is a land-locked country that occupies an area from 26 ° 20' to 30* 10' north latitude and 800 15' to 88 ° 19' east longitude (DHS, 1996). Nepal has an area of 147,181 square kilometers and population is approximately 30.3 million according to 2021 census (Nepal, 2022). Nepal is divided into 7 provinces after the latest constitution of Nepal in 2015. Kathmandu is the nation's capital and the country's largest metropolitan city that lies in Bagmati Province.



Source: Ministry of Federal Affairs and General Administration (MoFAGA, 2022)

Figure 12: Map of Kathmandu district

Kathmandu is positioned within the geographic coordinates 27°38'32" to 27°45'7" North latitudes and 85°16'5" to 85°22'32" East longitudes. The city lies at an average altitude of 1350 m above sea level. The rapid growth of the urban area doubled without the pace with the demand for infrastructure and services has caused the emergence of many urban environmental problems in Kathmandu. The most highlighted environment problem is air pollution due to its location in a bowl shaped valley with little natural air movement for much of the year (Thapa & Murayama, 2008). Air temperature in the Kathmandu Valley reaches in average monthly maximum of 29.30ºC and in average monthly minimum of 0.90ºC. So, the

annual in average temperature of the Valley is around 16.50ºC.The average hours of sunshine in Kathmandu is 6.3 hours which varies between 3.3 hours and 8.4 hours in a year (Upadhyay et al., 2006).

3.4 Sampling Method

a. Qualitative sampling

For KII, key informant like member of National Sport Council, policy makers, related stakeholders, members from AEPC, experts of sports sector and renewable resources were chosen. Total 11 key informants that are working on sports sector and renewable sector are interviewed for this study.

b. Quantitative sampling

The purposive sampling method was used in collecting the information for the field study. In addition, respondents are selected using snowball sampling technique. At first, one player was contacted then other was contacted using snowball method. This study used Cochran's formula i.e., $n= Z^2pq/d^2$ to determine the sample size. Here, p is the estimated proportion of the population, q is 1-p, d is the desired precision and z is the confidence level (the standard deviation set for 95% CI).

Now,

$p = 50\%$ [$\because$ the population is unknown]

$q = 1-p = 1-0.5 = 0.5$

$d = 5\%$

$z = 1.96$

$n = [Z^2 p q / d^2]$

$= [(1.96)^2 X0.5 X 0.5 / (0.005)^2]$

$= [3.84 X0.5 X 0.5 / 0.0025]$

$=384$

Hence, the total sample size is 384. The target populations of the study are sports players.

3.5Source and Methods of Data Collection

A variety of data collection tools was used for this research including primary data collection and secondary data collection. For data collection, questionnaires, interviews and survey method was used. Online survey method was used to collect the quantitative data using Google form distributed via Emails, Messenger, Viber and WhatsApp group.

Similarly, for qualitative data collection, first of all various related organization were visited by researcher. Then date and meeting were fixed. Those who were not available were contacted with a phone call first and meeting was fixed for the interview. Then permission was taken before the start of interview and consent was taken for audio recording. The face-to-face interview method was used to collect qualitative data using interview guidelines.

3.6Data Management, Analysis and Interpretation

3.6.1 For Quantitative data

About 412 data were collected via Google form where 2 were rejected and remaining 410 data were downloaded from Google from which was in a excel spreadsheet form then it was converted into SPSS format. The data was checked for completeness, correctness, and internal consistency to exclude missing or inconsistent data. After that only 384 complete data were used. The data were analyzed by using statistical software namely SPSS (Statistical Package for Social Science) version 20. Statistical significance was set at a 95 percent confidence level and $p<0.05$.

3.6.1 For Qualitative data

Different variables such as sportsperson, sports policymaker, renewable energy policymaker, and its relation with the use of renewable energy was analyzed and tabulated. The narratives of the KII were all transcribed manually and then it was translated from Nepali to English language. Then the translation was manually coded. The outcome of the KII was first viewed holistically and then thematically analyzed. This analysis was compared with existing research and a like research.

3.8Limitations

Any research, it is essential to anticipate any issues that may arise during the data collection and analysis phase. It helps to address the issue and solve problems. Some of the issues can be:

1. The field of research was on the people of Nepal, people associated with the sports sector, people related to renewable energy, and people working for sustainable development. So, it does not generalize other fields.

2. There are various limitations of data collection. The exact and true answer serves the purpose of the research. The endeavor was made to collect the correct information.

3. The outcome of the research may or may not be applied exactly everywhere due to various considerations.

4. The Covid 19 has also posed a threat to collect data. Maintaining social distance, creating groups for discussion, etc. are also threats.

5. The respondents bias may occur as this research has used online -survey method for quantitative data collection. So, self- administered questionnaire is used to address this limitation.

3.9 Ethical considerations

To make the research study ethically sound, ethical approval was taken from the selected organization where the study was conducted. In every research study, there are certain ethical issues. Similarly, for the successful completion of this study, the following ethical issues were considered:

a. Informed consent:

For the quantitative study, the informed consent was taken from each participant. The informed consent included the necessary information of the study such as its purpose, utilization of the collected data, maintaining confidentiality and privacy along with the name and information of the researcher. The participants were provided with the informed consent form at the beginning of the online survey and asked to read it to make sure whether they want to participate or not. The participants that are above 18 years (completed age) were considered for eligibility.

For the qualitative study, informed consent for audio recording was also taken from those participants involved in KII. After receiving written consent from the participants in the form of signature, the data collection begins.

b. Privacy and confidentiality:

The privacy and confidentiality of the participants were ensured by the researcher by limiting the access of participant's identities and records to authorized individuals.

c. Anonymity:

The participants were assigned the unique ID number or pseudo names for anonymity.

d. Data storage:

The researcher had stored the information and data from the patient safely on the laptop or computer which was only accessed by the researcher and the assistant.

e. Utilization of the result:

The results obtained from this study is solely be used for the study purpose.

CHAPTER 4: RESULTS

This section describes the result of the study. This chapter includes both quantitative and qualitative analysis in following sub sections:

4.1 Socio-demographic Information of the players

Table 4: Socio-demographic Information

Socio-demographic Characteristics		**Frequency (n=384)**	**Percentage (%)**
Age(in completed years)	18-25	101	26.3
	26-30	57	14.8
	31-35	113	29.4
	36-40	25	6.5
	Above 40	88	22.9
Gender	Female	158	41.1
	Male	226	58.9
Marital Status	Divorced	10	2.6
	Married	187	48.7
	Separated	13	3.4
	Unmarried	174	45.3
Educational Level	Secondary Level	216	56.2
	Bachelor level	117	30.5
	Masters and above	51	13.3
Category of sport	Team sport	117	30.5
	Individual sport	267	69.5

Type of sport	Indoor sports	246	64.1
	Outdoor sports	138	35.9
Level of sport	National level	116	50.2
	Provincial level	53	13.8
	District level	8	2.1
	International level	207	53.9
Years in sport participation	Less than 5	55	24.3
	5-10	120	31.2
	More than 10	209	54.4
Number of games played till now	Less than 10	184	47.9
	10-20	102	26.6
	20-30	48	12.5
	More than 30	50	13
Level of games played till now	National level	292	76
	Provincial level	242	63
	District level	178	46.4
	International level	208	54.2
	Olympic	6	1.6

The most of the respondents i.e., 29.4% are from 31-35 years of age group followed by 26.3% from 18-25 years of age group, 22.9% from above 40 years, 14.8% from 26-30 years of age group and remaining 6.5% are from 36-40 years of age group. Similarly, more than half i.e., 58.9% of the respondents are male and 41.1% are female. Where, 48.7% are married, 45.3% are unmarried, 3.4% are separated and 2.6% are divorced. About 56.2% have

secondary level of education, 30.5% have bachelor level of education and remaining 13.3% have masters and above level of education.

Majority of the respondents i.e., 69.5% play individual sport and 30.5% play team sport in which 64.1% are indoor sports and 35.9% are outdoor sport. The indoor sports include carom board, table tennis, basketball, chess, darts, aerobics, boxing, karate, judo, yoga, bowling, cue sports etc. The outdoor sports include football, basketball, volleyball, lawn tennis, cricket, badminton, skateboarding, kabaddi, swimming, archery, canoeing, climbing, paragliding, boxing, cycling, running, gymnastic etc. The most of the respondents i.e., 53.9% play international level sport followed by30.2% play national level of sport, 13.8% play provincial level and 2.1% play district level. Likewise, more than half of the respondents i.e., 54.4% have more than 10 years in sport participation followed by 31.2% have 5-10 years and 14.3% have less than 5 years. Besides, 47.9% have played less than 10 games till now followed by 26.6% have played 10-20 games, 13% have played more than 30 games and 12.5% have played 20-30 games. Also, majority of the respondents i.e., 76% have played national level games, followed by 63% have played provincial level game, 54.2% have played international level game, 46.4% have played district level game and 1.6% have played in Olympic.

4.2 Awareness and perception of players on use of RE in sports

1) Awareness of players on use of RE in sports

Table 5: Awareness of players on renewable energy

Awareness of players on renewable energy		**Frequency (n=384)**	**Percentage (%)**
Heard about renewable energy		384	100
Hear/learn of the renewable energy from	TV/ Radio	218	56.8
	School curriculum	289	75.3
	Newspapers/ books	164	42.7
	Internet	137	35.7
	Word of mouth	152	39.6
	Friends and family	194	50.5
Renewable energy	Energy derived from natural source	310	80.7
	Source of energy that eventually run out	74	19.3
Sources of renewable energy	Solar energy	371	96.6
	Wind energy	344	89.6
	Hydropower energy	348	90.6
	Geothermal energy	201	52.3
	Biomass energy	213	55.5
	Atomic energy	136	35.4
	Tidal energy	144	37.5
	Sewage waste	167	43.5
Renewable energy that Nepal is capable of producing	Solar energy	372	96.9
	Wind energy	317	82.6
	Hydropower energy	355	92.4
	Geothermal energy	88	22.9

	Biomass energy	148	38.5
	Atomic energy	37	9.6
	Tidal energy	26	6.8
	Sewage waste	113	34.4
I think renewable energy is a good idea	Very good idea	218	56.8
	Fairly good idea	115	29.9
	Good idea	51	7.3
The best option for generating energy	Renewable energy	379	98.7
	Fossil fuels energy	5	11.3

Almost all of the respondents i.e., 100% have heard about renewable energy where 75.3% heard or learn from school curriculum, 56.8% from TV/Radio, 50.5% from friends and family, 42.7% from newspapers/ books, 39.6% from word of mouth and 35.7% from internet. Likewise, majority of the respondents i.e., 80.7% responded renewable energy is an energy derived from natural source which is right and remaining 19.3% responded wrong i.e., source of energy that eventually run out. About 96.6% of the respondents are aware that solar energy is a source of renewable energy followed by 90.6% are aware of hydropower energy, 89.6% are aware of wind energy, 55.5% are aware of biomass energy, 52.3% are aware of geothermal energy, 43.5% are aware of sewage waste, 37.5% are aware of tidal energy and 35.4% are aware of atomic energy.

Similarly, 96.9% of the respondents think that Nepal is capable of producing solar energy followed by 92.4% hydropower energy, 82.6% wind energy, 38.5% biomass energy, 29.4% sewage waste, 22.9% geothermal energy, 9.6% atomic energy and 6.8% tidal energy. More than half of the respondents i.e., 56.8% think renewable energy is a very good idea followed by 29.9% think fairly good idea and 13.3% think good idea. Likewise, majority of the respondents i.e., 98.7% think renewable energy is best option for generating energy while only 1.3% think fossil fuel energy as a best option for generating energy.

Table 6: Awareness of players on use of renewable energy

Awareness of players on use of renewable energy		**Frequency (n=384)**	**Percentage (%)**
Benefits of implementation of renewable energy	Quality of life	288	75
	Environmental protection	295	76.8
	Economic development	270	70.3
	Green development	211	54.9
	Employment opportunities	202	52.6
	Reduced oil dependence	260	67.7
	Energy independence	225	58.6
Opinion for use of renewable energy	Recycling sources	276	71.9
	Infinite source	283	73.7
	Non-polluting or less polluting than burning fuel	275	71.6
	Save the earth from carbon dioxide emissions and global warming	242	63
	When looking forward towards the children of the future	212	55.2
	More advantageous	213	55.5
Aspects covered by sustainability	Social Aspects	294	76.6
	Economical Aspects	295	76.8
	Environmental Aspects	309	80.5
I think sport sector can use renewable energy sources for sustainability	Definitely	176	45.8
	Maybe	175	45.6
	Not really	31	8.1
	I don’t know	2	0.5

Most of the respondents i.e., 76.8% responded environmental protection as a benefit of implementation of renewable energy followed by 75% responded quality of life, 70.3% responded economic development, 67.7% responded reduced oil dependence, 58.6% responded energy independence, 54.9% responded green development and 52.6% responded employment opportunities. Likewise, majority of the respondents i.e., 73.7% responded for use of renewable energy is infinite source, followed by 71.9% responded recycling sources, 71.6% responded non-polluting or less polluting than burning fuel, 63% responded save the earth from carbon dioxide emissions and global warming, 55.5% responded more advantageous, 55.2% when looking forward towards the children of the future. Similarly, 80.5% of the respondents think that environmental aspects are covered by sustainability followed by 76.8% economical aspects and 76.6% social aspects. About 45.8% think sport sector can definitely use renewable energy sources for sustainability followed by 45.6% think maybe, 8.1% think not really and remaining 0.5% don't know.

2) Perception of players on use of RE in sports

Table 7: Perception of player on use of renewable energy

Perception of player on use of renewable energy		**Frequency (n=384)**	**Percentage (%)**
I save electrical energy in your daily activities.	All of the time	150	39.1
	Most of the time	117	30.5
	Some of the time	90	23.4
	Rarely	27	7
I support promotion of renewable energy.	Yes	347	90.4
	Maybe	37	9.6
Reasons for promotion of renewable energy	Security of energy supply	258	67.2
	Low cost	263	68.5
	Working with nature	260	67.7

	Prevent climate changes	233	60.7
	Clean sources	207	53.9
	Better than alternative	211	54.9
	Protect the environment	263	68.5
	Reduces global warming	233	60.7
The expansion of renewable energy should be initiated by	Government	189	49.2
	Individual growth household level	86	22.4
	Developers	44	11.5
	Environmental group/ NGOs	26	6.8
	District or provincial	16	4.2
	Energy companies	23	6
The best idea to increase awareness on renewable energy among citizens	Mobile Apps	275	71.6
	Newspaper, TV, Radio	218	56.8
	Awareness campaign	202	52.6
	School subject curriculum	214	55.7
	Social Media	296	77.1

Regarding the perception of player on use of renewable energy, 39.1% of the respondents responded they save electrical energy in their daily activities all of the time, followed by 30.5% most of the time, 23.4% some of the time and 7% rarely. Likewise, the majority of the respondents i.e., 90.4% support the promotion of renewable energy while 9.6% responded maybe. When asked about the reasons for promotion of renewable energy, 68.5% responded low cost, 68.5% responded protects the environment, 67.7% responded working with nature, 67.2% responded security of energy supply, 60.7% responded prevent climate changes, 60.7% responded reduces global warming, 54.9% responded better than alternative, and 53.9% responded clean sources.

Almost half of the respondents i.e., 49.2% think that expansion of renewable energy should be initiated by government followed by 22.4% think individual growth household level, 6.8% think environmental group or NGOs, 6% think energy companies and remaining 4.2% think district or province. Majority of the respondents i.e., 77.1% believe that social media is the best idea to increase awareness on renewable energy among citizens followed by 71.6% believe mobile apps, 56.8% believe newspaper, tv, radio, 55.7% believe school subject curriculum and 52.6% believe awareness program.

Table 8: Perception of player on use of renewable energy in sports.

