DATABASES ANALYSIS OF HYDROPOWER RESOURCE POTENTIAL AROUND THE GLOBE

Qasim Rauf, YanpinLi and Anam Ashraf

North China University of Water Resources and Electric Power, Henan, China

ABSTRACT

*The renewable generation is one of the fast growing power system .Whereas the world is facing the challenge of effectively exploiting and utilizing renewable energy resources, not only to meet the increasing energy demand, but also to preserve and to reduce the depletion of fossil fuels and to lessen the amount of CO2 emissions in our atmosphere .The national energy generation resources of every country plays an important role in the development. The energy transition is well underway in most European countries. It has a growing impact on electric power systems as it dramatically modifies the way electricity is produced. In this paper, our focus is to perform a systematic review of hydropower resource potential around the Globe. In this study we will address three research queries: **1)** what is the existing status of hydropower resource potential around the globe? **2)** What kind of methodologies frameworks and approaches are used for exploiting and utilizing renewable energy resources **3)** What are the limitations of exploiting renewable resource potentials. The purpose of the study is to highlight the current research issues, to provide valid solutions to these issues and to find out the limitations of existing work in this area of hydropower resource potential. This will be done by performing quantitative literature analysis of different databases and all the results will be gathered by analysing the statistical data using "SPSS". Remedial techniques for handling the limitation of usability engineering management will be planned in future.*

KEYWORDS

Sustainable energy resource; Hydroelectricity; Renewable energy source; Sustainable hydropower; Hydroelectric energy; Hydropower technology ; Hydroelectric power Hydropower; Resource potential; Systematic study of hydropower; Database analysis of resource potential; Resource potential around the globe

1. INTRODUCTION

Lack of latest power generation techniques leads to unavailability of electricity to the population and they depend on traditional systems. According to the study, it was revealed that more than 1.27 billion people worldwide do not have access to electricity in 2010 [1]. Almost all countries around the world have recognized the importance of dominance which is to be self-sufficient for power generation and management. To deal with the universal scatter gap, the power system must undergo an insurgency that specializes in learning about the transition from fossil fuels to renewable energy. Long ago, meeting the electricity demand through adequate supply of electricity was a major problem. This is a major task for renovating the power network that is responsible for the supply, because of the extraordinary inadequacies, the inability of management to cope with the backing mechanism that leads to serious issues of "circular debt", land imbalances Near recovery and impractical electrical costs [2]]. Energy consumption has grown rapidly in the last decade globally and is projected to increase by 33% from 2010 to 2030 [3]. Lack of fossil fuel resources is a major threat to the world economy and is a factor. Today the world faces the most important economic, environmental and developmental issues. The energy sector accounts for 75% of global GHG emissions [4]. The steady increase in global energy demand has led to an increase in carbon dioxide (CO2) emissions and is a serious impact

to the environment and a significant contributor to global climate change. The relationship between renewable and non-renewable energy sources, economic development, and CO2 emissions has been investigated in several studies. Many people have used panel country data to examine these relationships. For example, Apergis and Payne [5] studied 80 countries and found bidirectional causalities between renewable energy consumption and economic growth and between non-renewable energy consumption and economic growth. Hydroelectric power generation contributes about 16% of global electricity generation [6]. In 2010 it produced three-fourths of all global renewable electricity. Large and small hydro contributed 70% and 6% with half the production coming from China, Brazil, United States, Canada and Russia respectively. In some countries, including Brazil and many African countries, 75% of grid electricity comes from hydro.

In study, systematic review research questions are worked by the **"PICOC"** structure against research question look into strings are worked for various query strings including various databases ,"**IEEE, ACM", "GOOGLE SCHOLAR"** and "**SCIENCE DIRECT"**. Databases are made against each query strings and query protocol is implemented on the databases for conclusive assurance of papers, with assistance of "data extraction frames" information from each chosen paper is extricated and checked on statistically

2. PROTOCOL FOR SEARCH PROCESS

Consequent to deciding inquire about questions
a survey convention is created which consolidates the accompanying:

- The Search Process
- "Inclusion" & "Exclusion" Criteria
- The Selection Procedure
- The Data Extraction Process
- Data Synthesis

3. SOURCES FOR LITERATURE SEARCH

Hydropower resource potential is a wide and intrigue field with conflicting terminologies. We searched "Springer", "IEEE", "Science Direct" and "ACM "for primary studies

4. LITERATURE SEARCH STRATEGY

4.1 Research Question in PICOC Structure

I. RQ1: What is the existing status of hydropower resource potential around the globe?

- *Population: Citizens*
- *Intervention: Hydropower resource Potential management*
- *Outcome: Status of Hydropower Resource Potential around the globe*

1) Search Strings/Second Step: Synonyms

a) Population

"Citizens

b) ***Intervention***

"Resource potential Management", "Hydropower resource potential management approaches" , "Hydropower resource potential Evaluation", "Hydropower resource potential development approaches" "Hydropower resource potential development techniques"

c) ***Outcome***

"Hydropower trends around the Globe" , "Resource Potential Status", "Status of Resource Potential Management", "Current Resource Potential Status", "Hydropower Resource Potential status", "Hydropower Resource Potential Trends and Status"

2) Strings Used for Essential "Primary" Studies Search of Research Question 1

Table 1: Strings used for primary studies search of the existing status of hydropower resource potential around the globe

Database	***Search String***
Springer	"Resource potential Management", "Hydropower resource potential management approaches" , "Hydropower resource potential Evaluation", "Hydropower resource potential development approaches" "Hydropower resource potential development techniques", "Hydropower resource potential measurement", "Resource Potential", "Hydropower resource potential Analysis", "Resource potential management methodologies", "Hydropower resource potential methodologies", "Resource potential Essentials", "Resource potential methods", "Resource potential development processes", "Resource potential practices", "Resource potential approaches" , Hydropower resource potential techniques"
ACM	"Resource potential Management", "Hydropower resource potential management approaches" , "Hydropower resource potential Evaluation", "Hydropower resource potential development approaches" "Hydropower resource potential development techniques", "Hydropower resource potential measurement", "Resource Potential", "Hydropower resource potential Analysis", "Resource potential management methodologies", "Hydropower resource potential methodologies", "Resource potential Essentials", "Resource potential methods", "Resource potential development processes", "Resource potential practices", "Resource potential approaches" , Hydropower resource potential techniques".
IEEE	"Resource potential Management", "Hydropower resource potential management approaches" , "Hydropower resource potential Evaluation", "Hydropower resource potential development approaches" "Hydropower resource potential development techniques", "Hydropower resource potential measurement", "Resource Potential", "Hydropower resource potential Analysis", "Resource potential management methodologies", "Hydropower resource potential methodologies", "Resource potential Essentials", "Resource potential methods", "Resource potential development processes", "Resource potential practices", "Resource potential approaches" , Hydropower resource potential techniques".
Science Direct	"Resource potential Management", "Hydropower resource potential management approaches" , "Hydropower resource potential Evaluation", "Hydropower resource potential development approaches" "Hydropower resource potential development techniques", "Hydropower resource potential measurement", "Resource Potential", "Hydropower resource potential Analysis", "Resource potential management methodologies", "Hydropower resource potential methodologies", "Resource potential Essentials", "Resource potential methods", "Resource potential development processes", "Resource potential practices", "Resource potential approaches" , Hydropower resource potential techniques".

II. **RQ2:** What kind of methodologies frameworks and approaches are used for exploiting and utilizing renewable energy resources

1) ***Search Strings/Second Step: Synonyms***

a) Population

Citizens

b) Intervention

"Resource potential Management", "Hydropower resource potential management approaches" , "Hydropower resource potential Evaluation", "Hydropower resource potential development approaches" "Hydropower resource potential development techniques"

c) Outcome

"Hydropower trends around the Globe", "Resource Potential Status", "Status of Resource Potential Management", "Current Resource Potential Status", "Hydropower Resource Potential status", "Hydropower Resource Potential Trends and Status"

2) *Strings Used for Essential " Primary" Studies Search of Research Question 2*

Table 2: What kind of methodologies frameworks and approaches are used for exploiting and utilizing renewable energy resources

Database	*Search String*
Springer	"Resource potential Management", "Hydropower resource potential management approaches" , "Hydropower resource potential Evaluation", "Hydropower resource potential development approaches" "Hydropower resource potential development techniques", "Hydropower resource potential measurement", "Resource Potential", "Hydropower resource potential Analysis", "Resource potential management methodologies", "Hydropower resource potential methodologies", "Resource potential Essentials", "Resource potential methods", "Resource potential development processes", "Resource potential practices", "Resource potential approaches" , Hydropower resource potential techniques"
ACM	"Resource potential Management", "Hydropower resource potential management approaches" , "Hydropower resource potential Evaluation", "Hydropower resource potential development approaches" "Hydropower resource potential development techniques", "Hydropower resource potential measurement", "Resource Potential", "Hydropower resource potential Analysis", "Resource potential management methodologies", "Hydropower resource potential methodologies", "Resource potential Essentials", "Resource potential methods", "Resource potential development processes", "Resource potential practices", "Resource potential approaches" , Hydropower resource potential techniques".
IEEE	"Resource potential Management", "Hydropower resource potential management approaches" , "Hydropower resource potential Evaluation", "Hydropower resource potential development approaches" "Hydropower resource potential development techniques", "Hydropower resource potential measurement", "Resource Potential", "Hydropower resource potential Analysis", "Resource potential management methodologies", "Hydropower resource potential methodologies", "Resource potential Essentials", "Resource potential methods", "Resource potential development processes", "Resource potential practices", "Resource potential approaches" , Hydropower resource potential techniques".
Science Direct	"Resource potential Management", "Hydropower resource potential management approaches" , "Hydropower resource potential Evaluation", "Hydropower resource potential development approaches" "Hydropower resource potential development techniques", "Hydropower resource potential measurement", "Resource Potential", "Hydropower resource potential Analysis", "Resource potential management methodologies", "Hydropower resource potential methodologies", "Resource potential Essentials", "Resource potential methods", "Resource potential development processes", "Resource potential practices", "Resource potential approaches" , Hydropower resource potential techniques".

III. RQ3: What are the limitations of exploiting renewable resource potentials?

1) *Search strings/Second Step :Synonyms*

a) Population

"Citizens"

b) Intervention

"Resource potential Management", "Hydropower resource potential management approaches" , "Hydropower resource potential Evaluation", "Hydropower resource potential development approaches" "Hydropower resource potential development techniques"

c) Outcome

"Hydropower trends around the Globe" , "Resource Potential Status", "Status of Resource Potential Management", "Current Resource Potential Status", "Hydropower Resource Potential status", "Hydropower Resource Potential Trends and Status"

1) Strings Used for Primary Studies Search of Research question 3

Table 3: What are the limitations of exploiting renewable resource potentials?

Database	*Search String*
Springer	"Resource potential Management", "Hydropower resource potential management approaches" , "Hydropower resource potential Evaluation", "Hydropower resource potential development approaches" "Hydropower resource potential development techniques", "Hydropower resource potential measurement", "Resource Potential", "Hydropower resource potential Analysis", "Resource potential management methodologies", "Hydropower resource potential methodologies", "Resource potential Essentials", "Resource potential methods", "Resource potential development processes", "Resource potential practices", "Resource potential approaches" , Hydropower resource potential techniques"
ACM	"Resource potential Management", "Hydropower resource potential management approaches" , "Hydropower resource potential Evaluation", "Hydropower resource potential development approaches" "Hydropower resource potential development techniques", "Hydropower resource potential measurement", "Resource Potential", "Hydropower resource potential Analysis", "Resource potential management methodologies", "Hydropower resource potential methodologies", "Resource potential Essentials", "Resource potential methods", "Resource potential development processes", "Resource potential practices", "Resource potential approaches" , Hydropower resource potential techniques".
IEEE	"Resource potential Management", "Hydropower resource potential management approaches" , "Hydropower resource potential Evaluation", "Hydropower resource potential development approaches" "Hydropower resource potential development techniques", "Hydropower resource potential measurement", "Resource Potential", "Hydropower resource potential Analysis", "Resource potential management methodologies", "Hydropower resource potential methodologies", "Resource potential Essentials", "Resource potential methods", "Resource potential development processes", "Resource potential practices", "Resource potential approaches" , Hydropower resource potential techniques".
Science Direct	"Resource potential Management", "Hydropower resource potential management approaches" , "Hydropower resource potential Evaluation", "Hydropower resource potential development approaches" "Hydropower resource potential development techniques", "Hydropower resource potential measurement", "Resource Potential", "Hydropower resource potential Analysis", "Resource potential management methodologies", "Hydropower resource potential methodologies", "Resource potential Essentials", "Resource potential methods", "Resource potential development processes", "Resource potential practices", "Resource potential approaches" , Hydropower resource potential techniques".