Perception (n=384)	Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
	f	%	f	%	f	%	f	%	f	%
Nepal has potential for using solar energy in the sport sector.	102	26.6	124	32.3	62	16.1	55	14.3	41	10.7
I think that Nepal is fully using its existing potential of solar energy as one of the Renewable sources.	103	26.8	161	41.9	72	18.8	45	11.7	3	0.8
Nepal is capable of producing renewable energy other than solar and hydropower energy.	28	7.3	15	3.9	128	33.3	158	41.1	55	14.3
I think introducing renewable energy in sports sector is important.	11	2.9	8	2.1	70	18.2	206	53.6	89	23.2
I believe that the employment of renewable energy in Nepal will enrich the sports sector.	9	2.3	13	3.4	54	14.1	211	54.9	97	25.3
I think investment in energy projects is a successful investment.	10	2.6	14	3.6	53	13.8	192	50	115	29.9

If I have the opportunity to invest in renewable energy projects, I am willing to invest in them.	8	2.1	27	7	47	12.2	199	51.8	103	26.8
I think renewable energy helps to raise environmental awareness.	12	2.3	15	3.9	42	10.9	204	53.1	114	29.7
I feel encouraged to use renewable energy.	10	2.6	12	5.1	30	7.8	203	52.9	129	33.6
I believe athletes can influence the use of renewable energy in sports.	8	2.1	12	3.1	47	9.6	204	53.1	127	32

Regarding the perception of player on use of renewable energy in sports, 32.3% of the respondents disagree that Nepal has potential for using solar energy in the sports sector followed by 26.6% strongly disagree, 16.1% are neutral, 14.3% agree 10.7% strongly agree. Likewise, 41.9% of the respondent disagree that Nepal is fully using its existing potential of solar energy as one of the renewable sources followed by 26.8% strongly disagree, 18.8% are neutral, 11.7% agree and 0.8% strongly agree. Similarly, 41.1% of the respondent agree that Nepal is capable of producing renewable energy other than solar and hydropower energy followed by 33.3% are neutral, 14.3% strongly agree, 7.3% strongly disagree and remaining 3.9% disagree.

Besides, 53.6% of the respondent agrees that introducing renewable energy in sports sector is important followed by 23.2% strongly agree, 18.2% are neutral, 2.9% strongly disagree and remaining 2.1% disagree. Also, 54.9% of the respondent agree that the employment of renewable energy in Nepal will enrich the sports sector followed by 25.3% strongly agree, 14.1% are neutral, 3.4% disagree and remaining 2.3% strongly disagree. As well, 50% of the respondent agrees that investment in energy projects is a successful

investment followed by 29.9% strongly agree, 13.8% are neutral, 3.6% disagree and remaining 2.6% strongly disagree.

Likewise, 51.8% of the respondent agrees that they are willing to invest if they have the opportunity to invest in renewable energy projects, followed by 26.8% strongly agree, 12.2% are neutral, 7% disagree and remaining 2.1% strongly disagree. Similarly, 53.1% of the respondent agrees that renewable energy helps to raise environmental awareness followed by 29.7% strongly agree, 10.9% are neutral, 3.9% disagree and remaining 2.3% strongly disagree. Besides, 52.9% of the respondent agree that they feel encouraged to use renewable energy followed by 33.6% strongly agree, 7.8% are neutral, 3.1% disagree and remaining 2.6% strongly disagree. In the same way, 53.1% of the respondent agree that athletes can influence the use of renewable energy in sports followed by 32% strongly agree, 9.6% are neutral, 3.1% disagree and remaining 2.1% strongly disagree.

4.3 Energy consumption of stadium and factors influencing sustainability

1) Energy consumption of stadium

Participant 1 provides an insight in energy consumption of Dashrath Stadium, which is a currently functional stadium in Nepal. It seems that the energy consumption in stadium depends on the sports activities and events where about 1000 KVA energy is consumed in average.

Participant 1: "*Nothing has been done such renewable energy sources in the sports sector, and technology is still unknown there. This means that most of the councils that I have seen only consume energy from hydro. Another alternative is through the generator, it comes into operation through the diesel. Other than that, 20 KVA of solar panels are added. As far as I know, this is only in the National Sports Council and only in the Dashrath Stadium. This is about 10-11 years ago. This is for the completely official professional context that can is used in emergency computers, emergency lights, and LED light. Apart from those that are connected here, there are 2 Generators. In that, 500 KVA is built in there. Another 500 KVA is in covered hall, used for hydrogen circulation, there used 2 in 1 that can be operated through both hydroelectricity and generators, there are 2 kinds. Another is the flood light on the wall of the National Sports Council, 54 lights are there. One bulb light has 2000 watt. 4 poles consist of 216 bulb lights. There are 216 lights, 108 are powered by generators using 500 KVA power, and the rest are operated by hydropower."*

Participant 1 said that there has been done nothing on renewable energy sources in the sports sector, and technology was still unknown in the sport sector whereas only hydropower was used and fossil fuel i.e., generator was used for backups only. 20 KVA of solar panels are added in the National Sports Council about 10-11 years ago for flood lights and 2 generators for backup which can be operated through both hydropower and diesel.

2) Drivers/ factors in influencing the implementation of sustainability initiatives

Table 9: Drivers in influencing the implementation of sustainability initiatives

Key drivers (n=384)	Very Important		Important		Fairly Important		Not Important	
	f	%	f	%	f	%	F	%

Stakeholder's pressure	82	21.4	130	33.9	165	43	7	1.8
Protecting organizational reputation	46	12	176	45.8	158	41.1	4	1
Reducing operating costs	60	15.6	175	45.6	141	36.7	8	2.1
Top management commitment	82	21.4	164	42.7	135	35.2	3	0.8
Government legislation and regulation	80	20.8	155	40.4	146	38	3	0.8
Ethical responsibility	84	21.9	173	45.1	125	32.6	2	0.5
Culture of the organization	92	24	158	41.1	131	34.1	3	0.8
Financial incentives	84	21.9	162	42.2	136	35.4	2	0.5

Regarding the Energy consumption of stadium and factors influencing sustainability, 43% of the respondents ponder stakeholders' pressure is a fairly important driver in influencing the implementation of sustainability initiatives followed by 33.9% ponder important, 21.4% ponder very important and remaining 1.8% ponder not important. Similarly, 45.8% of the respondents ponder protecting organizational reputation is important driver in influencing the implementation of sustainability initiatives followed by 41.1% ponder fairly important, 12% ponder very important and remaining 1% ponder not important. Likewise, 45.6% of the respondents ponder reducing operating costs is important driver in influencing the implementation of sustainability initiatives followed by 36.7% ponder fairly important, 15.6% ponder very important and remaining 2.1% ponder not important. Besides, 42.7% of the respondents ponder top management commitment is important driver in influencing the implementation of sustainability initiatives followed by 35.2% ponder fairly important, 21.4% ponder very important and remaining 0.8% ponder not important.

Also, 40.4% of the respondents ponder government legislation and regulation is important driver in influencing the implementation of sustainability initiatives followed by 38% ponder fairly important, 20.8% ponder very important and remaining 0.8% ponder not important. Like same as, 45.1% of the respondents ponder ethical responsibility is important driver in influencing the implementation of sustainability initiatives followed by 32.6% ponder fairly important, 21.9% ponder very important and remaining 0.5% ponder not

important. As well, 41.1% of the respondents ponder culture of the organization is important driver in influencing the implementation of sustainability initiatives followed by 34.1% ponder fairly important, 24% ponder very important and remaining 0.8% ponder not important. In a similar manner, 42.2% of the respondents ponder financial incentives is important driver in influencing the implementation of sustainability initiatives followed by 35.4% ponder fairly important, 21.9% ponder very important and remaining 0.5% ponder not important.

4.4 Existing situations of RE use of sports events and activities

1. **Possibilities of using RE in the sports sector**

There are many possibilities of using renewable energy sources in the sports sector as in using RE like solar, wind, hydro, biomass etc. to generate electricity. This electricity that generated by RE can be used in sports sector for its sustainability.

Majority of the participants has shown concerned over not having any renewable energy sources in the sports sector. However, they are very positive towards having the possibilities of using renewable energy sources in the sports sector. Some of them responded that RE being a clean energy, it is possible to apply on sport sector while some of the solar panels are being used in one of the stadiums of Nepal too generating certain amount of electricity.

Participant 1 :"*Nothing has been done such renewable energy sources in the sports sector, and technology is still unknown there. This means that most of the councils that I have seen only consume energy from hydro. Another alternative is through the generator, it comes into operation through the diesel. Other than that, 20 KVA of solar panels are added. As far as I know, this is only in the National Sports Council and only in the Dashrath Stadium. This is about 10-11 years ago. This is for the completely official professional context that can is used in emergency computers, emergency lights, and LED light. Apart from those that are connected here, there are 2 Generators. In that, 500 KVA is built in there. Another 500 KVA is in covered hall, used for hydrogen circulation, there used 2 in 1 that can be operated through both hydroelectricity and generators, there are 2 kinds. Another is the flood light on the wall of the National Sports Council, 54 lights are there. One bulb light has 2000 watt. 4 poles consist of 216 bulb lights. There are 216 lights, 108 are powered by generators using 500 KVA power, and the rest are operated by hydropower."*

Participant 1 said that there has been done nothing on renewable energy sources in the sports sector, and technology was still unknown in the sport sector whereas only hydropower was used and fossil fuel i.e., generator was used for backups only. 20 KVA of solar panels are added in the National Sports Council about 10-11 years ago for flood lights and 2 generators for backup which can be operated through both hydropower and diesel.

Participant 4: *"Now there has not been any work regarding the renewable energy related to sport through RECAST, as I've seen. But work with renewable energy has been done, but not directly related with sports. Now here that type of experts, this is an organization established since 2034, from that year, I have not seen anyone with related to sports. Other renewable energy projects are there but not focused on sports."*

Participant 4 stated that there has not been any work regarding the renewable energy related to sport through RECAST. However, work with renewable energy has been done by the organization.

Participant 6*: "Now, in our University and Central Environment Division still there has not been teaching, in this subject particularly."*

Participant 6 stated that there has not no work done by the university and no subject being taught in RE on sports.

Participant 7:"*It is like this, if there is a demand then research will be done. APEC does supply electricity in some places, we are trying to provide the grid electricity. We have provided net meter energy in case of renewable energy. The sports councils can generate electricity by keeping solar panels on their rooftops. In that, they can do consumption on their own, we have managed that they can hand over energy to Nepal electricity authority during surplus and taking during low production."*

Participant 7 stated that the research for RE on sports will be conducted if there is demand. Their organization has worked in RE while mentioned APEC that supply electricity based on RE. Participant 7 also suggested that there is a possibility to generate solar power by sport council through using solar panels on their rooftops and coordinate with to Nepal electricity authority regarding electricity consumption.

Participant 8: *"Now in the field of sports, our research center has not done any work. If someone came up with a good idea, obviously we would have done it. Now, in the talk of*

renewable energy, you will see an old vehicle here, and students will learn how to convert it to run from the batteries that used to operate from petrol and diesel. They built one vehicle in the learning process, now they are working on a second vehicle. They are not experts; they have only passed engineering but have not done practical. We have given them a chance to learn. We have transformation work in a planning. This is a sustainable plan. Because now, in order to do this thing, now is a learning phase, they will take an old car, change the battery and make it electric. But this is not the only purpose, the goal is to design and develop these types of cars and vehicles in New Nepal, tomorrow one day, the work is proceeding."

Participant 8 stated that their organization has not done any work but they would have done it, if someone has brought idea regarding RE on sports. Their organization and their team are working on something for a sustainable plan.

Participant 9: *"Yes, there are possibilities. Once that time, our project was not able to move forward. A proposal was made to put solar panels in Damak's stadium and install them, but the initial cost was a bit too high. And from that, the long-term output will be good, but the short-term output will not happen all at once so that the project didn't continue. After that, the stadium was also not there. Elsewhere, the possibilities for alternative energy are scarce."*

Participant 9 stated that there are possibilities on using RE on sports sector. Their organization once had a project for one stadium in Damak but was not able to precede it being costly and other reasons.

Participant 10: *"Now RE is the first growing field of today. Now in the market, in RE sector, there is a lot of research activity in the world however not in our country. This is a clean energy so it is nothing like we can't use this in sports, we can use this easily. Now the environment, in our sector, because there is no massive development, in the context of our country, the sports sector is not included so RE will be hard."*

Participant 10 affirmed that the RE is the first growing field in current context, but not much research activities have been done in Nepal. And also acknowledged RE being clean energy which has possibilities of using in sports.

Considering the responses from participants, participant 1 stated that renewable energy in the sports sector is still at its infancy stage. Most commonly, water is used for the

production of electricity in Nepal. 20 KVA of solar panels has been added to Dashrath Stadium before 11 years which is used in emergency computers, emergency lights and LED light. Participant 4 and Participant 6 is not aware of the use of renewable energy in sports sector at all while Participant 7 stated that possibilities of sports councils in generating electricity by keeping solar panels on their rooftops. Participant 8 and 10 stated that the research center has not done much work in the sector of sports. Participant 9 presented a positive response towards renewable energy by stating that proposal to place solar panels in Damak stadium was made for its installation. However due to the high-cost project could not continue.

2. Use of renewable resources in sports sectors

Renewable energy can be used for electricity generation, space and water heating and cooling, and transportation. It can be used as a clean energy that not only provides electricity in lights but also benefits in health by not producing carbon emission and clean air, which will never run out. However, the instruments need for the production of RE will eventually need maintenance and it is costly too.

Majority of the respondents believe that no such technology has been used in sport sector. However, some of the respondents said that they have used solar panels for some use in their organization but has not used in the wider area of sports. As only solar panel has been used for some floodlights in stadiums as a backup otherwise hydropower is being used. They still use non- renewable energy for backup electricity during events and games but no such other RE was used in sports. They believed that there should be some research done to use the RE in sport sector.

Participant 1: *"I don't know anything else about it. Maybe some of our raw material like batteries will get from outside, Solar also come from outside. Somehow cheaper than the generator. Hydropower is the cheapest for us. The capacity of its battery is, Distilled water is used, acid is used, that too is not available here, should be bought from outside. We have technical human resources here in Nepal. We can do the repair, but it is very expensive to get the instruments and machineries."*

Participant 1 stated that the hydropower is the cheapest for Nepal where solar panel, batteries are expensive but not than generators. The maintenance is done by the HR inside the

country however the equipment needed for solar energy production is not available inside the country.

Participant 2:*"In our, the event which happened in the last year in England or so, after that only sports came in priority. Even before that, we have been talking about environmental protection and everything has been listed in plan too. And according to that, the basis of our discussion will be our new structure, that going to be built. But in our structure, we are trying to keep that information. That kind of proposal has not been come till yet. Holistic approach proposal has been there instead of individual focused ones. During the discussion, stockholders are keeping their own views in front. A cross-cutting subject is in the discussion. It depends on the compatible with our plan and program that is brought by the Ministry's proposal."*

Participant 2 acknowledged the event in England which helped sports to be in a priority list for Nepal and was waiting for the proposal in order to build such infrastructure using RE in the sport sectors.

Participant 3*: "Now, first of all is, we should prepare questionnaire and then distribute, there are different places, different things. Which place needs what kind of renewable energy, can be solved by data processing, data manipulation, tabulation, representation and after that taking solution. Prospects are there for renewable energy."*

Participant 3 stated that there is a need of doing survey where questionnaire should be prepared and should be distributed then data tabulated, for analysis and conclusion.

Participant 4: *"Now, like ours, there are many innovative types of research work have been done. the thing is I don't have expertise in Sports."*

Participant 4 showed that they have no expertise in sports but there is many research conducted in Nepal.

Participant 5*: "I don't have that information. It could have been used in 1-8 places. If this is done in other sectors, it will be done in the sports sector too. Another thing is that we can advance the concept, put the holistic approach in it, and keep sports as a priority. Now 1000 lights, flood lights are used in football, in that, we use electricity. Other than that, we should use in the room, in the office, in the place where the audience sits. We can't go to the energy without involvement of other priorities or something new."*

Participant 5 stated about being unsure as there could have been use of renewable energy in 1-8 places and agrees that if other sector using it then sports sector will soon use it. Participant 5 told that RE should be used as a holistic approach by keeping sports in priority list.

Participant 6*: "Why not. We do talk about it, but it is not in regular basis. In our department and other close departments, we have been teaching by the help of electricity from solar at the beginning till now. The computer is running from PowerPoint with energy coming out of the solar. Here is the capacity to be able to afford in here."*

Participant 6 stated that we can use RE on sports sector while their organization is teaching students, running computers with solar electricity and approves that Nepal has capacity to afford the RE.

Participant 9: *"As far as I know, renewable resources have not brought to Nepal and that have not been used in sports. For floodlights, we have kept generators for backup and solar due to load-shedding we can't do anything, so only for the backup of computers, not for other purposes, backups are there in the councils. Pokhara Stadium, there is a generator for backup. And solar power is may be kept in small places like 100-200 watts. There is nothing for saving energy and for backups."*

Participant 9 is unaware of RE being brought to Nepal and used in sports. Participant 9 stated that there is a floodlight which is using generators and solar for backup in the sport council while Pokhara Stadium also uses generator for backup.