4.2. Literature Publication Search Strategy

As hydropower resource potential is with diverse terminology so we decided to use the search string with different synonyms of hydropower resource potential such as "Sustainable energy resource", "Hydroelectricity", "Renewable energy source", "Sustainable hydropower", "Hydroelectric energy", "Hydropower technology", "Hydroelectric power "Literature published between 1993-2019 are selected to search by using only the tittle and keywords fields

4.3 "Inclusion" and "Exclusion "Criteria of Literature

"Inclusion" criteria include

(1) screened out the research study for resource potential trends and status "Exclusion" criteria

include

(1) Eliminate research study about trends and status in other fields
(2) Excluding copy sections, barring those without total information. Eliminate studies without full text.

5. DATA EXTRACTION / PUBLICATION QUALITY ASSESSMENT

For the information extraction the summary sheet was designed from the chosen literature. That will extricate the at finally chosen papers surveying their quality and searching answers for research questions

Quality Assessment Detail 1-5:

1. Literature provides detailed information of hydropower resource potential and resource potential management trends?

The possible responses to this question are: "Yes (a)" for the detail description of hydropower resource potential trends around the globe; "partially (b)" for the partial or not detail information about hydropower resource potential trends around the globe; and ''No (c)'' paper having no information about resource potential management trends

2. Literature gives the enough tenet as how the hydropower resource potential management procedures are applied across the globe?

The possible responses to this question are ''Yes (a)'' for having the information as how the hydro resource potential management techniques helped out across the globe; ''partially (b)'' paper having partial or not detail information as how the hydropower resource potential management techniques helped out across the globe; and ''No (c)'' paper having no information as how the hydropower resource potential techniques helped out across the globe.

3. The literature provides clear outcomes of hydropower resource potential management status for across the globe?

The possible responses to this question are: "Yes (a)'' paper having clear outcomes; "partially (b)'' for paper having partial or not detail results; and "No (c)'' for paper having no outcomes.

4. The literature has been published in a relevant journal or conference proceedings?

The possible responses to this question are: "Very relevant (a)"; "Relevant (b)", and "Not so relevant (c)" .This question will be evaluated by considering the order of significance provided by the computerized library, the CORE conference positioning (A, B and C conferences), and the Journal Citation Reports (JCR) lists.

5. The study has been cited by other authors?

The possible responses to this question are: "Yes (a)" on the off chance that the paper has been cited by more than five creators; "partially (b)" in case the paper has been cited by 1 to 5 (1-5) authors; and "No (c)" for no citation. This question was appraised by considering the Google researcher citations count

Table 4: Data Extraction and Publication Quality Assessment

Paper/Publication Tittle:			
Authors:		**Year of Publication:**	
Reference Type: Journal/Conference/Thesis/Unpublished		Publisher: Science Direct /IEEE/Springer/ACM	
Quality Assessment		**(a)**	**(b)** **(c)**
Study provides detailed description of hydropower resource potential across the globe?			
The study provides the guideline as how the hydropower resource potential techniques are used across the globe?			
The literature provides clear outcomes of hydropower resource potential management status for across the globe			
The study has been published in a relevant journal or conference proceedings?			
The study has been cited by other authors?			
Data extraction for Questions		**Answers**	
What are the resource potential influencing factors and problems encountered in management of hydropower resource potential across the globe?			
		Questionnaires	
Which Hydropower Resource potential evaluation methods commonly used for evaluation?		User/researcher usability test Following existing guidelines Observation and interviews Statistical analysis through system log files	
Which management technique/method has been reported in this study?		Technique /Method	
Which kind of case study discussed in the paper?		Hydropower across the country Resource potential in developed countries Hydropower resource potential in developing countries Hydropower resource potential in under developed countries	
Data characteristics		Academia Mixed Industrial Government	
What are the limitations of hydropower resource potential management across the globe?		Hydrology dependency Low dissolved oxygen level generation Reservoir construction Perception variation Distributed Environment Others	
Empirical Validation of the resource potential management techniques applied across the globe		Case Study Experiment Survey experience reports observational study, survey action research Others	
Which classification of theoretical studies are mentioned here?		Design principles and ideas of resource potential management Evaluation method of hydropower resource potential management Development and influencing factor of hydropower resource potential management Design principles, ideas, and evaluation methods Development, influencing factor, and evaluation method of hydropower resource potential management	

6. PUBLICATION'S GENERAL INFORMATION

Table 5 shows the general details of publications within the systematic study audit prepare all these papers were finalized to gather the information according to our designed questions.
Through searching of the literature for 27 years within the four databases, we got collective of 8035 published studies. After implementation of our "inclusion" and "exclusion" criteria, we considered 61 publications for analysis

Reasons for the high exclusion rate are as follows.

1) *It happens commonly that repetition of same publication occurs in databases.*
2) *Unrelated field of study retrieved commonly.*
3) *Search function limitation by databases*

Table 5: Information Regarding Databases Literature

S.No	Information Regarding Databases Literature				
	Tittle	Author	Database (Digital Library)	Journal/ Conference/Chapter/ Magazine	Year
1	Renewable energy deployment to combat energy crisis in Pakistan	Abdul Raheem, Sikandar Ali Abbasi, Asif Memon, Saleem R. Samo, Y. H. Taufiq-Yap, Michael K. Danquah and Razif Harun	Springer	Journal	2016

02	India-Pakistan Energy Cooperation: Rethinking Opportunities and Newer Approaches	Mahendra P. La ma	Springer	Chapter	2014
03	Global Expansion of Renewable Energy Generation: An Analysis of Policy Instruments	Sanya Carley, Elizabeth Baldwin, Lauren M. MacLe an, Jennifer N. Brass	Springer	Journal	2017
04	The role of renewable and non- renewable energy consumption in CO_2 emissions: a disaggregate analysis of Pakistan	Syed Anees Haide r Zaidi, Danish, Fujun Hou, Faisal Mehmood Mirza	Springer	Journal	2018
05	Solar Energy: Topographical Asset for Pakistan	Pervez Hameed Shaikh, Faheemullah Shaikh, and Mushtaq Mirani	Springer	Journal	2013
06	Potential consequences of projected climate change impacts on hydroelectricity generation	Pierre Mukheibir	Springer	Journal	2013
07	Poverty, environment and economic growth: exploring the links among three complex issues with specific focus on the Pakistan's case	Himayatullah Khan	Springer	Journal	2008
08	An econometric analysis of inter-fuel substitution in energy sector of Pakistan	Waqar Khalid, Abdul Jalil	Springer	Journal	2019
09	The Future of Energy II: Renewable Energy	*Francis F. Chen*	Springer	Chapter	2011
10	Evaluating renewable energy sources for implementing the hydrogen economy in Pakistan: a two-stage fuzzy MCDM approach	Li Xu , Syed Ahsan Ali Shah, Hashim Zameer , Yasir ,Ahmed Solangi	Springer	Journal	2019
11	Developing High-Resolution Remote Sensing Technology	Kabiyeva Marzha n Kaskina Dina	Springer	Chapter	2018

	into an Advanced Knowledge Management System to Assess Small-Scale Hydropower Potential in Kazakhstan	Bradshaw Roland			
12	Modelling Water Resource Allocation: A Case Study on Agriculture Versus Hydropower Production	Jorge Bielsa Rosa Duarte	Springer	Chapter	2002
13	Study on Corrosion Status and Control Strategies in Energy Field in China	Jianyun Zhang	Springer	Chapter	2019
14	Applying rough random MODM model to resource- constrained project scheduling problem: A case study of Pubugou Hydropower Project in China	ZheZhang, Jiupin g Xu	Springer	Journal	2014
15	Hydropower	Jingsheng Jia,Petr as Punys Jing Ma	Springer	Chapter	2012
16	Small Hydropower Resources And Prospects Of Small Hydropower Electric Plants In The Near-Border Regions Of Ukraine	Igor Winkler	Springer	Conference	2009
17	Geospatial and hydrological modeling to assess hydropower potential zones and site location over rainfall dependent Inland catchment	Manish Kumar G oya, Vishal Singh, Akshay H. Meena	Springer	Journal	2015
18	Utilization of the world's potential water resources by hydropower installations	G. A. Pretro M. P. Fedorov	Springer	Journal	1993
19	Adaptation to Climate Change in the Management of a Canadian Water-Resources System Exploited for Hydropower	Marie Minville François Brissette Stéphane Krau Robert Leconte	Springer	Journal	2009

20	Hydropower for sustainable water and energy development in Ethiopia	Dagmawi Muluge ta Degefu Weijun He Jian Hua Zhao	Springer	Journal	2015
21	The Current Situation and Perspectives on the Use of Hydropower for Electricity Generation	Jorge Morales Pedraza	Springer	Journal	2015
22	Harnessing Renewable Energy Technologies for ICT and e-Governance Services in Un-Electrified Communities in Rural Nepal	Mona Sharma	ACM	Conference	2012
23	Parasol and GreenSwitch: Managing Datacenters Powered by Renewable Energy	In˜igo Goiri, William Katsak, Kien Le†, Thu D. Nguyen, Ricardo Bianchini	ACM	Conference	2013
24	Potential to reduce energy consumption and GHG emissions by using renewable energy technologies in the conversion of existing houses into net-zero and near net- zero energy buildings	S. Rasoul Asaee , V. Ismet Ugursal	ACM	Conference	2018
25	Application of Data Science for Controlling Energy Crises: A Case Study of Pakistan	Saif Ullah, Muhammad Asif, Shahbaz Ahmad , Ulfat Imdad, Osama Sohaib	ACM	Conference	2019
26	Leveraging Renewable Energy in Data Centers: Present and Future	Ricardo Bianchini	ACM	Conference	2012
27	The Case for Efficient Renewable Energy Management in Smart Homes	Ting Zhu ,A ditya Mishra, David Irwin, Navin Sharma, Prashant Shenoy, Don Towsley	ACM	Workshop	2011
28	Increasing Data Centre Renewable Power Share via Intelligent Smart City Power Control	Florian Niedermeier, Wolfgang Duschl , Torben Möller , Hermann de Meer	ACM	Conference	2015

29	HydroNode: An Underwater Sensor Node Prototype for Monitoring Hydroelectric Reservoirs	Luiz F. M. Vieira, David Pinto , Sadraque S. Viana, Marcos A. M. Vieira , José Augusto M. Nacif, Alex B. Vieira	ACM	Conference	2012
30	Energy Generation Capacity Analysis of a Canal Based Hydro Project	Farhan Khan , Kinza Ali, Ahmed Kausar , Shafaq Kausar	IEEE	Conference	2013
31	Energy outlook in Pakistan	Khuram Pervez Amber , Naila Ashraf	IEEE	Conference	2014
32	Cost Optimization of an Off-Grid Hybrid Renewable Energy System with Battery Storage for Rural Electrification in Pakistan	Rizwan Kamal, Muhammad Younas, Muhammad Shoaib Khalid, Affaq Qamar	IEEE	Conference	2018
33	Economic Evaluation of Tarbela Dam	Haris Mushtaq, Dr. Mohammad Bilal Khan, Hafeez Rehman Khan, Muhammad Ali Zahoor	IEEE	Conference	2015
34	A Micro Hydro Power Plant for Distributed Generation using Municipal Water Waste with Archimedes Screw	Ali Raza, Muhammad Saleem Mian, Dianguo Xu, Jawad Ahmed	IEEE	Conference	2013
35	Optimization of Daily Operation of Micro Hydro Power Plant Coupled with Compress Air Storage	Usama Bin Irshad, M.S Javaid, Saifullah Shafiq, Md Shafiul Alam, M.A Abido, Tahir Mumtaz	IEEE	Conference	2016
36	Extenuating Shortfall of Electric Power through Potential Accessible in Pakistan	Mariyam Arif , Ye Liu and Israr ul Haq	IEEE	Conference	2018
37	Grid Interconnection of Micro Hydro Power Plants: Major Requirements, Key Issues and Challenges	Waqas Ali , Haroon Farooq, Ata Ur Rehman, Mohsin Jamil, Qasim Awais , Mohsin Ali	IEEE	Conference	2018