Participant 10: *"According to accurate information, the use of renewable energy in sports is not applicable. As for research, there should be research in our country. To be known, there is no research being done about using RE in sports sector."*

Participant 10 believes the use of renewable energy in sports is not applicable but research needs to be done for it.

Participant 11: *"No. According to my information, renewable energy connected with sports and projects are not there. If we connect sports and renewable energy, we can see in both urban and rural background. Now in the urban background, wherever there are sports fields, stadiums, in order to ensure uninterrupted power supply, we have to install solar or other renewable energy systems on a small scale, even if the lights go out for a while. It may be*

possible to establish a system of continuous power supply so that there is no problem. Another thing is, in urban areas, waste can be used as of the renewable energy, so we can combine it with sports. Now in the rural area, the sports can be played in the evening with the help of lightings. This knowledge is yet to reach there, so we can reach that along with the technology."

Participant 11 stated that there is not RE connected with sports. However, there are possibilities to connect in both urban and rural setting for continuous power supply. Participant 11 also mentioned that stadiums and sport fields can be used for solar installation in urban while rural area is still unaware of it so we can provide both information and technology there.

Taking all the responses into the consideration, Participant 1 thinks that the hydropower is the cheapest for Nepal where solar panel, batteries are expensive. Participant 2 feels that renewable energy sources should be introduced in sports sector. Participant 3 and 4 emphasizes the research field to analyze use of renewable energy in appropriate field. Participant 5and 9 are unsure as there could have been use of RE in sports sector will soon use it. Participant 6 shows positive response and states that using RE in their organization for teaching students, running computers with solar electricity and approves that Nepal has capacity to afford the RE. Participant 10 and 11 believes there is no use of RE in sports but research needs to be done for it.

3. Potential for energy saving by using renewable resources in sports

Renewable Resource have the prospect of being able to regenerate over time and that cannot be depleted no matter how much they are used such as solar, wind, geothermal, hydropower, and tidal energy. They have a great potential for energy saving by using renewable resources in sports.

The respondents are unclear about the potential of RE in sport sector. Some responded there is so much potential, some said none while some are not sure about it. However, they believe that as RE has so much potentiality for sustainability so there is a chance that RE can create much potential energy in sport sector too. Some of them believe that hydropower has enough potential to fulfill the energy need of the country which is still being not used so other alternative RE will have not that potential as hydro in Nepal.

Participant 1:*"No. Looking around inside the country, I have found solar system in many places of Singha Durbar. But today, when the electricity was operated very well, solar has not been in used. That's why Solar has not been in advantage since then. I see a weakness in the fact that the contractors do not repair, do not mend, and do not use it completely instead they use new machines for the commission."*

Participant 1 told that there is no potential while there used to be solar panel in Singha Durbar but nowadays it's not in use because of availability of hydroelectricity and not being repaired well.

Participant 3*: "There is so much. Renewable resources look at it, there is no plain area, and there are only hills and steeps lands. We need Technology. Environment in Nepal is not as rugged as America's area. We have fertile soil, natural rain water harvesting. But the place is not good and make machine suitable for that, then it will be possible. This is important to be understood by the planner, not only me."*

Participant 3 approves that there are so much potential in Nepal due to its hills and steeps lands and urges to having a need of technology for it which should be understood by planner.

Participant 9: *"There may be possibilities, but in Kathmandu, how much possibilities is there from the air, it should be researched by the government initiative, how much wind speeds can be achieved, everything will have to be seen. This should be a government initiative. Now what we have in Nepal is hydro. If I tell you that, Nepal has produced hydro as much as possible, from that, Nepal surely carries the potential. It's just that we are not able to do it now. Solar energy is a free energy; we could have been gone for that. Generator is an alternative only when there are no other options, oil is not available with us, for that our money will be sent to outside. And that creates environment pollution, sound pollution, and air pollution is the maximum."*

Participant 9 stated that there might be possibilities of wind energy which needs to be researched by government and solar energy can be a good alternative too. Participant 9 believes Nepal has hydroelectricity which is enough and needs to produce to its full capacity.

Participant 10: *"Now it's a new sector, so there is no chance that it has no potential. Now this is a growing field, so there is no way using RE. Now, if we give priority in the sports to*

the first thing, it will be a day shift or a night shift, for that we can use RE, involved people that are interested for 24 hours there, then we can do it."

Participant 10 specified that there is a potential as RE is a growing field and can be used in sports if given priority.

Participant 11: *"Now it is difficult to say this is the best. Depending on the places in Nepal, different technologies can work. In Nepal, electricity supply in the national context is hydro; now hydro is also a renewable resource. Only that what kind of effects will it has in the environment, can be the reason. We have hydro divided in 3 categories of run off the river, peaking run off the river and storage. As run off the river is a renewable no matter how big is it. The peaking run off the river and storage may not be renewable but it is a clean energy. The only reason why it is not renewable is that it is run by storing the water. The main pillar of Nepal is hydropower. Others are solar, wind, and may be other technologies there."*

Participant 11 is unsure about that RE is best as it depends on different places of Nepal. Participant 11 stated that Nepal has hydropower as RE which is a main pillar of the country and thinks that other RE sources might have potential too.

Taking into account all the response, Participant 1 thinks there is no potential and solar panel being used in Singha Durbar is not functional, also Participant 11 is unsure too. Participant 3 and 10 approves that there are so much potential in Nepal due to its topography. Participant 9 stated that there might be possibilities of wind energy and solar energy. Participant 11 and 9 stated that Nepal has hydropower as RE which is a backbone of the country and has more potential than other alternatives.

4. **Possibilities of increasing share in the sector and Job creation using renewable resources**

The global economy is dependent on the energy sector. Use of RE in the job creation will be fruitful in the world economy as the traditional energy resources are being consumed rapidly than they can be created, and are a major contributor to carbon emissions. So, being a clean energy RE not only provides clean energy but also creates new jobs in energy sector. The per unit of energy produced by the solar photovoltaic cells, landfill gas, or biomass plants have a higher number of jobs created than energy produced through conventional sources.

The majority of the respondents have confidence in that the RE can create job creation in Nepal as many skilled human resources are there inside the country and we can use them in RE sector. This not only create job but also provide earnings for living as well as it will bring less dependency on the other fossil fuels and LPG gas. And they also think that there are possibilities of increasing share in the sector where many investors are interested in implementing shares in the RE sector.

Participant 1:*"Now we have the skilled technical human resources but we don't get the responsibility to repair it even if we have the expertise. The company, from which the technology comes, is given to the contractor. I have not done any investment in shares however I am interested. If I had the money to invest, then we have our rivers. If we can use that in a good way then we can earn, we can sell, we can get many benefits."*

Participant 1 states that, the skilled technical human resources are not being used in Nepal while, is interested in investment of shares in RE and get benefits from it.

Participant 3*: "Yes, there can be job creation. There is so many places in Nepal for rural development. In scattered villages, renewable energy gives jobs for the future. Yes, we can get returns from share investments. We must invest in small scale, and then return will be get and invest that again at the community level."*

Participant 3 thinks that job can be created using RE and investment returns can be get from it too from staring in a small scale then going big.

Participant 4: *"Job creation using renewable resources is everywhere; it is done by people, in bio mass. The world is all energy. A country that can produce more and more energy can do development."*

Participant 4states job can be created everywhere using RE and a country can be developed by producing the energy.

Participant 6*: "This subject is a technical matter. For employment, now we, in sustainable management rather than engineers can get more job, technical persons like to invent solar. Basically, we have paid more attention to solar power than others; we also use solar power in our homes. Our sun shining time in Nepal is also good, the length of time."*

Participant 6 thinks that there is a good potential for job creation as we use solar in home and Nepal has lengthy sunshine duration.

Participant 7:" *"Yes, it is beneficial for job creation, use of our own sources, and saved from spending foreign currency. Let us see that we import almost of 2 billion petroleum products annually, 40 billion for our gas, the LPG. This is also why we can reduce the consumption; the crisis will be lessened. The country will benefit from the creation of job opportunities and other intangible benefits are gotten by the society, like road, bridge, school, we could have developed that. On previous days, we have seen the interest of some people on solar PV due to decrease in prices. More than 600 people have applied for permission for investment in the power development division. Many even have given the application for 600-700 megawatt solar. Banks are also interested in investment now a day."*

Participant 7 believes that RE is beneficial for job creation as it uses our own resources, saves spending foreign currency; reduce consumption of petroleum products and LPG. Due to decrease price, the people and banks are interested in investing on solar PV.

Participant 9: *"Not in sports. It does not seem shareholders are attracted. I also have not invested in share however; I have done solar installation and using it in my house."*

Participant 9 believes that RE is not for job creation in sport sector however, is using solar in home.

Participant 10: *"Personally, as an expert, we have done a lot of work in solar, in micro-hydro, in biogas, in biomass. In the form of an institute, brought by government like we do review the subsidies provided by the government, evaluate and verify the technology. Now in the case of RE, if we invest in solar, in biogas, we are self-dependent, we can develop ourselves. As for the development of biogas, we do not require manpower from outside, we can create job here. Even in case of Solar, those things that has to be made come from outside, but we can do the installation. In case of wind, we can made small and small turbines here too. Stoves are also made her we have been sustainable; we can do it ourselves. In the RE sector, specially, turbines of up to 1 megawatt, we can make it here, we don't have to go outside for the small turbines. This is why, it can create job in market at a huge amount."*

Participant 10 listed out the benefits from in vesting on RE such as becoming self-dependent, development by own, job creation, skilled human resource production, and being sustainable with it.

Participant 11: *"Now the best company to invest is HIDCL- Hydropower Investment Development Company, which has been established by the government. Other is private has a company that does project development only. The others are 1-2 companies are there which are still doing small investments. There are no others that invest in large scale. Now that's not the case. Now, about 30,000 people are getting jobs in our alternative sector. This is the data from the thumb rule of previous company that we have cooperated with. And every year, about 500 additional workers are employed. This can be here and there according to the situation and time. After the federalism, some of the work went to the local level."*

Participant 11suggests to invest in HIDCL established by the government while other private company does project development only. About 30,000 people are getting jobs in the alternative sector with 500 additional workers are employed each year.

Keeping in mind, Participant 1 is interested in investment of shares in RE and gets benefits from it while the skilled technical human resources are not being used in Nepal. Participant 3, 4, and 6 thinks that job can be created using RE and investment returns can be got from it too from staring in a small scale then going big. Participant 7 and 10 also believes that RE is beneficial for job creation as it uses our own resources, saves spending foreign currency, reduce consumption of petroleum products and LPG. Due to decrease price, the people and banks are interested in investing on solar PV. However, participant 9 believes that RE is not for job creation in sport sector but, is using solar in home. Participant 11suggests to invest in HIDCL established by the government and has provided 30,000 people employment in the alternative sector with 500 additional workers every year.

5. Changes made for energy efficiency in the sports sector and its impact

The different changes such as technologies for renewable energy sources, improvement of the lighting system, modernization of ventilation systems, renovation of the building envelope and upgrade of electrical equipment can be made for energy efficiency.

The majority of the respondents answered that they have not done such any kinds of changes regarding RE in sport sector and no plans being made also, but some are willing to

corporate if anyone has the proposal. They know the importance of RE and has so much positive impacts of RE in energy sector, if it can be used in sports sector then it would be a incredible choice.

Participant 1 :" *"I haven't thought about this situation that much. I am ready to cooperate if I got such environment."*

Participant 1 agrees to corporate to make changes regarding energy efficiency in the sports sector.

Participant 6*: "Now it is possible to have interest, it is an interesting subject. Recently, no plan has been made."*

Participant 6thinks energy efficiency in the sports sector is an interesting subject but has not made any plans.

Participant 8: *"No, we have not done right now. Typically, I have not worked in the sports. There is one thing I have done, and that too is in experimental phase. In the demand of municipality, in the open space, I have created a sample made of iron to do exercise, physical exercise, like a gym. If that works, other cities, municipalities and villages will be involved in sports. The other is about wind energy, or about solar, about small hydro energy, research and study has not been done there still. To talk about wind, once there was a young man, he came to work on wind energy saying that he has done PhD in wind energy, but he went back to Germany, without any work done. Now in Solar, what is there is, solar water pump is made here, like some kinds of machines. Another is the use of solar cells to charge the batteries in a machine, such as a system for scaring the wild animals, it is in process."*

Participant 8 states that there has not been done anything regarding changes in energy efficiency in the sports sector as it's not their field of work but has provided exercise tools in the park on demand of municipality.

Participant 9: *"Even I have not done anything in the renewable energy. Because even this generator, for management of the stadium, it would not have happened if it had not been hit by Load shedding in the Nepal that time. When we get onerous, when we have to adjourn the running game, it is not good for that to happen. It only came because that's very important*

and was very necessary. If only it was not load shedding then Nepal would not have got generator also, it would not have been important."

Participant 9 claims to have not done anything in the RE sector in sports because the generator for backup in stadium game only came after the crisis caused by load shedding in Nepal.

Participant 10: *"Like for a waste it has been managed, is one thing, from a community perspective, and from a personal perspective, waste management has been done that's one. The second thing is that the gas came out from that, when RE is used, the dependent in LPG has been decreased. It has been economically advantageous, and feedbacks are also good. We are dependent on the other country for the LPG, we don't have it. That's what to bring it, when used biogas, the dependency has been decreased and income generation has been increased, there is good in the community."*

Participant 10 has done changes regarding waste management and producing biogas from it which has made general people less dependent on LPG along with the income generation.

In general, it can be said that almost all the participants have claimed that they have not made any changes regarding energy efficiency in the sports sector using RE.However, participant 1 is positive for corporation, participant 6thinks it's an interesting subject, participant 8 claims to have builtexercise tools in the park on demand of municipality. Meanwhile, participant 9 claims to have got the generator for backup in stadium game only came after the crisis caused by load shedding in Nepal. However, participant 10 has done some changes regarding waste management producing biogas which has made general people less dependent on LPG along with income generation.

6. Responsibility of energy management and general sustainability efforts in the sports sector

Energy management can be done through the tracking and optimization of energy consumption to conserve energy usage in a building. Sustainability efforts can be made in sport sectors for social and environmental responsibility such as to reduce operating costs, to decrease waste and disposal costs, to create and expand markets for green products and services, and to improve employee safety using greener products.

The majority of the respondents blame country for not making plans on energy management and RE regarding the sport sector. They think the state is responsible for developing such policies and implementing RE in sports. They believe that there is not enough collaboration to develop such technologies who will take the responsibilities to invest in the sport sector. They also believe that the expertise must suggest such ideas to the policy makers so that these plans can formulate from the policy level and can be implemented in a official way.

Participant 1:*"The biggest thing is the management of state. If we can manage all this then there are energetic youth, there are skilled youth, there are people with skill. Those skills are not sending abroad if we can provide employment here for the development of this country, from every sector, from electrical work to sports, they can work there. The state needs to prepare the environment, the policy had to be in place, the chain of command, arc should also be clear and if it was done actively, it would be fine."*

Participant 1 believes that state management is the way to go for using skilled energetic youth for the development of the country by providing employment to them, to stop them from going abroad. Participant 1 claimed that the state is responsible for preparing the policy, creating such environment, making chain of command to do so.

Participant 2:*"There are two things in the policy. One thing that happened when making the policy was how unnecessary it was made. today's policy is made like a shopping list, how many perks are necessary to implement them, and 2-3 things are necessary for backup to implement them. Like research is needed, manpower is needed and there had to be an environment of positive cooperation of the stakeholders. Keeping this in mind, it is not easy to implement good policies.Another thing is that we need to have a clear discussion with the stakeholders before making a policy. If you take their ideas into the program and provide them with the necessary resources, the policy will be successful. On the other hand, it is difficult to implement policies due to fast- fast changes of leadership in ministries, because of the political instability. As the officials who were sitting in the formulation of the policy come up, when the next one comes, for the development of that policy, that officials have not been institutionalized yet. This has made effects in the implementation."*

Participant 2 blames policy makers for making policy look like a shopping list as it needs manpower, research, and cooperation of stakeholders to formulate and implement the

policy. Participant 2 believes that the policy would be successful if we take stakeholder's ideas into the program and provide them with the necessary resources. Participant 2 thinks political instability and frequent change of official leaders are in faults for policy being not implemented.

Participant 3*: "Now there is no coordination, no not at all. Now those who work in energy, those who work in agriculture, those who study in science, those who work in sports, thinks that sports are done by gangster. Same as, in other side, players say they don't understand us, we can't make them understand us. That's why there is a huge gap."*

Participant 3 thinks lack of coordination among the sectors and perception about other people is responsible for having huge gap of understanding.