38	A predictive pan-European economic and production dispatch model for the energy transition in the electricity sector	Laurent Pagnier, Philippe Jacquod	IEEE	Conference	2017
39	Thermal Unit Commitment considering Pumped Storage Hydro Electricity Plants	Mary Prasanna T, C.H. Ram jethmalani, Dr.Sishaj P Simon	IEEE	Conference	2013
40	Optimization of Capacity and Operational Scheduling for Grid- Tied Microgrid using Pumped-Storage Hydroelectricity and Photovoltaic	Petrus Yuri Nugraha, Augie Widyotriatmo , Sutanto Hadisupadmo , Deddy Kurniadi	IEEE	Conference	2015
41	Interaction between short-term and seasonal storages in a predominantly renewable power system	Christoph Groiss, Walter Schaffer, Wolfgang Gawlik	IEEE	Conference	2017
42	Developing and utilization of hydroelectric powe r and improving atmospheric environment	Maoyu Ran ; Yan Hu	IEEE	Conference	2011
43	Restless Waters: Fossil Fuel Emissions Conditioning a Reduction inHydroelectric Reso urces in Chile	Hugh Rudnick ; Rodrig o Palma-Behnke ; Andrea Rudnick ; Carlos Benavides	IEEE	Magazines	2014
44	Energy Scenario and Potential of Hydr oelectric Power in Pakistan	Waqar Uddin ; Sadam Hussain ; Kamran Zeb ; Musaib Aleem Dildar ; Z. Ullah ; Ihsan Ullah Khalil ; R. Ullah ; A. Haider ; Muhamm ad Adil ; H. J. Kim	IEEE	Conference	2018
45	Assessment of renewable energy resources and the use of hydro power for fluctuation compensation in Cameroon	M. Pendieu Kwaye ; J. Bendfeld ; N. Anglani,	IEEE	Conference	2015

46	A review of current renewable energy activities in Bangladesh	Alimul Haque Khan, Kazi Rehnuma Zafreen, Mir Muntasir Hossain, Maidul Islam,	IEEE	Conference	2015
47	Prospects of rural electrification of Balochistan province with renewable energy sources	Anis Ur Rehman ; Syed Mushtaq A. Shah ; Syed Ali Raza Shah ; Saeed Badshah ; M.A. Khattak,	IEEE	Conference	2017
48	Feasibility and simulation study of high-rise building Micro-grid with PV and mini-hydro pumping	Jianmin Zhang ; Qianzhi Zhang,	IEEE	Conference	2013
49	Optimal Electric Energy Production scheduling for Thermal-Hydro Electric Power Systems	Jiekang Wu,	IEEE	Conference	2009
50	Interface model based cyber-physical energy system design for smart grid	Janet Roveda ; Susan Lysecky ; Young-Jun Son ; Hyungtaek Chang ; Anita Annamalai	IEEE	Conference	2011
51	"Water resources planning hydropower for sustainable and green energy in Turkey	Ibrahim Yuksel ; Hasan Arman ; Ibrahim Halil Demirel	IEEE	Conference	2018
52	Analysis of ways of solving the problem of hybrid energy complexes based on reserve for power supply of autonomous rural consumers in Myanmar"	Michael G. Tyagunov ; Thu Yein Min	IEEE	Conference	2018
53	,"24 years postgraduate program renewable energy"	Evelyn Brudler ; Michel Golba ; Andreas Günther ; Hans Holtorf, Leonie Ibing, Edu Knagge, Udo Kulschewski			2012
54	Assessment of Hydropower Plants Energy Production Cost Influenced by	Ionut Bogdan Stoenescu ; Sorin a Costinas ; Gheorg	IEEE	Conference	2019

	Operational Decisions and Control Strategy	he Marius Deaconu“			
55	Flow regime aspects in determining environmental flows and maximising energy production at run-of-river hydropower plan ts	Alban Kuriqi, António N. Pinheiro, Alvaro Sordo-Ward, Luis Garrote	Science Direct	Journal	2019
56	Is the hydropower boom actually taking place? A case study of a South East European country, Bosnia and Herzegovina	Özge Can Dogmus, Jonas Ø. Nielsen	Science Direct	Journal	2019
57	Trans-regional transmission of large-scale hydropower: problems and solutions in receiving power grid	Jianyu Lu, Jianjian Shen, Chengguo Su, Qianqian Shen	Science Direct	Journal	2019
58	The energy injustice of hydropower: Development, resettlement, and social exclusion at the Hongjiang and Wanmipo hydropowe r stations in China	Xiaofan Zhao, Liang Wu, Ye Qi	Science Direct	Journal	2019
59	The Hydropower Pote ntial Assessment Tool (HPAT): Evaluation of run-of- riverresource potentia l for any global land area and application to Falls Creek, Oregon, USA	Thomas M. Mosier, Kendra V. Sharp, David F. Hill	Science Direct	Journal	2016
60	Resource assessment and feasibility study for the generation of hydrokinetic power in the tailwaters of selected hydropower s tations in Nigeria	Laniyi L. Ladokun,Bolaji F. Sule, Kajogbola R. Ajao, Adeniyi G. Adeogun	Science direct	Journal	2018
61	Temporal analysis of water-energy nexus indicators for hydropower gener ation and water	Mohammed Basheer,Nadir Ahmed Elagib	Science Direct	Journal	2019

	pumping in the Lower Blue Nile Basin				

[8,9,10,11,12,13,14,15,`16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38, 39,40,41,42,43,44.,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68]