Participant 4: *"I can't say anything about a certain person in this context, I will say government. Again, I don't blame TU either because if only they gave budget from top, then only it will happen."*

Participant 4 states that government is responsible to provide budget so that their organization can work.

Participant 6*: "Now, first of all, the country needs to make a plan. A certain kind of policy had to be taken, according to which the money had to be allocated. Whatever our budget is, it is spent on our basic needs. Sports has become like an alternative choice. Indeed, this should be a mandatory activity actually."*

Participant 6 believes that the country is responsible for making plan, policy, budget, and urges that sports should be made a mandatory activity.

Participant 8: *"Now I don't know the things of the sports sector that much, that should be done by the experts who are experts in the sports sector. It's called Sports and entertainment sector, isn't it."*

Participant 8 claims not knowing anything about the sports sector and mentions that should be done by experts.

Participant 10: *"Main thing is policy is the first thing for the energy management. In our context, we have focused on energy use rather than energy management. Now the management comes after that. Now, in reality, energy use and energy efficiency will be the*

same as goes in along with each other. But now, our promotion is on energy use, and then we manage it afterward."

Participant 10 believes policy is responsible for energy management because Nepal's focus is on energy use instead of energy management.

All responses considered, Participant 1, 4 and 6 claimed that the state is responsible for preparing the policy, creating such environment, making chain of command to, and allocation of budget. Participant 2 and 10 blames policy makers for making policy look like a shopping list as it needs manpower, research, cooperation of stakeholders to formulate and implement the policy and needs to be focused on energy management. Participant 3 thinks lack of coordination among the sectors and perception about other people is responsible for having huge gap of understanding. Although, participant 8 claims not knowing anything about the sports sector and mentions that should be done by experts.

7. Challenges in implementing energy efficiency in the sports sector

The sports industries are among the main energy wasters around the world. It is reasonable that running a sports facility requires an adequately amount of power, but it should not waste more energy than necessary. The lack of resources for policy formulation and lack of implementation, high unawareness rates among target people, the high cost of energy efficient applications, are some challenges to achieve higher energy efficiency in sports sector. Some solutions can be adopted for energy efficiency while helping the environment.

The majority of the participants listed out political instability as a major challenge in implementing energy efficiency in the sports sector also they have blame policy for not including any energy, budget or anything in sports. The major challenge is to reducing change in leadership post due to political instability that has a main effect in policy formulation and execution and some say that due to no idea for energy related activities in sports.

Participant 1:*"The biggest challenge is the political instability of our country. Due to the political instability like there is a project to build and that project is not even completed, another government will come and reduce that project to zero again. According to my initial study, our hydropower, which can generate 84 thousand megawatts of electricity, it is in a*

careless state, for that the contractor is from other countries, the investment of other countries, but the resources are of our country. And they don't give you chance to invest in that, like contractor focuses on buying diesel, solar, battery, acid and such things spends money in an artificial type. We have not been able to develop according to or capacity, the attention of the state has not reached there. The capacity of the state to produce is not there or not wanted. Because of that the things with us are not in use. It's all the state's fault. Not being able to use it even though we have such capacity. We can sell electricity by investing in a multi-national company, but we that much of capacity and we say we have water, land and forest, but we don't use it. We promote the transported goods, but we don't care about domestic goods."

Participant 1 states that the biggest challenge is the political instability of our country. Participant 1claims that because of the fraud contractor, the hydropower is in a careless state which can generate 84 thousand megawatts of electricity and not been able to develop in full capacity. Participant 1 is frustrated with state for not being able to use it even though having capacity where we can sell electricity by investing in a multi-national company.

Participant 5*: "The first thing is the policy. The policy has involved something in it but other is money. The third is input. This should be done research first."*

Participant 5 states policy, money and input is challenge for the implementation.

Participant 7:*"The first thing is because of politics. In the form of political agenda rather than development agenda. We have resources as gold bowls with us, but we are asking for iron coins, silver coins with others, that is unfortunate. The 2/3rd majority government did not last for 5 years, was elected for 2 years, did not hold elections many times, did not remain transparent, did not have competition, did not follow the law. Because of that reason, the potential that we have, whether it is tourism, water, solar, or herbs, could not happened even with the economic development. But is not necessary to become sad, different has been seen in these previous days, the consultancy is becoming independent, the inter-connected facilities between Nepal-India are easier than before, we have made that. In the next 3 years, about 3500 megawatts will be produced, now days 2200 megawatts are produced in Asar-Shrawon. In the next 2-3 years, we will be self-sufficient in winter too and will be an exporter too."*

Participant 7 thinks political agenda rather than development agenda is challenge where politics is not transparent, competitive and do not abide law. Participant 7 claims Nepal will be self-sufficient in hydro energy production if used in full capacity.

Participant 8: *"Because of no ideas. This kind of challenges is due to idea are not made. Someone had to come up with an idea, sport sector has this kind of problem, has this problem, bring that and do research. We only provide a platform here."*

Participant 8 affirm the main challenge is having no idea where sports sector has such problem and needs to do research.

Participant 11: *As such, when it comes to energy in Nepal, it has been established that energy is only hydropower. One of them is the reason for being slow development. It became that here is no need to develop anything except hydropower for a long time. After the talk of alternative energy came to the world, then only, it happened that we need to develop all sources of energy. But the focus was only on the places where the hydropower did not reach. That's why there is an idea for implementing few alternative sources of energy, but it still is hydroelectric centric in case of energy, one of the main reasons is that. Another thing is that the gestation period of the hydropower project is very long, from conception to completion. Because you have to look at social issues, environmental issues, different people, financial problems, technology is also big, according to all calculations, if you look at the completion of a big project, the project will take 2 times more the initial time. If we look at it, any project has been completed in time. Now I don't want to say from the government policy, it has said to develop it. Mostly in our policies there are big goals. By 2030 AD, our goal is to make 15,000 megawatts, but we will actually have 22-2300 megawatts only. 2030 doesn't look too far away, so it seems difficult. One important thing to note is that since the private sector has been involved in hydropower, the work has been fast. The private sectors involvement has not been that long."*

Participant 11 attest that Nepal has established that hydropower is the lone energy source as challenge for being slow development and plead to need of development of all kinds of energy. Participant 11 mentioned lengthy time taken for completion of hydropower project is another challenge and policy is on faulting too. Participant 11 urges that involvement of private sector might rush the slow work of hydropower project.

Taking into account, Participant 1 states that the biggest challenge is the political instability of our country. Participant 1, 7 and 11 is frustrated with state for not being able to use it even though having capacity where we can sell electricity by investing in a multi-national company. Participant 5 states policy, money and input is challenge for the implementation. Participant 7 thinks political agenda rather than development agenda is challenge where politics is not transparent, competitive and do not abide law. However, Participant 8 affirms the main challenge is having no idea where sports sector has such problem and needs to do research. Participant 11 attest that Nepal has established that hydropower is the lone energy source as challenge for being slow development and plead to need of development of all kinds of energy and needs the involvement of private sector for fast work.

8. Solar Panels in the sports organization

Solar energy is a free radiant light from the sun which can create electricity using solar panels. Solar power can get from the conversion of energy from sunlight into electricity, either directly using photovoltaic (PV) cells or indirectly using concentrated solar power, or a combination. The PV cells converts light into an electric current using the photovoltaic effect. It is free, affordable and exhaustible form of energy which is accessible in developing country like ours. Solar energy is second most used renewable energy after hydropower energy in the world.

The majority of the respondent preferred solar energy over renewable energy other than hydropower. They think solar energy can be installed easily and can be used for backups incase of load shedding and power cut off. However, they showed some concerned over the expensive cost of installment of solar panels like equipment, panels, labor, maintenance cost etc.

Participant 1:*"Now we can get it from solar energy for good, but it is very expensive for the connection. It is beneficial if we operate with electricity. Solar can also be considered as alternative energy in a modern era."*

Participant 1 thinks that it is good to have solar energy but is expensive for the connection.

Participant 2: *"Maybe there was 1-2, I have seen. When it comes to solar energy, it is possible that has an effect on the environment by the battery that will be used for it. I think it will cost 60% or much only for the battery. And while talking about this, the question of sustainabilitycan comes up."*

Participant 2 states that solar energy can have environmental effects due to battery used for electricity generation, which is also costly and might impact in sustainability.

Participant 5*: "That formal information is not there to the ministry. But when we were planning, we focused on environment friendliness and safety. Recycling the water, reusing it, and disposal of the waste material found there, there are 3 ways to recycle, reuse, and reduce. It is necessary to do extensive research on this matter."*

Participant 5 talks about the focus have given on the on-environment friendliness and safety when planning, and call for need of research in that area.

Participant 10: *"I think it's solar. According to the solar intensity, Nepal is the best place in the world based on sun rising period. What we don't have is, land like if we want to produce solar power in huge megawatt like in the desert, we don't have such lands in our country. Now the next thing is to work in the remote area, there is a little problem of transmission, it is very a difficult to connect it to the grid. The other one is a bit of problem in policy, focus has been on hydro more. In fact, there is a policy that allows one to put grid on solar to be installed if they want. This is why the solar will continue to grow big from now on."*

Participant 10 believes that solar energy is good for alternative energy in Nepal claiming best place in the world based on sun rising period but there is a problem of space needed for solar panel installation on large scale and hard to work on highly dense rural area in Nepal.

Participant 11: *"Now if we talk about this equipment production, in the beginning, there was no production of any technology here. Gradually, we introduced that technology here and made the private sector capable, and started doing the production. Now in the context of our work, if we are talking about local and small hydropower, then most of the equipment are produced here, only the generator will be bought from outside. If we talk about Solar, batteries are largely produced but the demand is not met. But there are many companies that produce, charge control, lights, wires, switches, only panels are not made others are there.*

The maintenance depends upon the scale of solar energy technology. Now days, there are new battery in market, new changed technology there. New batteries have come which does not need to be replaced with distilled water and their lifespan is also long. There is research being made globally in storing the energy during the peak hour of battery, to use it in other times.

Participant 11 claims to have introduced technology here and made the private sector capable in producing solar batteries, which is largely produced but still the demand could not meet. It also produces charge control, lights, wires, switches etc., only panels are not made in Nepal. Participant 11 showed some insight of new batteries and new technology being introduced in the market.

Considering all responses, Participant 1 and 2 thinks that it is good to have solar energy but is expensive for the installation and can have environmental effect due to battery used for electricity generation. Participant 5 talks about the focus have given on the on-environment friendliness and safety when planning, and call for need of research in that area. Participant 10 believes that solar energy is good for alternative energy in Nepal based on sun rising period but there is a problem of space needed for solar panel installation on large scale. Participant 11 showed some insight of new batteries and new technology being introduced in the market.

9. Policies for the sustainability of sports sectors on using renewable resource

Being one of the largest sectors, sports sector consumes tons of energy but nothing has been done for the sustainability of energy use in sports. We know that our country has benighted the sport sector comparing to the other neighboring countries. The sports sector is still in underdeveloped condition. So, not much has been done for sports and its sustainability on using renewable resources.

The majority of the respondents are expressed that there have not been any policies made regarding RE on sports. They think that many policy makers and even they are unaware on how to use RE in sports. They think this is a new world to them and has urged to adapt RE on sports in policy level. There are policies being made on RE field but has not been linked with the sports.

Participant 1:*"Nothing until now."*

Participant 1 states that there are no policies being made for the sustainability of sports sectors on using renewable resource

Participant 2: *"Now, in this, even choosing the specifically any individual project, then that we have covered in macro level, for that will achieve our sustainable goal in 2030. For the sustainability of the playgrounds, it is necessary for every municipality. But it needs to be continuously operated, repaired, and produced players according to it. International ground in the province is a must, just like the sports grounds, to make it a national standard. But on the one hand, it will take a lot of money to buy it and on the other side; it is a challenge for a continuous and sustainable development. But said so, there is no reason the government will not work in that way. Now, management should be done by those who are in level, municipalities, and development of infrastructure until they have spent their energy and efforts according to the capacity, somewhere made playgrounds, somewhere made cover holders. And the main policy commission will work together with the Ministry of Youth and Sports to discuss about the program, give them backgrounds and parts, and we have contributed to the current running program."*

Participant 2 states that they have some individual project in macro level to achieve SDG 2030. Participant 2 felt needs to have international ground in every province to make it standard level however it is a challenge a continuous and sustainable development. Participant 2 claims that policy commission will work together with the Ministry of Youth and Sports to discuss about the program, give them backgrounds to the current running program.

Participant 3*: "No, no. there is nothing being made. We need to give them pressure, then they will do."*

Participant 3 claims to have nothing been made and give pressure to make policy.

Participant 5*: "In sports, there is a new departure of Nepal. A policy has been departure. Our activities are held in accordance with that departure policy. We have our sports policy. We have sports development act, and we are in the process of bringing sports development policy. Now we are bringing a long-term 20-year policy for sports. Before it was started, we used to have as an annual event only. But now, we are going for long-term sustainability. Then after that structure will come. All this policy is an extra document only, someone had to implement it. We have a ministry to do the implementation. Even for this ministry, yesterday,*

was connected with education, and was connected with whom, sometimes whom, now has become an independent ministry. However, the youth is attached there; it has been 20 years being a separate ministry. The ministry is about policy guideline, policy implementer, leading sports creating a future vision, and work in the overall subject of the ministry. Then we have National Sports Councils to implement with us, about 6 decades old. This is also only unit that if for the implementation of the government's policy. Now we have game events, we need game groups, we have 184 game groups. They are specialized in specific sectors. They organize sports events at the national level and at the international level. They have created a game as for a player to playing environment and plus financially earning money. In the year 2077, one act came which had only goal that was to agreement of federalism. The ministry is in one place, the Sports Council is in center. Sports councils has become very politically motivated organizations, their employees are not experienced because of the politics, not transparent. What weakness was there is that, sports union is in a big role in today but the act could not involve that. Now, the structure of the provincial association should be strong for the development of sports."

Participant 5 affirms to have policy on sports and is planning to bring long-term 20-year policy for sports, going for long-term sustainability. Participant 5 proclaims that there has been a separate ministry for sports in the last 20 years to implement the documented policy, and 6 decades old sports council. Participant 5 introduced a act came in the year 2077 B.S. corresponding for federalism and blames ministry for being politically inward than transparent.

Participant 6*: "Now what we can say on the basis of environmental knowledge is that the players must have their changing room standard. The wastage coming out of that, dirt had to be managed properly. Along with it, the water they drink, foods, water quality must be drinkable according to the WHO guideline."*

Participant 6 provides insight on need to have waste management and players' drinking water quality, foods, changing room should meet the WHO guideline.

Participant 7:*"There is policy for energy in transmission, in generation, in distribution, in to provide quality service by the government. Government agencies also provide services and also give chance to the private sector. A Conducive Environment has been created. Now there is not a proposal that has come to invest in a solar for the sports industry."*

Participant 7 states that there is policy for energy in transmission, in generation, in distribution, in to provide quality service by the government but not in solar for sports.

Participant 9: *"There was not included before, according to the 2048 policy, now of 2077, I did not think that anything was done about this. In the right of the legislation, it is now being discussed in the Upper House, may be after that it will be possible. There is nothing on the policy."*

Participant 9 thinks it will only be made if there is a discussion in Upper parliament house about the sustainability of sports, if not then it is not possible

Participant 10: *"There is nothing that linked directly with RE. This is the first time. RE linked with Sports is the first time I have heard. As far as the policy of the state is concerned, we should try to use it in the sports sector. Now we should bring this in policy, we should try. For RE, there are policies. In our basic concept, if we invest in RE, we will not have a return profit and it doesn't come front in the priority. The state has done only for piloting. It has not been a first priority even if the policies are good."*

Participant 10 tells that there has policy made for RE but there is no policy made linked with RE on sports and should try to make as far as the state is concerned.

Participant 11: "*Now Nepal Government has made policy to guide this renewable energy called Rural Energy Policy 2063, it is in websites of our center too. It is said that it helps more in the contribution this modern energy through the alternative energy. It aims to promote the development of environmentally friendly energy and to support small and medium-sized enterprises in the local level of alternative energy. Now the government of Nepal has decided to make an alternative energy subsidy policy to use different energy sources in different places. That policy is revised in every 4 years. The last one policy is called alternative energy subsidy policy 2078. Now, the rural policy and alternative energy policy has said to expanding access to modern energy, but has not involved other sectors."*

Participant 11 states that Nepal Government has made policy to guide this renewable energy called Rural Energy Policy 2063 aims to promote the development of environmentally friendly energy to support small and medium-sized enterprises in the local level. The policy is revised in every 4 years, alternative energy subsidy policy 2078 being the latest one.