VII. Graphical depiction of analysed data outcomes and Specific Information related to existing literature

Q5: Source of Publication		
Options	*Response %*	*Responses*
Conference	52.45	32
Chapters	9.83	6
Journals	34.42	21
Workshop	1.63	1
Magazines	1.63	1
Total Responses= 61	Answered Responses= 61	Skipped=0
Mean=1.51		
Standard Deviation=0.566		
Variance =0.321		
Standard Error =0.073		

Figure 1: Source of Publication

Q6: Publisher		
Options	*Response %*	*Responses*
Springer	34.42	21
ACM	13.11	08
IEEE	40.98	25
Science Direct	11.47	07
Total Responses= 61	Answered Responses= 61	Skipped= 0
Mean= 2.393		
Standard Deviation=0.143		
Variance=1.243		
Standard Error=1.115		

Figure 2: Publisher

Q8: Study provides detailed description of hydropower resource potential across the globe?		
Options	*Response %*	*Responses*
a	22.9	14
b	77.04	47
c	0	0
Total Responses= 61	Answered Responses= 61	Skipped=0
Mean=0.770		
Standard Deviation=0.424		
Variance=0.179		
Standard Error=0.054		

Figure 3: Study provides detailed description of hydropower resource potential across the globe

Q12: The literature provides clear outcomes of hydropower resource potential management status for across the globe		
Options	*Response %*	*Responses*
a	29.50	18
b	70.49	43
c	0	0
Total Responses= 61	Answered Responses= 61	Skipped=0
Mean=0.705		
Standard Deviation=0.459		
Variance=0.211		
Standard Error=0.059		

Figure 4: The literature provides clear outcomes of hydropower resource potential management status for across the globe

Q15: The study has been cited by other authors		
Options	*Response %*	*Responses*
a	93.44	57
b	6.55	4
c	0	0
Total Responses= 61	Answered Responses= 61	Skipped=0
Mean=0.9344262		
Standard Deviation=0.2495898		
Variance=0.6229508		
Standard Error=0.0319567		

Figure 6: The study has been cited by other authors

Q14: The study has been published in a relevant journal or conference proceedings		
Options	*Response %*	*Responses*
a	19.67	12
b	80.3	49
c	0	0
Total Responses= 61	Answered Responses= 61	Skipped=0
Mean=0.803		
Standard Deviation=0.401		
Variance=0.161		
Standard Error=0.051		

Figure 5: The study has been published in a relevant journal or conference proceedings

7. CONCLUSION

In this systematic review (SR) performed on resource potential management and hydropower resource potential around the globe , three research questions were established and research strings were designed using PICOC structure to extract research papers from different database, including ACM, IEEE, Springer, and Science Direct. Search protocol was designed for setting studies rules regulations to follow for summarize and concrete results after analysis.

On the basis of set protocols how the resource potential techniques are used around the globe for handling the hydropower resources while only 25 percent studies partially describe the techniques applications. In SR 75 percent study provides clear results of resource potential management status across the world, 25 percent are partially providing results of applications.

From these results, we found that so many researchers are doing studies on hydropower management. Their aim is to find out the existing constraints. They are also working on remedial techniques for management engineering for the hydropower. The aim of this study is to perform the active deep analysis of hydropower resource potential study across the globe Papers were chosen stress perceptive against every analysis question from these finalized databases 61 paper were chosen, these selected papers were analysed, assessed associate degree a based mostly by knowledge extraction was performed according to data extraction form . The collected data is statistically analysed by Statistical software **"Spss"** and according to this analysis, research papers selected for this study were taken between 1993-2019, out of 100 percent 34 % papers were published in journal 52 % in conference and 10 % chapters and 2% workshops and 2% magazines publications.

REFERENCES

1. S. C. Bhattacharyya, "Energy access programs and sustainable development: A critical review and analysis," Energy Sustain. Dev., vol. 16, no. 3, pp. 260–271, Sept. 2012.
2. S. Malik, M. K. Hayat, and M. U. Hayat, "External debt and economic growth: Empirical evidence from Pakistan," International Research Journal of Finance and Economics, vol. 44, no. 44, pp. 1450-2887, 2010
3. Abdel aziz, E.A., Saidur, R., Mekhilef, S. "A review on energy saving strategies in industrial sector". Renewable and Sustainable Energy Reviews, 15, 2011, pp.150–168.
4. International Energy Association (2015) Energy and Climate Change, World Energy Outlook special report(page#18).Retrievedon4thOctober2019from.https://www.iea.org/publications/freepublications/publication/ WEO2015SpecialReportonEnergyandClimateChange.pdf
5. Apergis N, Payne JE (2011a) On the causal dynamics between renewable and non-renewable energy consumption and economic growth in developed and developing countries. Energy Syst 2:299–312. https://doi.org/10.1007/s12667-011-0037 6
6. REN21 (2011) Renewables 2011 global status report. REN21 Secretariat, Paris retrieved on 6th December 2019
7. EIA (2010) International Energy Annual 2006: electricity generation. US Department of Energy. http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=6&pid=33&aid=12&cid=all,&syid=2007 &eyid= 2011&unit=BKWH. Retrived on 10th November 2019
8. Abdul Raheem, Sikandar Ali Abbasi, Asif Memon, Saleem R. Samo, Y. H. Taufiq-Yap, Michael K. Danquah , Razif Harun "Renewable energy deployment to combat energy crisis in Pakistan" Energy, Sustainability and Society 2016
9. Mahendra P. Lama ,"India-Pakistan Energy Cooperation: Rethinking Opportunities and Newer Approaches " 2014
10. Sanya Carley, Elizabeth Baldwin, Lauren M. MacLean, Jennifer N. Brass, "Global Expansion of Renewable Energy Generation: An Analysis of Policy Instruments "Environmental and Resource Economics , October 2017, Volume 68, Issue 2, pp 397–440
11. Syed Anees Haider Zaidi, Danish, Fujun Hou, Faisal Mehmood Mirza , "The role of renewable and non-renewable energy consumption in CO2 emissions: a disaggregate analysis of Pakistan" Environmental Science and Pollution Research, November 2018, Volume 25, Issue 31, pp 31616–31629
12. Pervez Hameed Shaikh, Faheemullah Shaikh, and Mushtaq Mirani "Solar Energy: Topographical Asset for Pakistan" Applied Solar Energy ,January 2013, Volume 49, Issue 1, pp 49–53
13. Pierre Mukheibir "Potential consequences of projected climate change impacts on hydroelectricity generation , Climatic Change November 2013, Volume 121, Issue 1, pp 67–78