Under consideration, Participant 1, 3 states that there are no policies being made for the sustainability of sports sectors on using renewable resource. Participant 2 states that they have some individual project in macro level to achieve SDG 2030. Participant 5 affirms to have policy on sports and Participant 7, 10 and 11 tells that there has policy made for RE only. Participant 6 provides insight on need to have waste management and player drinking water quality, foods, changing room should meet the WHO guideline. Participant 9 thinks it will only be made if there is a discussion in Upper parliament house about the sustainability of sports, if not then it is not possible

10. Sports players as an influence, voice, platform, brand ambassador for use of renewable energy on the audience:

The world has been poured with technologies and rise of digital media. The modern world, we live in is influenced by other people. This modern generation seeks lot from the influencers they follow on social media. Sports player are also renowned for being an influencer as they have an effect of so many lives around the people in the world. So, the sports payer can use their platform, voice to use RE on audience for better change and benefit the environment.

The most of the participants agreed that we can use sports player as brand ambassador. They showed great interest on using players as a influencer, brand ambassador on promotion of RE among the audience as they can easily influence the view of the audience using the voice and platform. Being a public figure, the sport players has many fan following who support them can promote use of RE and sustainability.

Participant 1: *"For that, the affiliated national sports councils, making a brand ambassador, what benefits are there for the state, and for that person? About that, a master plan is necessary and it is better to use after that only."*

Participant 1 states that a master plan is needed for benefit evaluation for state and for the person after being a brand ambassador, then only it should be used for promotion of RE and sustainability.

Participant 3*: "The person who has been gone to a certain sector he can't be brand. He is focused on his own business. People of sport focus on sports, people of science focus on science, people of farming focus on farming, people of politics focus on politics. Unpaid ambassador like us is needed. The money is not paid, but all the people who know how to do*

it, how to do it, how to say it, and those who can coordinate, we need that moderator, if we can motivate that person then everything is possible. The central moderator person, unpaid ambassador, spokesman, or who can write, speak or know something, have knowledge on something, then we can do it. We need the person who does it."

Participant 3 indicates that the person can't be brand if the person has gone to certain sector as they are focus on their work only. Participant 3 thinks unpaid ambassador is needed for public speaking, coordination, moderation and other work.

Participant 4: *"Of course, we can. Now look at the India, look at America, looks at England, if it is cricket or football, or hockey. Now football is very popular in our country, cricket has also been popular now days. Now this, our (name), a very good cricketer of Nepal, if he becomes an ambassador, then his fan following is very huge. That is right, we should use him, and then people have good faith in him, think that now if there is a successful man in any field. Like that in sports, if they say it, people will easily understand it rather than if we say it. Do not win. If we use our celebrity then there are many possibilities."*

Participant 4 gave examples of other countries that they have made sports player, a brand ambassador that play different types of sports. Participant 4 mentions football and cricket being popular in Nepal, the fan following of the players is huge which will follow the players word and can be used for promotion.

Participant 5*: "Players are public figures. Like nobody knows us, you and me. But everybody knows (name), everybody knows (name), everybody knows our (name). They are public figures. People believe what they say but people don't believe what we are talking about. They should be made brand ambassador; everybody knows them. They have public image; we should use their public image in other sectors. Exactly like making them ambassadors of campaign, brand ambassadors, and slogan ambassadors for each campaign. For this, rather than other figures and other persons, we should use this figure and it is better to take it as a massive way."*

Participant 5 gave examples of different players in Nepal who are public figures that believes what they say and points out to use them as ambassadors of campaign, brand ambassadors, and slogan ambassadors.

Participant 9: *"yes, we can. Now, this player, in councils, we are responsible medium for players to bring from the councils. There are players all around the country. From us, we can reach through the players to the people. Sports can be the strong mediums than the other mediums."*

Participant 9 thinks they are responsible for bringing players to the sports council and they can reach to the people through the players making spots a strong medium.

Participant 10: *"It is new subject in context of sports to me. We are not connected to it. But based on my personal experience, as a sports sector, the state gives less priority to it and facilities for the players are also a less priority. Now for the promotion, it can be done by using the internationally known players."*

Participant 10 finds it a new topic which they are not connected and is positive on using internationally known players for the promotion.

Participant 11: *"We can. That is not true that it is impossible. Players are the most important part of the game. The players are the people who are easily get accepted by the general mass. That's why in some of the commercials, we see the players. In that way, we can involve the players in the promotion of this subject."*

Participant 11 assures that the players can be used for promotion, same as being used in commercials because players are important part of games and can get accepted by the crowd easily.

From the responses, Participant 1 believes that a master plan is needed for benefit evaluation then only it should be used. Participant 3 indicates unpaid ambassador is needed for public speaking, coordination, moderation and other work. Participant 4, 5 and 11 gave examples of other countries and players that they have used as brand ambassador. Participant 9 thinks they are responsible for bringing players to the sports council and they can reach to the people through the players making spots a strong medium. Participant 10 finds it a new topic which they are not connected and is positive on using internationally known players for the promotion.

11. Insufficient budget

Budget is a driving force for any organization to run or function. Every fiscal year, the state allocates it budget in different sectors for the development of the country. So, as the budget is also allocated for the sports sector in the country too.

The respondents showed a concerned about getting very little amount or percentage of budget in sport sectors. They also disquiet about the budget allocation for RE sector too. They were agitating to spend money on low budget and having not much to develop according to the plan made.

Participant 2*: "If we look at the account of the budget, even when the overall budget that ministry has, a lot of it has gone to the sports. About 80% of it is budgeted for sports councils and the remaining 20% is for Scouts and for the ministry's programs for the administration. Looking at the weight age of the Ministry's budget, it looks like a big percentage, but the overall budget is not enough. Now for our player, for the playground, logistics and proper food, it is not enough. There is need to be increased on that."*

Participant 2 presents that 80% budget is allocated for the sports sector however; the weight age of the Ministry's budget is not enough and needs to be increased.

Participant 5*: "In this, I will add 2 things, one of them is that infrastructure has been increased. According to the numbers, the infrastructure has been developed but not completed. Because this ministry is the second physical ministry. We are the ministry who gets extremely less budget. We have only 0.16% of the total budget of the country. In the budget of 100 rupees, we get is only 16 cents, that too is for the organization. Provincial and local, 3 divisions. We have lack of budget and second is we have put budget in the title. That's why we have lack of budget in our infrastructure which is getting more and more expensive each year due to discontinuity of construction because of lack of budget. This is on the priority but a research study has not been done."*

Participant 5 provides insight on budget having only 0.16% of the total budget of the country in the sports sector which is shared by organization, provincial and local level. Participant 5 is worried for having lack of budget to build sports infrastructure as it has been to discontinuity of construction each year.

Participant 7:*"Now, if you look at the Ministry of Energy, the budget will be 111 billion in this year, 80-82% of it will be in the power sector and the rest will be in the irrigation sector."*

Participant 7 provides budget details of Ministry of Energy, with 111 billion in this fiscal year where 80-82% of it will be used in the power sector and rest will be for irrigation, the other part of the ministry.

Participant 9: *"The government does not seem to have taken a policy on alternative energy. Nothings there even in sports, nothing has been done. There is no budget allocated at all, in this fiscal year. There is no rule also."*

Participant 9 states that government does not seem to have taken a policy on alternative energy and budget also is not there because of no policy and rules being made.

Participant 10: *"The state that allocates budgets for renewable energy, is by the government organization is the alternative energy promotion center. It will be done through AEPC. For them also donors support is there rather than government's support and, they run the program with some % from the government and some % from the donors. Now, except from that a big hydro power in RE, a big hydropower is not called RE now days, other than that all the programs are run by AEPC. We as an institute, we have to give something through technology, according to the support they need, according to socio-economic, it is only support. They are also donor based so we can tell that the investment from the state is very little. Exactly the figure can't be calculated, I don't know."*

Participant 10 assure that AEPC is responsible for using country's budget that is allocated for RE which is very little so they have to use the supports from donors.

Participant 11: *"It is very difficult to say exactly like that, even if there is an allocation for alternative energy, it is very less. If you connect the hydro, then there will be much. Except that if we talked about this AEPC, then it will be very little."*

Participant 11 claims there is very little budget allocated for alternative energy but there is a little more budget is allocated for hydropower projects.

Participant 2 and 5 raises concern toward insufficient budget from government in the sports sector. The participants claim that the budget does not cover all the required activities

for the sports sector including logistics, food, and infrastructural aspects. Similarly, the budget is not adequate enough for an alternative energy promotion center as per Participants 7,9,10, and 11.

12. Research in sports on renewable resource

In developing country like ours where the sports sector is still growing form the infancy level, the research on sports is much neglected. There has been rarely some research been done regarding development and sustainability of sport sector.

The most of the respondents replied that there has been research conducted in sports sector however, renewable energy is a new topic for them. They also showed interest on need of research in sports and also need of research for including RE and sustainability linked with sports.

Participant 2*: "Now in that, we are working to facilitate and work in collaboration on because the individual sector is a ministerial accountability. But the multi-sectoral should touch more than one; the planning commission has now collaborated and carried out this kind of research operation. But when it comes to the Ministry of Youth and Sports, we are researching the implementation of any program from a youth employment fund, its possible impact and how it can be improved. We have not done only for sports."*

Participant 2 states that multi-sector like planning commission has collaborated and carried many research operations however; they have not done related research regarding sports yet but declares it is possible.

Participant 6*: "We have 2-4 universities and 2-4 institutions like Nepal Academy of Science and Technology (NAST) which are involved in the research sector. But only a small amount of our investment goes in research. It seems that some corporate houses have sprung up, but not in an institutional form. I have seen in Kathmandu; it has been helping many clubs and all but it has not been working nationally."*

Participant 6 admits that there are some universities and certain institutions like NAST is responsible for research conduction in Nepal but only a small amount of our investment goes in research.

Participant 7:*"The Ministry has not conducted any research on that. In the field of renewable energy, solar power is the source of energy in Nepal, and it is possible to generate 3-6 watt per square meter of solar power. If you look in the whole country, the potential of solar power is not that much, you can see only 2000-3000 watt of energy supply only. Why we can't go beyond that is because there is smog in upper part, the Himalayas, there is snow and in Terai there is agriculturally suitable land so there comes the talk of food security too. according to that, in infertile lands here and there can be found in the hilly belt of the country that has faced the south, there is possibilities."*

Participant 7 affirms that the Ministry has not conducted any research related to RE based on the potential of Nepal for generating solar energy because of its topography.

The participants 2, 6 and 7 claims to have no research related activities regarding sports till yet as there are many organizations responsible for operating research in Nepal. Participant 2 states they have not done related research regarding sports yet but declares it is possible. Participant 6 admits that there are some universities and certain institutions like NAST is responsible for research conduction in Nepal but only a small amount of our investment goes in research. Participant 7 affirms that the Ministry has not conducted any research related to RE even with so much potential of Nepal for generating solar energy because of its topography.

13. Reason for not having enough research in sports

Research should be done in spots sector for evaluation of performance, boosting performance and promoting innovation. It also helps in increasing participation in sport and the importance of sport within the community. The research of RE in sports helps in promoting strength and health through sport and physical activity. However, there is a lack of research related with sports in Nepal. The participants said that the reason for not having enough research in sports is because of lack of recreations, ideas in the country, as lack of policy that implements the research activities.

Participant 3*: "The reason for this is because of no feeling of recreation from inside. Can't recognize the feeling in depth. Not because of the policy, but due to the one who doesn't understand? Policy can be made tomorrow. Parliament assembly is ours, who haven't recognized that, there is no importance of that that's why."*

Participant 3 claims that there is no recreational thinking in people for conducting research where policy can be made if the interest is built and blames parliament assembly for not recognizing the importance.

Participant 4: *"The reason for not having is that the organization depends on the type of expert, the type of project, and the demand. First of all, it is the policy of the government, now it is towards the university and the policy of the university towards the organization. The main thing in research is a budget, without money, no one can do research, that too is related to science. That will also be not done in 2-4 lakhs. What I understand is that funding is a problem in any research."*

Participant 4 provides reasons for no research is due to the dependence of organizations towards experts, project type and demand in market, and the main reason is budget and funding is lack in research sector.

Participant 11: "*The reason for no research is this; our main thrust at the moment is to make the government's access to all alternative energy sources obsolete now. Access to alternative energy is to provide energy technology for lighting or self-cooking in every house. We are working and focused on that. For that also, we are working as an executive branch of the government. Talking about that, still there are no electricity in every house, 95% of has, 5% are still in the remaining. That focus can only be transferred to other sectors only after the 100%. Others than that, in health, we are using renewable energy in hospitals, in education; we are also supplying power for lights to run morning shift classes in a school. Another is to draw water for agriculture, to irrigate the place from water leaking, using solar energy, and also for drinking water. Other is energy from the wastage, energy is generated from waste management .We are working on this area; this is connected with production and also directly with the people's life. In terms of priority, sports are in the backward."*

Participant 11 tells that the reason is sports not being in top of the priority list and the government aim is to made energy accessible in every house in Nepal right now, so that the focus will only change after the completion of the aim.

The reasons are different according to the participants as Participant 3 claims because of no recreational thinking in people, Participant 4 thinks due to the dependence of organizations towards experts, project type and demand in market and lack of budget while Participant 11 thinks sports not being in top of the priority list.

14. Budget for research conduction on renewable resource in sports

Even having a little amount of budget allocated in the sport sector, the authority has to allocate extra budget for research conduction that even on renewable resource linked with sports is very low in the priority list.

Some of the respondents have made appeal for the government on allocation of budget specially for the research purposes. They also showed realization on developing policy regarding separation of budget for research conduction.

Participant 2*: "We are working towards a policy based on facts and giving priority to that. This does not mean that it will show an immediate effect, the research will show the effect in the long run. For that, the laws of the government will give a platform for the promotion program. But it is difficult for a country like ours to spend money for that investment due to small economy. Another thing is that the research also has duplication. If doing it from one organizational in a unified form, no matter how much you spend, you can get a reward from it. And the other thing is that if you do it with a small budget, you will not be able to give the quality of it."*

Participant 2 has showed interest on budget allocation in research through policy based on facts and priority but doubts having immediate effect because Nepal has small economy, also have duplication and need to check for the quality.

Participant 4: *"In this year, I have located 1.56% from the total budget of TU in research."*

Participant 4 claims to have located 1.56% from the total budget of TU for research purpose.

Participant 8: *"I told the government. I have 2 wishes. The 1st one is for federal government of Nepal to made a policy to spend 1% of its GDP on research and development. The previous government did nothing and we have not heard till this day too. They have been given another option because that might have cost more. We have told them the choice to spend 1% from the development funds on research and development instead from the GDP, to the federal government, to the province government, and to the local government. But till now no one has made such policy."*

Participant 8 has made demand to the government for allocating budget in research but argues that it has not been heard even giving them different options. Participant 2 has showed interest on budget allocation in research through policy based on facts and priority but doubts having immediate effect while Participant 4 claims to have located 1.56% from the total budget of TU for research purpose and Participant 8 has made demand to the government for allocating budget in research but argues that it has not been heard.

15. Role of Corporate house in renewable resources on sports:

Corporate house are the large corporations, industrial, business house in this context of group having total assets of more than 40% in terms of gross income. There are big corporate houses in Nepal where they invest in different sector for making profit along with the development.

The participants expressed that the corporate houses in Nepal shave interest on RE because of its growing trend, and some are also have invested money on RE too. However, they are afraid to collaborate with the private sector as the government policy does not allow them in RE and sports.

Participant 4: *"We come under the rules of TU, so we should follow do according to its rules. We can't produce, we can't do business. If we agree with the private sector, they will invest in the production, and again if invest in the university, then there is internal thing which I can't reveal. No, there is nothing in the policy. First of all, to get that money, you have to connect with TU, it's very complicated. There are no suppliers to supply the goods here."*

Participant 4 profess that they come under the rules of TU and should follow according to it so that they could not coordinate with corporate house due to various reasons.

Participant 5*: "Nowadays, it is increasing. We have about 1000-12000 footsal. That is done by private sector. We can see that now a day, Corporate House and Big House has invested in Sports. Even they, outside of the government sector, a little profit are needed, to build image, to increase good will. The more it develops, the faster they enter. Because of that, we should take their input as a positive. There is no satisfactory condition."*

Participant 5 avow that the corporate houses are increasing as well as have invested in sports, and requests to take their input in a positive way because government sector is non profitable but they are profit based.

Participant 7:*"Many industries have produced solar panels on their roofs. During the awful load shedding we have given some importance in that too. we have not seen geothermal as such attractiveness in Nepal. Some of the researchers have been done, some are doing research on wind energy, some potential are there. However, it is not easy to bring blades in mountain area because of jam again that is a remote area we can't even bring in a bulk. In the context of today, we have focused on solar and alternative energy like the solar and wind. We have said to put 10% in our system for that. And in water resources too, in ROR storage, PROR projects should be 90-95% made, we are working on to be considered as a country with energy security."*

Participant 7 states that many industries have produced solar panels on their roofs as other alternative energy does not attract customer and has less potential than solar energy in the country.

Participant 10: *"They are interested mainly in the solar sector. Now whether to sell or what to do they are with interest. It has return profit according to the investment. "*

Participant 10 is sure that the corporate house is interested in solar sector because of its return profit based on the investment.

Participant 11: *"It is like this, if we talk about the work done by APEC is to be carried out, then our focus is on the remote areas, that's why the interest of the corporate house is not there. Yet, 500 companies have cooperated with us so far. There are many consultant firms, many companies, many production companies, many third-party communications, many small companies are there. I have seen that corporate houses have worked on some grid connected solar systems. But still, there is no attraction in this sector from big Corporate House."*

Participant 11 thinks that the AEPC work is focused on remote area interest of the corporate house is not there yet many companies have cooperated with them but corporate house has worked on some grid projects.

The response showed that, Participant 4 profess they could not coordinate with corporate house due to various reasons. Participant 5 and10 avow to take their input in a positive way even they are profit based. Participant 7 states that many industries have produced solar panels on their roofs and has potential of solar energy in the country. Participant 11 thinks that corporate house has worked on some grid projects but less attracted in working on remote area.

16. Recycling, Use of wastages and biomass energy production

Recycling saves energy by reducing or eliminating the need to make materials from scratch and also reduces the use of natural resources by reusing materials. There has not been much done for recycling in Nepal but discarded waste has been used for energy production in some places.

Participant 2*: "no, I don't know about that. That is not my sector."*

Participant 2 insist to not having knowledge on recycling and use of waste on energy production.

Participant 3*: "It was talked in starting but there is no one who does it. There were efforts being made to do this. As if, I have done rain water harvesting in this area."*

Participant 3 claims to have discussed at beginning but no efforts were made but has rain water harvesting in that area.

Participant 6*: "In here, we have solid waste degrading machine turbulence system. There is one institutional digressional plan, we used to produce gas from that but it is not functional now days. Now, in any sports buildings, there will not be too much waste. Now, if there is any competition, 10-20 thousand audience in the stadium will throw some garbage, but not always. We can't keep a recycling plant there just for that, it will cost a lot of money but we can keep dustbins all over the place. And that should be included in the municipal treatment system."*

Participant 6 states that there is solid waste degrading machine turbulence system which was used to produce gas from that but it is not functional now days. Participant 6 thinks that there will not be too much waste in any sports buildings while in the stadium will

throw some garbage not enough to install recycling plant for that but can be used in municipal treatment system.

Participant 7:*"Now, we have also decided to convert municipal waste into energy, the research has been conducting. Dharan is producing, Biratnagar also producing. The energy from sludge has not happened yet, methane is produced."*

Participant 7 has decided to convert municipal waste into energy where research is being done for that meanwhile, Dharan and Biratnagarhas produced energy from wastes.

Participant 9: *"Well, during the game there is 10-20 thousand audience, when the viewers come, everyone does it at that time, and it's not always that, we have to see it all at once. Now that can also be an alternative, from the waste also."*

Participant 9 thinks that the waste can be alternative for energy production however; they need to observe the quantity of wastes in the stadium first.

Participant 10: *"We can do it. The state has given subsidized, now in the army barracks, in the police station where people are there for 24 hours, and the biogas can be produced from the waste there. In Nepal, many big projects have been implemented from the municipal waste, not from the toilet waste, but from the municipal waste. Like one in Bhairahawa, one in Pokhara, one in Dharan. That is for large scale like 30 TP which gives of 30 kg per input."*

Participant 10 is positive on producing energy from waste where the country has given subsidized in places like army barracks, in the police station where people are there for 24 hours, to produce biogas like in Bhairahawa, Pokhara, and Dharan.

Participant 11: *"A very large, is in the Kotre at Pokhara which produces energy from solids. 4,000 cubic meters of size, gas and fertilizers are produced from 40 tons of waste after being processed. It also has been in discussions for Kathmandu, studies being done. A slightly larger plant will be built in Kathmandu that is for the local level, the whole inside the valley. It is just a dumping site in here. If we went for the production of energy, then the energy can be produced in a large quantity."*

Participant 11 tells that a large biogas plant is on Pokhara with 4,000 cubic meters of size, gas and fertilizers are produced from 40 tons of waste every day and is planning to install a slightly larger plant in Kathmandu as well.

Considering all responses, Participant 2 insist to not having knowledge while Participant 3 claims to have discussed at beginning but no efforts were made but Participant 11 is planning to install a slightly larger plant in Kathmandu as well. Participant 7 and 10is positive on producing energy from waste wherein Bhairahawa, Pokhara, Dharan.and Biratnagar has produced energy from municipal waste. Participant 6 and 9 thinks that the waste production needs to observe in the stadium first.

17. Perception of people in community level for the use of RE in sports

People can get different impression on the use of RE in sports. People have a great interest in sports, but they do not go beyond the games played. As use of RE is especially in Nepal is a topic of interest while use of RE in sports takes another level of knowledge to understand it.

Participant 4: *"Now people are slowly taking the interest but there is not much as should be."*

Participant 4 states that people are slowly taking the interest in sports but is not enough.

Participant 6*: "Now students are interested in sports from the point of student life. Mostly now, we are, Nepal is very far behind on sports in the world. We cannot compete with players from other developed countries, but we are playing also. But the craze for sports like before is very less. The facilities have been somehow increased than before but not so interested in sports."*

Participant 6 affirm that students are interested in sports even though Nepal is very far behind on sports compared to the world.

Participant 7:*"So, now in renewable energy, the case is, many people understand that solar and wind is only renewable energy but hydro is also a renewable energy. Many people tend to forget. The hydro is white gold in the context of Nepal. The white gold has been flowing and we could not use it. We do talk about the potential we could not able to harvest it. Now*

everyone's initiative is necessary in this. The policy, the act, the rules are striving towards creating conducive environment. Some of the projects are being made from the existing sector. Research are being done, research for 16-17 thousand megawatts, there are applications are made for license for generation."

Participant 7 convey that many people understand that solar and wind is only renewable energy but hydro is also a renewable energy. Participant 7 thinks that people talk about the potential but could not able to harvest it and plead for everyone's initiative.

Participant 9: *"In the context of sports, in the subject of renewable energy related to sports, that much perception and knowledge have been not come up yet."*

Participant 9 confirms that there is not much perception and knowledge on people regarding sports and renewable energy related to sports.

Participant 10: *"People have not understood that RE is this, have not understood that it is clean energy. But those who has used it, have given good feedback, it depends on the community or a person. The state of consciousness is also good. RE has solved health problems, and from that good education and helped in income generation too. That's why we had to take it positively."*

Participant 10 states that people still do not understand RE as clean energy and only those who has used it understands.

Participant 11: *"It's like this, now I don't have the opportunity to talk to the people of the sports sector about alternative energy. Now when we talked to the general people, they were concerned that if we didn't brought access to alternative energy such as micro hydro, solar, they would not have seen this electricity in their lifetime. In some places, I was there live. In the places where the kerosene lamps are lit, solar energy is being used so, they were extremely happy and have supported us too. A lot of value has been given in the rural sector. Now, in the urban areas, used only for that time when there is no power supply. For example, small investor, solar for back-up is used for electricity supply in homes. It is not like depending on 24/7 for the management. This is why, the perception of people in rural and urban sectors are very different."*

Participant 11 states that people are unaware of alternative energy where lot of value has been given in the rural sector as there is scarce of electricity but the urban areas only use

alternative energy when there is no power supply. so, the perception of people in rural and urban sectors are very different.

In view of respondents, Participant 6 affirm that students are interested in sports where Participant 7 convey that many people understand that solar and wind are only renewable energy but left hydro energy. Participant 9, 10 and 11 states that people are unaware of alternative energy and the perception of people in rural differ from urban area.

18. Incorporating RE in sports in curriculum

Teaching people, children and students about the new ideas and opportunities through the school curriculum is a great approach to reach more people. The use of curriculum to spread knowledge of RE to use in sports sector might helps in development of sustainability of sports.

The most of the respondents answered that the curriculum does include the RE sector from basic knowledge in school level to specific broad knowledge up to masters and PhD in Nepal. Different university in Nepal like KU, TU, IOM, IOE, and CTEVT does teach students about the RE as a course for sustainable development.

Participant 6*: "Nowadays, the teaching on environment related subjects have been started from school level. The certain Course of Stain abilities is also available from the School to the PhD. This is in other like Kathmandu University, TU, Institute of Engineering Studies is teaching this subject."*

Participant 6 claims that the teaching on environment related subjects have been started from school level and certain Course of Stain abilities are also available from the School to the PhD level in many universities of Nepal.

Participant 10: *"According to the curriculum, is just for information in school level curriculum. Just a basic thing is there. More from that is in higher education to PhD, about RE in ours are very good. There are people who are PhD holder on RE, from our country and from foreign countries and there is Sir who has done PhD. Here too in IOM, courses are conducted. Courses in higher education are offered widespread, others are not informed. Master's program in ours, is based on the energy sector, namely Renewable Energy, Engineering Energy System, Planning and Management, Energy for Sustainable Development. 3 courses are there in Master's. Everyone is connected with RE after going*

around. Energy management, energy research, and energy sustainable development are all connected to RE. More than that there are PhD courses in the RE sector. That's why there is extremely good in a higher education."

Participant 10 make known that there are only basic things in school level however, there are different specific course available regarding RE in higher education up to PhD in Nepal.

Participant 11: *"Yes, there is. There is a subject of renewable energy in the curriculum of the school. The lowest level is class 8, and there is a little bit of energy in the science of 9,10. Then in College, if it comes at the university level, then the subject of renewable energy is in engineering education at the master's level. In science, those for environmental science majors, rural development majors in humanities, etc. are there. Plus, CTEVT Courses, Vocational Trainings in Technicians, Skill Certifications up to the level 1, 2, 3, 4, for solar, biogas skill tests. The staff who works with us have studied this subject and had on-the-job training and given the exam to get the certificate."*

Participant 11 assert that there is a subject of RE in the curriculum of the school from class 8 to 10, in college and university level plus vocational courses and different trainings are available at CTEVT.

From the responses, Participant 6 and 10 stated that environment related subject has been incorporated from school to highest level of education in Nepal. Participant 11 also added that CTEVT courses, vocational trainings and others also incorporates solar and biogas skill tests.

19. Media roles on promotion of use of RE in sports

Mass media plays a very important role in creating awareness among the general public and in the dissemination of the information. Media can familiarize audience with healthy behavior change products and services when used to promote existing programs. The public relations are a valuable tool in the promotional mix unlike paid marketing programs.

The respondents have mixed response regarding the role of media on promotion of use of RE in sports. Some respond media has covered less, some said media has covered really well while some say not at all regarding the promotion of use of RE and in sports too.

Although they think that media has a greater role on influencing perception of people to direct country towards the development activities.

Participant 6*: "Now in Environmental Science and Management, we see sometimes it have been covered at some point in time. The Environmental Journalist Community used to host programs on radio and TV. Now it only does it sometimes because most of the journalists have very little knowledge about this matter."*

Participant 6 put in words that sometimes media covers about RE in Environmental Science and Management, and Environmental Journalist Community used to host programs on radio and TV but now days it has been less broadcasted.

Participant 9: *"Instead, it seems that the media supports some of it, and sometimes they also broadcast about adapting to other energy in alternative energy sources. Even though, it is not possible to do it all by the media alone. Some of the media have done work to reach to the people. But it does not seem to have been covered that much."*

Participant 9 claims that media only supports some parts of RE, although it is not possible to do it all by the media alone, some of the media have done work to reach to the people.

Participant 10: *"This media doesn't seem so positive in case of Nepal. My negativity is there in the perception of media. They write bad things about the good things and do what the corporate houses tell them to do. They don't have their own free judgment, media is not positive on it, they only have negativity on social media."*

Participant 10 points out that media doesn't seem so positive in case of Nepal as they write bad things based on corporate houses command.

Participant 11: *"I have found that the media has covered it really well. Because now a days, renewable energy, a small technology also has a big impact in villages. In that case, media has covered it really well. Plus, we have done media related programs time to time, in the past. The center will also give training to journalists in this regard, for exposure visit, to show technology like solar, biogas, and stoves. We did the same thing in the past so they have given a big coverage. Involvement of media is good."*

Participant 11 is positive that media has covered it really well plus they have done media related programs time to time to inform them about the RE related work and provide information to the mass though involvement of media.

Taking everything into the account, Participant 6 and 9 claims that media has covered and supported some works of RE, which have helped to reach to the people. However, Participant 10 doesn't seem so positive about media coverage in Nepal. While, Participant 11 is positive that media has covered it really well in providing information to the mass though involvement of media.

4.5 Key sustainability initiatives currently being implemented in the sports sector of Nepal

1) Sustainability initiatives currently being undertaken by Nepal

Table 10: Sustainability initiatives currently being undertaken in organization

Initiatives (n=384)		**Implemented**		**Planning to implement in next 5 years**		**Not being implemented**	
		f	**%**	**f**	**%**	**f**	**%**
Certified standards		150	39.1	135	35.2	99	25.8
Improving customer service		122	31.8	214	55.7	48	12.5
Sustainable financing		107	27.9	223	58.1	54	14.1
Waste management		114	29.7	217	56.5	53	13.8
Water management initiatives		132	34.4	188	49	64	16.7
Employee engagement		135	35.2	186	48.4	63	16.4
Resource efficiency		126	32.8	189	49.2	69	18
Adopting corporate social responsibility		115	29.9	204	53.1	65	16.9
Energy saving initiatives		127	33.1	194	50.5	63	16.4
Renewable	Solar wind hybrid	134	34.9	190	49.5	60	15.6

energy gadgets	Solar lanterns, lights	154	40.1	172	44.8	58	15.1
	Solar PV cell	167	43.5	161	41.9	56	14.6
	Solar water heater	223	58.1	127	33.1	34	8.9

Regarding sustainability initiatives currently being undertaken by Nepal, about 39.1% of the respondent answered certified standards is implemented followed by 35.2% respond planning to implement in next 5 years and 25.8% respond not being implemented. Similarly, 55.7% of the respondent answered improving customer service is planning to implement in next 5 years in the organization followed by 31.8% respond implemented and 12.5% respond not being implemented. Likewise, 58.1% of the respondent answered sustainable financing is planning to implement in next 5 years in the organization followed by 27.9% respond implemented and 14.1% respond not being implemented. Besides, 56.5% of the respondent answered waste management is planning to implement in next 5 years in the organization followed by 29.7% respond implemented and 13.8% respond not being implemented.

Also, 49% of the respondent answered water management initiatives is planning to implement in next 5 years in the organization followed by 34.4% respond implemented and 16.7% respond not being implemented. As well, 48.4% of the respondent answered employee engagement is planning to implement in next 5 years in the organization followed by 35.2% respond implemented and 16.4% respond not being implemented. Same as, 49.2% of the respondent answered resource efficiency is planning to implement in next 5 years in the organization followed by 32.8% respond implemented and 18% respond not being implemented. Likewise, 53.1% of the respondent answered adopting corporate social responsibility is planning to implement in next 5 years in the organization followed by 29.9% respond implemented and 16.9% respond not being implemented. Similarly, 50.5% of the respondent answered energy saving initiatives is planning to implement in next 5 years in the organization followed by 33.1% respond implemented and 16.4% respond not being implemented.

Also, 49.5% of the respondent answered solar wind hybrid is planning to implement in next 5 years in the organization followed by 34.9% respond implemented and 15.6% respond not being implemented .As well, 44.8% of the respondent answered solar lanterns, lights are planning to implement in next 5 years in the organization followed by 40.1% respond implemented and 15.1% respond not being implemented. Same as, 43.5% of the

respondent answered Solar PV cell is implemented in the organization followed by 41.9% respond planning to implement in next 5 years and 14.6% respond not being implemented. Besides, 58.1% of the respondent answered Solar water heater is implemented in the organization followed by 33.1% respond planning to implement in next 5 years and 8.9% respond not being implemented.

2) Impact of sustainability initiatives

Table 11: Impact of implementing various sustainability initiatives for better competitiveness.