14. Himayatullah Khan, " Poverty, environment and economic growth: exploring the links among three complex issues with specific focus on the Pakistan's case ",Environment, Development and Sustainability December 2008, Volume 10, Issue 6, pp 913–929
15. Waqar Khalid, Abdul Jalil ""An econometric analysis of inter-fuel substitution in energy sector of Pakistan" Environmental Science and Pollution Research ,June 2019, Volume 26, Issue 17, pp 17021–17031
16. Francis F. Chen , "The Future of Energy II: Renewable Energy" , An Indispensable Truth pp 75-175,2011
17 .Li Xu , Syed Ahsan Ali Shah, Hashim Zameer , Yasir ,Ahmed Solangi, "Evaluating renewable energy sources for implementing the hydrogen economy in Pakistan: a two-stage fuzzy MCDM approach , Environmental Science and Pollution Research, November 2019, Volume 26, Issue 32, pp 33202–33215,2019
18. Kabiyeva Marzhan, Kaskina Dina, Bradshaw Roland , "Developing High-Resolution Remote Sensing Technology into an Advanced Knowledge Management System to Assess Small-Scale Hydropower Potential in Kazakhstan" , Exergy for A Better Environment and Improved Sustainability 2 pp 581-605,2018
19. Jorge Bielsa, Rosa Duarte, " Modelling Water Resource Allocation: A Case Study on Agriculture Versus Hydropower Production" Economics of Sustainable Energy in Agriculture pp 157-175, 2002
20. Jianyun Zhang, " Study on Corrosion Status and Control Strategies in Energy Field in China", The Cost of Corrosion in China pp 251-554, 2019
21. Zhe Zhang, Jiuping Xu, "Applying rough random MODM model to resource-constrained project scheduling problem: A case study of Pubugou Hydropower Project in China",
22. Jingsheng Jia, Petras Punys, Jing Ma, "Hydropower" , KSCE Journal of Civil Engineering, June 2014, Volume 18, Issue 5, pp 1279–1291,2012
23. Igor Winkler, "Small Hydropower Resources And Prospects Of Small Hydropower Electric Plants In The Near-Border Regions Of Ukraine, Energy and Environmental Challenges to Security pp 371-378,2009
24. Mona Sharma, "Harnessing Renewable Energy Technologies for ICT and e-Governance Services in Un-Electrified Communities in Rural Nepal" , 6th international conference on theory and practice of electronic Governace pages 365-368,2012
25. In˜igo Goiri, William Katsak, Kien Le†, Thu D. Nguyen, Ricardo Bianchini ,"Parasol and GreenSwitch: Managing Datacenters Powered by Renewable Energy , 18th international conference on Architectural support for programmi ng languages and operating systems ,pages 51-64,2013
26. S. Rasoul Asaee , V. Ismet Ugursal , "Potential to reduce energy consumption and GHG emissions by using renewable energy technologies in the conversion of existing houses into net-zero and near net-zero energy buildings" , 4th International Conference on Engineering & MIS 2018
27. Saif Ullah, Muhammad Asif, Shahbaz Ahmad , Ulfat Imdad, Osama Sohaib , "Application of Data Science for Controlling Energy Crises: A Case Study of Pakistan " 8th International Conference on Software and Computer Applications, 2019
28. Ricardo Bianchini , "Leveraging Renewable Energy in Data Centers: Present and Future" , 21st international conference on high Performance parallel and Distributed Computing Pages 135- 136,201
29. Ting Zhu ,A ditya Mishra, David Irwin, Navin Sharma, Prashant Shenoy, Don Towsley , "The Case for Efficient Renewable Energy Management in Smart Homes" Third ACM Workshop on Embedded Sensing Systems for Energy-Efficiency in Buildings,Pages 67-72, 2011
30. Florian Niedermeier, Wolfgang Duschl , Torben Mö ller , Hermann de Meer , "Increasing Data Centre Renewable Power Share via Intelligent Smart City Power Control", 2015 ACM Sixth International Conference on Future Energy Systems
31. Luiz F. M. Vieira, David Pinto , Sadraque S. Viana , Marcos A. M. Vieira , José Augusto M. Nacif, Alex B. Vieira , "HydroNode: An Underwater Sensor Node Prototype for Monitoring Hydroelectric Reservoirs" Seventh ACM International Conference on Underwater Networks and Systems,2012
32. Farhan Khan , Kinza Ali, Ahmed Kausar , Shafaq Kausar , "Energy Generation Capacity Analysis of a Canal Based Hydro Project", 2012 IEEE International Conference on Power Electronics, Drives and Energy Systems
33. Khuram Pervez Amber , Naila Ashraf, Energy outlook in Pakistan , 2014 International Conference on Energy Systems and Policies (ICESP)
34. Rizwan Kamal, Muhammad Younas, Muhammad Shoaib Khalid, Affaq Qamar, "Cost Optimization of an Off-Grid Hybrid Renewable Energy System with Battery Storage for Rural Electrification in Pakistan, 2018 Clemson University Power Systems Conference (PSC)