Key benefits (n=384)	Very high		High		Fairly high		Low	
	F	%	F	%	f	%	f	%
Enhanced profitability	55	14.3	114	29.7	212	55.2	3	0.8
Improved innovation	32	8.3	177	46.1	173	45.1	2	0.5
Improved image	59	15.4	159	41.4	163	42.4	3	0.8
Superior consumer satisfaction	56	14.6	188	49	138	35.9	2	0.5
Enhanced business opportunities	67	17.4	185	48.2	130	33.9	2	0.5
Improved stakeholder satisfaction	60	15.6	182	47.4	140	36.5	2	0.5

Regarding Impact of implementing various sustainability initiatives for better competitiveness, 55.2% of the respondent replied enhanced profitability is fairly high followed by 29.7% replied high, 14.3% replied very high and remaining 0.8% replied low. Similarly, 46.1% of the respondent replied improved innovation is high followed by 45.1% replied fairly high, 8.3% replied very high and remaining 0.5% replied low. Likewise, 42.4% of the respondent replied improved image is fairly high followed by 41.4% replied high, 15.4% replied very high and remaining 0.8% replied low.

Besides, 49% of the respondent replied superior consumer satisfaction is high followed by 35.9% replied fairly high, 14.6% replied very high and remaining 0.5% replied

low. Also, 48.2% of the respondent replied enhanced business opportunities is high followed by 33.9% replied fairly high, 17.4% replied very high and remaining 0.5% replied low. As well, 47.4% of the respondent replied improved stakeholder satisfaction is high followed by 36.5% replied fairly high, 15.6% replied very high and remaining 0.5% replied low.

4.6 Key challenges for implementing the renewable resources in sport

1) Challenges in implementing sustainable initiatives in the sport sector

Table 12: Challenges in implementing sustainable initiatives in the sport sector

Key challenges (n=384)	Very challenging		Challenging		Fairly challenging		Not at all	
	f	%	F	%	f	%	f	%
Lack of government support	85	22.1	149	38.8	149	38.8	1	0.3
Lack of political will	66	17.2	215	56	101	26.3	2	0.5
Lack of resources for sustainability initiatives	83	21.6	178	46.4	123	32.0	0	0.0
Lack of knowledge	77	20.1	193	50.3	114	29.7	0	0.0
Lack of leadership	84	21.9	186	48.4	113	29.4	1	0.3
Current economic climate	90	23.4	187	48.7	107	27.9	0	0.0
Lack of business case	80	20.8	180	46.9	122	31.8	2	0.5
Lack of management commitment	79	20.6	189	49.2	115	29.9	1	0.3
Culture for sustainability	76	19.8	196	51	110	28.6	2	0.5
Current market structure	80	20.8	206	53.6	95	24.7	3	0.8
Lack of policies regarding energy	78	20.3	201	52.3	103	26.8	2	0.5
Renewable energy adaptation	78	20.3	201	52.3	101	26.3	4	1

Regarding challenges in implementing sustainable initiatives in the sport sector, 33.8% of the respondent find lack of government support is challenging followed by 38.8% find fairly challenging, 22.1% find very challenging and remaining 0.3% find not challenging at all. Similarly, 56% of the respondent find lack of political will is challenging followed by 26.3% find fairly challenging, 17.2% find very challenging and remaining 0.5% find not challenging at all. Likewise, 46.4% of the respondent found lack of resources for sustainability initiatives is challenging followed by 32% find fairly challenging and 22.6%

find very challenging. Besides, 50.3% of the respondent found lack of knowledge is challenging followed by 29.7% find fairly challenging and 20.1% find very challenging.

Also, 48.4% of the respondent find lack of leadership is challenging followed by 29.4% find fairly challenging, 21.9% find very challenging and remaining 0.3% find not challenging at all. As well, 48.7% of the respondent foud current economic climate is challenging followed by 27.9% find fairly challenging, and 23.4% find very challenging. Same as, 46.9% of the respondent find lack of business case is challenging followed by 31.8% find fairly challenging, 20.8% find very challenging and remaining 0.5% find not challenging at all. In a same manner, 49.2% of the respondent find lack of management commitment is challenging followed by 29.9% find fairly challenging, 20.6% find very challenging and remaining 0.3% find not challenging at all.

Likewise, 51% of the respondent find culture for sustainability is challenging followed by 28.6% find fairly challenging, 19.8% find very challenging and remaining 0.5% find not challenging at all. In a similar way, 53.6% of the respondent find current market structure is challenging followed by 24.7% find fairly challenging, 20.8% find very challenging and remaining 0.8% find not challenging at all. Besides, 52.3% of the respondent find lack of policies regarding energy is challenging followed by 26.8% find fairly challenging, 20.3% find very challenging and remaining 0.5% find not challenging at all. Also, 52.3% of the respondent find renewable energy adaptation is challenging followed by 26.3% find fairly challenging, 20.3% find very challenging and remaining 1% find not challenging at all.

4.7 Major findings

Items	Findings
Awareness of players on use of RE in sports	100% respondents (players) have heard about renewable energy 75.3% heard or learned from school curriculum 80.7% responded aware about what re means. 98.7% think renewable energy is best option for generating energy 45.8% think sport sector can definitely use renewable energy sources for sustainability
Perception of players on use of RE in sports	39.1% of the respondents responded they save electrical energy in their daily activities all of the time 90.4% support the promotion of renewable energy 49.2% think that expansion of renewable energy should be initiated by government 77.1% believe that social media is the best idea to increase awareness on renewable energy among citizens 32.3% of the respondent disagree that Nepal has potential for using solar energy in the sport sector 41.9% of the respondent disagree that Nepal is fully using its existing potential of solar energy as one of the renewable sources 41.1% of the respondent agree that Nepal is capable of producing renewable energy other than solar and hydropower energy 53.6% of the respondent agree that introducing renewable energy in sports

	sector is important 51.8% of the respondent agree that they are willing to invest if they have the opportunity to invest in renewable energy projects 53.1% of the respondent agree that athletes can influence the use of renewable energy in sports
Energy consumption of stadium	1000 KVA energy is consumed in average. Depends on sports events and activities
Factors in influencing the implementation of sustainability initiatives	43% of the respondents ponder stakeholders' pressure is a fairly important driver 5.8% of the respondents ponder protecting organizational reputation is important driver 45.6% of the respondents ponder reducing operating costs is important driver 42.7% of the respondents ponder top management commitment is important driver 40.4% of the respondents ponder government legislation and regulation is important driver 45.1% of the respondents ponder ethical responsibility is important driver 41.1% of the respondents ponder culture of the organization is important driver 42.2% of the respondents ponder financial incentives is important driver
Existing situations	Majority of the Key Informant were very positive towards having the

of RE use of sports events and activities	possibilities of using renewable energy sources in the sports sector Some of the Key Informant said that they have used solar panels for some floodlights in stadiums as a backup otherwise depend on hydropower Some of them believe that hydropower has enough potential to fulfill the energy need of the country Majority of them have confidence in that the RE can create job creation in Nepal Majority of them blame country for not making plans on energy management and RE regarding the sport sector Majority of them preferred solar energy over renewable energy other than hydropower Majority of them expressed that there have not been any policies made, unaware and appears as a new world in implementing RE on sports Majority showed great interest on using players as a influencer, brand ambassador on promotion of RE among the audience Also disquiet about the budget allocation for RE sector and Sports sector The reason for not having enough research in sports is because of lack of recreations, ideas in the country, as lack of policy that implements the research activities.
Sustainability initiatives currently being undertaken by Nepal	39.1% of the players answered certified standards is implemented 55.7% of the players answered improving customer service is planning to implement in next 5 years 58.1% of the players answered sustainable financing is planning to implement in next 5 years 56.5% answered waste management is planning to implement in next 5

	years 49% of the respondent answered water management initiatives is planning to implement in next 5 years 50.5% of the respondent answered energy saving initiatives is planning to implement in next 5 years 49.5% of the respondent answered solar wind hybrid is planning to implement in next 5 years 43.5% of the respondent answered solar PV cell is implemented in the organization 58.1% of the respondent answered solar water heater is implemented
Impact of sustainability initiatives	55.2% of the respondent replied enhanced profitability is fairly high 46.1% of the respondent replied improved innovation is high 42.4% of the respondent replied improved image is fairly high 49% of the respondent replied superior consumer satisfaction is high 48.2% of the respondent replied enhanced business opportunities 47.4% of the respondent replied improved stakeholder satisfaction is high
Challenges in implementing sustainable initiatives in the sport sector	Majority of the Key informant listed out political instability as a major challenge in implementing energy efficiency in the sports sector 33.8% of the players find lack of government support is challenging 56% of the players find lack of political will is challenging 46.4% of the respondent find lack of resources for sustainability initiatives is challenging

	50.3% of the respondent find lack of knowledge is challenging 48.4% of the respondent find lack of leadership is challenging 48.7% of the respondent find current economic climate is challenging 52.3% of the respondent find renewable energy adaptation is challenging

CHAPTER 5: DISCUSSION

In this study, the majority of the respondents responded renewable energy is energy derived from a natural source which is right and few responded wrong i.e., a source of energy that eventually runs out. This implies that the majority of people know about renewable energy while few needs to provide knowledge regarding renewable energy. In this study, the most chosen source of energy is 96.6% for solar energy, 90.6% for hydropower energy, 89.6% for wind energy, 55.5% for biomass energy, 52.3% for geothermal energy, 43.5% for sewage waste, 37.5% for tidal energy and 35.4% for atomic energy. This result shows that people are knowledgeable about natural energy. Additionally, solar panels are installed in buildings including houses, organizations and industries, making solar energy as the most familiar energy as compared to other energy than hydro. Other studies also showed that solar is chosen by 92.8%, hydropower for 79.5%, 74.7% for Wind energy,55.4% for biomass, and 48.2% for geothermal energy (Zakaria et al., 2019). However, another study showed that 32% were aware of power generation from solar energy, biomass energy and small hydro power plants, 24% supported wind power, 22% atomic energy,9% from sewage waste and very few supported tidal and other renewable energy sources (Khambalkar et al., 2010).

As Nepal is lavish in rivers which can generate enough electricity needed for the country. Besides that, Nepal is surrounded located near the equator, so naturally receives much sunlight. On average, Nepal receives an average of 6.3 hours of sunshine, which varies between 3.3 hours and 8.4 hours (Upadhyay et al., 2006). Thus, Nepal is well-suited for generating electricity from the sun, and can be more affordable and accessible than other energy. Furthermore, biomass is one of the major sources of producing energy in Nepal after solar and hydro but fewer people are aware of the matter. Because only in Pokhara, Dharan and Biratnagar has a waste plant for generating energy and some rural area has installed biogas in Nepal. Nepal being an abundant as a agricultural country with resources like wood, plant crop and animal husbandry. The waste materials from farming, garbage, and food process can be reused in energy production. This knowledge should be spread out to the public to increase their understanding and awareness on biomass energy as well as to increase the awareness on renewable energy.

In this study, 80.5% of the respondents think that environmental aspects are covered by sustainability, 76.8% think economical aspects and 76.6% think social aspects. However, in other studies, 51% think of environmental aspects, 24% think of economic aspects, and

16% think of social aspects (Almenhali, 2019).In this study, 77.1% of the respondents believed that social media is the best idea to increase awareness on renewable energy among citizens followed by 71.6% believed in mobile apps, 56.8% believed in newspapers, TV, radio, 55.7% believed in school subject curriculum and 52.6% believed in the awareness program. Other studies also showed that 90.3% believed that social media increases people's awareness, 69.8% by school subjects and 66.2% by campaign approach applied by the government for its advertisement and education program, 49.4% by mobile applications (Zakaria et al., 2019).

In this study, 98.7% of the respondents think renewable energy is the best option for generating energy while only 1.3% thinks fossil fuels energy. Similarly, key informants also viewed that renewable energy is a better option than fossil fuel energy because RE is a much cheaper, clean and more sustainable energy than fossil fuels which certainly will going to finish one day, creates pollution, is costly, and has environmental impacts. Supporting this statement, other studies also showed that Good renewable energy sources are felt to be a very good idea nowadays (Khambalkar et al., 2010). Also, (London Renewables et al., 2003), (Yüksel, 2008)and (Bilgen et al., 2008)viewed that the power generators are capable of meeting the demands but it would be a good idea if users were provided security of energy through the supply of 40% of the total demand came from a renewable source.

In this study, 73.7% agree to the use of renewable energy because of infinite sources, 71.9% responded to recycling sources, 71.6% responded to non-polluting or less polluting than burning fuel, 63% responded to saving the earth from carbon dioxide emissions and global warming, 55.5% responded more advantageous, 55.2% when looking forward towards the children of the future. Similarly, another study showed that 43% felt they would encourage the use of renewable sources because of their nonpolluting nature, 24% agreed that the use of renewable energy was important when looking forward to the children of the future, but only 1 % would discourage the use of renewable energy (Khambalkar et al., 2010).

This study revealed that 56.8% think renewable energy is a very good idea followed by 29.9% thinks a fairly good idea and 13.3% think a good idea. Likewise, 98.7% think renewable energy is best option for generating energy while only 1.3% thinks fossil fuel energy as a best option for generating energy. Other study showed that 87% preferred combination of petroleum and renewable energy among the four energy-mix where 78%

favored the use of renewable energy only, while 29% favored' for the use of petroleum as sole energy and only 3% preferred for the use of nuclear energy (Hua et al., 2008)

In this study 51.8% agreed and 26.8% strongly agree to pay for sustainable RE willingly. Similarly, other study showed that respondents were willing to pay for 10% expansion of RE into electricity mix up to 26.5 Euros on the electricity bill based on quarterly manner (Ntanos et al., 2018), which was higher than (Kontogianni et al., 2013; Markantonis & Bithas, 2009) that ranged between 11–16 Euros every quarter. Likewise, respondents were found to be paid 16.33 Euros quarterly as an additional charge on the electricity bill (Zografakis et al., 2010). Another study showed that 44.8% were willing to pay the supplementary amount of 0.06 hour per liter for fuel and it was found that the average amount people were willing to pay was 0.079 hour per liter on top of the fuel market price (Savvanidou et al., 2010).

In this study, most of the respondents answered that the curriculum does include the RE sector from basic knowledge in school level to specific broad knowledge up to masters and PhD in Nepal. Different university in Nepal like KU, TU, IOM, IOE, and CTEVT does teach students about the RE as a course for sustainable development. While in (Zakaria et al., 2019) study showed that many games were used during teaching and learning of RE through science subject to make it interesting, in the school level so that the students realize the importance of RE in the future.

The majority of the candidates who proclaimed sustainability in other studies (Almenhali, 2019) have a great understanding of sustainability in the water conservation and economic growth but low understanding of innovation and social aspects, meaning that not all interviewees understand completely of sustainability. Like in a similar manner, in this study too many participants supported RE on sports as an initiative to develop sports on a sustainability path. However, some key informants are worried about issues developed by installation, use of batteries and its effects on the environment and want to develop detail plan in action to tackle those problems.

This study showed that the majority of the participants listed out political instability as a major challenge in implementing energy efficiency in the sports sector also they have blame policy for not including any energy, budget or anything in sports. The major challenge is to reduce change in leadership post due to political instability that has a main effect in

policy formulation and execution and some say that due to no idea for energy-related activities in sports. Other studies(Foster-Pedley & Hertzog, 2006) showed that the high price of equipment resulted in reduced cost-effectiveness, the reliability and quality of government policy, a lack of awareness, a lack of experience, a lack of innovative financing solutions.

Therefore, the government must address these challenges and needs to develop strategies to tackle these obstacles in a current regulated status. There seems to be a preference for a different side intervention that does rely on taxes, subsidies and incentives.

CHAPTER 6: CONCLUSION AND RECOMMENDATION

Conclusion

This study aims to explore the awareness and perception of players on the use of renewable energy in sports, energy consumption of stadiums and factors influencing, existing situations of sports events and activities, key sustainability initiatives that are currently being implemented in the sports sector of Nepal and key challenges for implementing the renewable resources in sport. This study has adopted a mixed method research design i.e., both qualitative and quantitative study.

The analysis of results provides valuable insight into the determinants of sports players' attitudes towards the implementation of renewable energy sources. This valuation research reveals that the vast majority of the respondents knew renewable energy is an energy derived from natural sources which is right and few responded wrong. Many key informants also are unaware of the RE on sports. It is obvious that there is a great need to raise awareness among all sports players, leaders, officials, and policymakers through continuous and focused campaigns regarding the use of RE on sports.

The majority of the respondents think renewable energy is the best option for generating energy while only a few think fossil fuel energy is the best option for generating energy. Similarly, nearly a third quarter of the respondents said the use of renewable energy is infinite source, followed by recycling sources, and non-polluting or less polluting than burning fuel, and almost two-thirds of respondents think that renewable energy saves the earth from carbon dioxide emissions and global warming, more than half responded more advantageous, and is beneficial when looking forward towards the children of the future. In this regard, renewable energy resources appear to be the one of most efficient and effective solutions for clean and sustainable energy development in Nepal.

Regarding the perception of players on the use of renewable energy, more than one-third of the respondents responded they save electrical energy in their daily activities all of the time, the majority of the respondents support the promotion of renewable energy because of its low cost and environmentally friendly nature. Almost half of the sports players think that the expansion of renewable energy should be initiated by the government and more than a quarter believe that social media is the best idea to increase awareness of renewable energy

among citizens. Many respondents are willing to pay and invest on RE sector related to sports. Majority of the respondents ponder stakeholders' pressure is a fairly important driver in influencing the implementation of sustainability initiatives. It is of high interest to policy makers and related stakeholders that how much more individuals and citizens are willing to pay for RE than for fossil fuel energy and which factors are affecting willingness to pay for it.

There are important information gaps and misleading perceptions regarding RE sports to the public, of specific populations, groups, and decision-makers at various levels. Many key informants think that lack of coordination among the sectors and perception about other people is responsible for having a huge gap of understanding while people are unaware of alternative energy. It was found that the perception of people in rural areas was different from urban areas regarding RE. So, supportive policies and favorable investment frameworks for RE is necessary in order to achieve the market dispersion required for fulfilling the demand of energy requirements and sustainability targets.

Hence, the well-organized implementation of the policy, plans, programs, and projects is needed with installations of RE in time to take into consideration public perception, awareness attitude, behavior, and acceptability. RE with the prerequisite of energy saving and energy efficiency in the sports sector can be firmly linked through raising energy awareness and providing adequate information. It is necessary to contribute to a responsible and active citizen who will participate in shaping the future with energy conservation and environmental sustainability.

Recommendation

The following recommendations are given to promote the use of RE for the sustainability of sports in Nepal:

- It is recommended that governments should make policy frameworks and incentives for using RE in sports to convert into sustainability.
- Relevant policymakers should take into consideration planning appropriate projects, select implementation methodologies, and formulate action and implementation plans on the basis of short, medium, and long term.
- The Governments should promote sport as a means to raise awareness about climate change through collaboration and partnerships with different stakeholders such as

local governments, the private sector, academic sectors, civil society sectors, and science, technology, and innovation experts.

- National governments must collaborate with NGOs and INGOs to undertake capacity-building efforts involved in the sporting sector to address and mitigate climate change, collect robust data, and focus on assessments related to sporting events.
- The sports sector should be obligated to take solid actions such as using solely renewable energy, building carbon-free sports venues, and smart initiatives by increasing public awareness of renewable energy.
- The scarcity of knowledge and expertise associated with sustainability initiatives in sports is a huge challenge. So, training programs related to sustainability will help leaders, policymakers, and change agents to better understand how to plan, craft, and implement various sustainability-related strategies for viable benefit.
- Given that, this thesis is cross-sectional, the results presented here are only tentative and of limited value for generalization. Therefore, additional research with more elaborate and better-articulated designs is called for further exploration into the complex issue of sustainability initiatives is needed.
- Outdoor sports that do not consume energy or use alternative energy should be promoted by the government and private sectors.

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APPENDEX

For Athletes:

Consent form

Form No.:

Name of Data Collector: ..... Date: .....

Introduction

Namaste! My name is **Om Krishna Prasain,** PHD Student from **Prince of Songkla University, Thailand**. I am here to gather the data of the research entitled **"Renewable Energy for Sustainability of Sports in Nepal"** as per the need of completion of my PHD.

Consent Statement

- I agree to participate in the above research project and give my consent freely.
- I understand that the project will be conducted as described in the "Information Sheet", a copy of which I have retained.
- I understand that I can withdraw from the project at any time and do not have to give a reason for withdrawing.
- I consent to participate in an interview with the researcher.
- I understand that my personal information will remain confidential to the researcher.
- I understand that my organization will not be identified either directly or indirectly.
- I have had the opportunity to have questions answered to my satisfaction.

Participant's Signature……

Semi-structured Questionnaire

A. Socio-demographic questions

S.no.	Questions	Response
1.	Name	…….
2.	Age (completed years)	…….
3.	Gender	a) Male b) Female c) Others
4.	Marital status	a) Married b) Unmarried c) Divorced d) Separated e) Others……..(specify)
5.	Education level (completed)	…….
6.	Name of the sport you play	…….
6.1	Category of sport	a) Team sport b) Individual sport
6.2	Type of sport	a) Indoor sport b) Outdoor sport
6.3	Level of sport	a) National level b) Provincial level c) District level d) International level e) Others……..(specify)
7.	Years in sport participation	……
8.	How many games have you played till now?	…….

8.1	What games have you played till now? (More than one can be selected)	a) National level b) Provincial level c) District level d) International level e) Olympic f) Others……..(specify)
B. Awareness of players on renewable energy		
9.	Have you heard about renewable energy?	a) Yes b) No
10.	Where did you hear/learn of the renewable energy? (More than one can be selected)	a) Tv/ Radio b) School curriculum c) Newspapers/ books d) Internet e) Word of mouth f) Friends and family g) I haven't. h) Others……..(specify)
11.	Do you know what renewable energy is?	a) Energy derived from natural source b) Source of energy that eventually run out c) I don't know
12.	What are the sources of renewable energy? (More than one can be selected)	a) Solar energy b) Wind energy c) Hydropower energy d) Geothermal energy e) Biomass energy f) Atomic energy g) Tidal energy h) Sewage waste i) I don't know j) Others……..(specify)
13.	What are the renewable energy that Nepal is capable of producing? (More than one can be selected)	a) Solar energy b) Wind energy c) Hydropower energy d) Geothermal energy e) Biomass energy f) Atomic energy g) Tidal energy h) Sewage waste i) I don't know j) Others……..(specify)

14.	Do you think renewable energy is a good idea?	a) Very good idea b) Fairly good idea c) Good idea d) Bad idea e) I don't know
15.	What is the best option for generating energy or better energy options?	a) Renewable energy b) Fossil fuels energy c) I don't know d) Others……..(specify)
16.	What benefits does the implementation of renewable energy provide? (More than one can be selected)	a) Quality of life b) Environmental protection c) Economic development d) Green development e) Employment opportunities f) Reduced oil dependence g) Energy independence h) I don't know i) Others……..(specify)
17.	What is your opinion on use of renewable energy? (More than one can be selected)	a) Recycling sources b) Infinite source c) Non-polluting or less polluting than burning fuel d) Save the earth from carbon dioxide emissions and global warming e) When looking forward towards the children of the future f) More advantageous g) Discourage h) I don't know i) Others……..(specify)
18.	What are the aspects covered by sustainability? (More than one can be selected)	a) Social Aspects b) Economical Aspects c) Environmental Aspects d) I don't know b) Others……..(specify)
19.	Do you think sport sector can use renewable energy sources for sustainability?	a) Definitely b) May be c) Not really d) I don't know
C. Perception of player on use of renewable energy		
20.	Do you save electrical energy in your daily activities?	a) All of the time b) Most of the time c) Some of the time d) Rarely

21.	Do you support promotion of renewable energy?	a) Yes b) No c) Maybe
22.	What is the reasons for promotion of renewable energy? (More than one can be selected)	a) Security of energy supply b) Low cost c) Working with nature d) Prevent climate changes e) Clean sources f) Better than alternative g) Protect the environment h) Reduces global warming i) I don't support the promotion. e) Others……..(specify)
23.	What do you think the expansion of renewable energy should be initiated by?	a) Government b) Individual growth household level c) Developers d) Environmental group/ NGOs e) District or provincial f) Energy companies g) Others……..(specify)
24.	In your opinion, what is the best idea to increase awareness on renewable energy among citizens? (More than one can be selected)	a) Mobile Apps b) Newspaper, TV, Radio c) Awareness campaign d) School subject curriculum e) Social Media f) Others……..(specify)

D. Perception of player on use of renewable energy in sports.

Perception	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
Nepal has potential for using solar energy in the sport sector.					
I think that Nepal is fully using its existing potential of solar energy as one of the Renewable sources.					
Nepal is capable of producing					

renewable energy other than solar and hydropower energy.					
I think introducing renewable energy in sports sector is important.					
I believe that the employment of renewable energy in Nepal will enrich the sports sector.					
I think investment in energy projects is a successful investment.					
If I have the opportunity to invest in renewable energy projects, I am willing to invest in them.					
I think renewable energy helps to raise environmental awareness.					
I feel encouraged to use renewable energy.					
I believe athletes can influence the use of renewable energy in sports.					

E. Energy consumption of stadium and factors influencing sustainability.

25. Do you think these drivers in influencing the implementation of sustainability initiatives?

Key drivers	**Very Important**	**Important**	**Fairly Important**	**Not Important**
Stakeholders pressure				
Protecting organizational reputation				
Reducing operating costs				
Top management commitment				
Government legislation and regulation				

Ethical responsibility				
Culture of the organization				
Financial incentives				

26. which of these sustainability initiatives are currently being undertaken in your organizations?

Initiatives		**Implemented**	**Planning to implement in next 5 years**	**Not being implemented**
Certified standards				
Improving customer service				
Sustainable financing				
Waste management				
Water management initiatives				
Employee engagement				
Resource efficiency				
Adopting corporate social responsibility				
Energy saving initiatives				
Renewable energy gadgets	Solar wind hybrid			
	Solar lanterns, lights			
	Solar PV cell			
	Solar water heater			

27. What do you feel the following have an impact when implementing various sustainability initiatives for better competitiveness.?

Key benefits	**Very high**	**High**	**Fairly high**	**Low**
Enhanced profitability				

Improved innovation				
Improved image				
Superior consumer satisfaction				
Enhanced business opportunities				
Improved stakeholder satisfaction				

F. Challenges in implementing sustainable initiatives in the sport sector

28. What extent do you feel the following are barriers in your organization when implementing sustainable initiatives?

Key challenges	**Very challenging**	**Challenging**	**Fairly challenging**	**Not at all**
Lack of government support				
Lack of political will				
Lack of resources for sustainability initiatives				
Lack of knowledge				
Lack of leadership				
Current economic climate				
Lack of business case				
Lack of management commitment				
Culture for sustainability				
Current market structure				
Lack of policies regarding energy				
Renewable energy adaptation				

For KII: stakeholders from sports ministry/association/councils

1. What is the existing situation of the sports sector? stadiums, sports halls, training centers etc.?
    - Nature of event, games, Types of sports
    - Operating schedule: seasonal, specific
    - Area, venue, Participations Capacity attendance
    - Facilities provided for audience and players, demand, needs, and supply
    - Heating, ventilation, and air-conditioning (HVAC)
    - Current Use of resources: generator, LED, AC, Cooler, etc.,
    - Energy output of solar electricity and thermal systems, Cost and expenses
    - Stadium management and Sports facilities management
2. What is your annual energy use? Average energy use, the cost for the stadium by square foot? What are the peak and yearly energy demands?
3. What is energy use on game day vs. non-game day? Energy audit.
4. How do you pay for electricity? Peak and non-peak pricing? Cost, benefit, and energy reduction?
5. What are the possibilities of using renewable energy sources in the sports sector?
6. Is there any use of renewable resources: solar panels, wind turbines, etc. in sports sectors? If not, what reasons for not using any kind of renewable energy technology?
7. What is the potential for energy saving by using renewable resources in sports?
8. Are there possibilities of increasing share in the sector and Job creation using renewable resources?
9. Have you made any investments in renewable energy or energy efficiency?
10. Do you participate in any initiatives to track energy use at your stadium?
11. What changes have you made for energy efficiency? Does it have an impact?
12. Who is responsible for energy management and general sustainability efforts?
13. What are your greatest obstacles or challenges in implementing energy efficiency?
14. What are the changes done in the usage of non-renewable energy resources? increase or decrease of fossilized energy resource usage in the sector? Use of rainwater?

15. Which renovation solution would be most suitable for achieving low energy use in an existing sports hall/ stadium/ training centre? economy?
16. How should a photovoltaic solar cells system and solar thermal collectors be placed and sized to be profitable for an existing sports hall/ stadium/ training center?
17. What can Sports players do to influence for use of renewable energy on the audience: voice, platform, brand ambassador etc.?
18. Is there any recycling been done for energy conservation and efficiency?
19. Are there any policies for the sustainability of sports sectors using renewable resources?

For KII: stakeholders from energy department of Alternative Energy Promotion Centre (Nepal)

1. Introduction: post, experience
2. What are the possibilities of using renewable energy sources in the sports sector?
3. Is there any use of renewable resources: solar panels, wind turbines, etc. in sports sectors?
4. What is the potential for energy saving by using renewable resources in sports?
5. Are there possibilities of increasing share in the sector and Job creation using renewable resources?
6. What changes have you made for energy efficiency in the sports sector? Does it have an impact?
7. Who is responsible for energy management and general sustainability efforts in the sports sector?
8. What are your greatest obstacles or challenges in implementing energy efficiency in the sports sector?
9. What are the changes done in the usage of non-renewable energy resources? Increase or decrease of fossilized energy resource usage in the sector? Use of rainwater?
10. Which renovation solution would be most suitable for achieving low energy use in an existing sports hall/ stadium/ training centers? Economy?
11. How should a photovoltaic solar cells system and solar thermal collectors be placed and sized to be profitable for an existing sports hall/ stadium/ training center?

Are there any policies for the sustainability of sports sectors using renewable resource?

Questionnaire Validation:

To Whom It May Concern

I am very pleased to validate the questionnaire which is prepared by **Mr. Om Krishna Prasain** for the research under the title "**Renewable Energy for the Sustainability of Sports in Nepal**" In my understanding, this questionnaire and guiding questions for Key Depth Interview will be able to gather data from big samples in order to establish a cause and relationship with regard to find out the awareness and perception of player on use of renewable energy in sports. This will also help to determine the energy consumption of stadium and factors influencing the key sustainability initiatives that are currently being implemented in the sports sector of Nepal.

I strongly recommend that the researchers will be able to establish relationship between the sport and renewable energy in the current scenario of developing country like Nepal. For this an online survey will be conducted to reach a large target demographic area of Nepal in the unfavorable condition due to Covid Pandemic.

Thank you!

.....

Name: Alak Babu Prasai (PhD)
General Secretary Nepal Phd Associ

Date: 15/05/2021

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Thank you!

Dhruba

DR. Er. Dhruba Bhatta (PhD, Environmental Engineering
Email:- dibi2060@gmail.com
Tokyo Institute of Technology, Japan / Yonsei University, South Korea)
98433 18770 → mobile number

Date: 05/02/2021

To Whom It May Concern

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Thank you!

Jr. Dhungana
Janardan Dhungana (DDSC)
Chief Librarian, Tribhuvan University.
9841330548

Date: 03/03/2021

To Whom It May Concern

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Thank you!

Dr. Mahendra Sapkota
Contact: 977-9851139359
Email: sapkota.mahendra27@gmail.com
Affiliation: Central Department of Rural Development
Tribhuvan University, Nepal

Date: 03/04/2021

To Whom It May Concern

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Thank you!

Bishnu Kumar Sinjali, Ph D
+977 - 9841291022

Date: 23/05/2021

VITAE

Name **Om Krishna Prasain**

Student ID **6310930044**

Educational Attainment

Degree	**Name of Institution**	**Year of Graduation**
M.A. (Political Science)	Tribhuvan University	2020
M.A (Sociology)	Tribhuvan University	2012
B.A Humanities & Social Science	Tribhuvan University	2007

Scholarship Awards during Enrolment

1. **Graduate School Research Grant Award,** Prince of Songkla University for Doctor of Philosophy, 2020

Work – Position and Address

2. Assistant Campus Chief : Sulakshyana Kirti Campus, Kathmandu
3. Lecturer, Kailashkut Multiple Campus, Mitrapark, Kathmandu

List of Publication and Proceeding

1. Om Krishna Prasain, Wirach Taweepreda, Saroj Gyawali, Amrit Dhakal, Renewable Energy as a New Concept for Sports Sustainability in Nepal : A Qualitative Study (in submitted)
2. Om Krishna Prasain, Wirach Taweepreda, Saroj Gyawali, Amrit Dhakal, A Qualitative Study Exploring the Potential of Renewable Energy for Sustainability in Sports Sector of Nepal (in submitted)