35. Haris Mushtaq, Dr. Mohammad Bilal Khan, Hafeez Rehman Khan, Muhammad Ali Zahoor , " Economic Evaluation of Tarbela Dam", 2015 Power Generation System and Renewable Energy Technologies (PGSRET)
36. Ali Raza, Muhammad Saleem Mian, Dianguo Xu, Jawad Ahmed , A Micro Hydro Power Plant for Distributed Generation using Municipal Water Waste with Archimedes Screw ,INMIC Multi Topic, IEEE International Conference,2013
37. Usama Bin Irshad, M.S Javaid, Saifullah Shafiq, Md Shafiul Alam, M.A Abido, Tahir Mumtaz,Optimization of Daily Operation of Micro Hydro Power Plant Coupled with Compress Air Storage , 2016 19th International Multi-Topic Conference (INMIC)
39. Waqas Ali , Haroon Farooq, Ata Ur Rehman, Mohsin Jamil, Qasim Awais , Mohsin Ali "Grid Interconnection of Micro Hydro Power Plants: Major Requirements, Key Issues and Challenges" , 2018 International Symposium on Recent Advances in Electrical Engineering (RAEE)
40. Laurent Pagnier, Philippe Jacquod "A predictive pan-European economic and production dispatch model for the energy transition in the electricity sector", 2017 IEEE Manchester PowerTech
41. Mary Prasanna T, C.H. Ram jethmalani, Dr.Sishaj P Simon , Thermal Unit Commitment considering Pumped Storage Hydro Electricity Plants , 2013 International Conference on Energy Efficient Technologies for Sustainability
42. Petrus Yuri Nugraha, Augie Widyotriatmo , Sutanto Hadisupadmo , Deddy Kurniadi , "Optimization of Capacity and Operational Scheduling for Grid-Tied Microgrid using Pumped- Storage Hydroelectricity and Photovoltaic , 2015 10th Asian Control Conference (ASCC)
43. Christoph Groiss, Walter Schaffer, Wolfgang Gawlik, " Interaction between short-term and seasonal storages in a predominantly renewable power system", CIRED - Open Access Proceedings Journal , Volume: 2017 , Issue: 1 , 2017
44. Maoyu Ran ; Yan Hu ,Developing and utilization of hydroelectric power and improving atmospheric environment", 2011 International Conference on Electrical and Control Engineering,2011
45. Hugh Rudnick ; Rodrigo Palma-Behnke ; Andrea Rudnick ; Carlos Benavides, "Restless Waters: Fossil Fuel Emissions Conditioning a Reduction in Hydroelectric Resources in Chile, IEEE Power and Energy Magazine ,Volume: 12 , Issue: 5 , Sept.-Oct. 2014
46. Waqar Uddin ; Sadam Hussain ; Kamran Zeb ; Musaib Aleem Dildar ; Z. Ullah ; Ihsan Ullah Khalil; R. Ullah ; A. Haider ; Muhammad Adil ; H. J. Kim, Energy Scenario and Potential of Hydroelectric Power in Pakistan", 2018 International Conference on Power Generation Systems and Renewable Energy Technologies (PGSRET)
47. Manish Kumar Goya, Vishal Singh,Akshay H. Meena "Geospatial and hydrological modeling to assess hydropower potential zones and site location over rainfall dependent Inland catchment" , Water Resources Management, June 2015, Volume 29, Issue 8, pp 2875–289
48. G. A. Pretro, M. P. Fedorov, Utilization of the world's potential water resources by hydropower installations, " Hydrotechnical Construction"August 1993, Volume 27, Issue 8, pp 435–443
49. Marie Minville, François Brissette, Stéphane Krau, Robert Leconte, "Adaptation to Climate Change in the Management of a Canadian Water-Resources System Exploited for Hydropower", Water Resources Management, November 2009, Volume 23, Issue 14, pp 2965–2986
50. Dagmawi Mulugeta Degefu, Weijun He, Jian Hua Zhao, Jian Hua Zhao "Hydropower for sustainable water and energy development in Ethiopia, "Sustainable Water Resources Management,December 2015, Volume 1, Issue 4, pp 305–314
51. Jorge Morales ,Pedraza , "The Current Situation and Perspectives on the Use of Hydropower for Electricity Generation, Electrical Energy Generation in Europe pp 93-167,2015
52. Alban Kuriqi, António N. Pinheiro, Alvaro Sordo-Ward, Luis Garrote, "Flow regime aspects in determining environmental flows and maximising energy production at run-of-river hydropower plants", Applied Energy ,Volume 256, 15 December 2019, 113980
53. Özge Can Dogmus, Jonas Ø. Nielsen, "Is the hydropower boom actually taking place? A case study of a South East European country, Bosnia and Herzegovina" Renewable and Sustainable Energy Reviews Volume 110, August 2019, Pages 278-289
54. Jianyu Lu, Jianjian Shen, Chengguo Su, Qianqian Shen, "Trans-regional transmission of large-scale hydropower: problems and solutions in receiving power grid" Global Energy Interconnection, Volume 2, Issue 4, August 2019, Pages 342-350
55 .Xiaofan Zhao, Liang Wu, Ye Qi , "The energy injustice of hydropower: Development, resettlement, and social exclusion at the Hongjiang and Wanmipo hydropower stations in China" Energy Research & Social Science, Volume 62, April 2020, 101366

56. Thomas M. Mosier, Kendra V. Sharp, David F. Hill , "The Hydropower Potential Assessment Tool (HPAT): Evaluation of run-of-riverresource potential for any global land area and application to Falls Creek, Oregon, USA, Renewable Energy, Volume 97, November 2016, Pages 492-503
57. Laniyi L. Ladokun,Bolaji F. Sule, Kajogbola R. Ajao, Adeniyi G. Adeogun, "Resource assessment and feasibility study for the generation of hydrokinetic power in the tailwaters of selected hydropower stations in Nigeria, Water Science, Volume 32, Issue 2, October 2018, Pages 338-354
58. Mohammed Basheer,Nadir Ahmed Elagib, "Temporal analysis of water-energy nexus indicators for hydropower generation and water pumping in the Lower Blue Nile Basin", Journal of Hydrology, Volume 578, November 2019, 124085
59. M. Pendieu Kwaye ; J. Bendfeld ; N. Anglani, "Assessment of renewable energy resources and the use of hydro power for fluctuation compensation in Cameroon" 2015 5th International Youth Conference on Energy (IYCE)
60. Alimul Haque Khan, Kazi Rehnuma Zafreen, Mir Muntasir Hossain, Maidul Islam,A review of current renewable energy activities in Bangladesh, 2015 3rd International Conference on Green Energy and Technology (ICGET)
61. Anis Ur Rehman ; Syed Mushtaq A. Shah ; Syed Ali Raza Shah ; Saeed Badshah ; M.A. Khattak, "Prospects of rural electrification of Balochistan province with renewable energy sources"3rd International Conference on Power Generation Systems and Renewable Energy Technologies (PGSRET),2017
62. Jiekang Wu, Optimal Electric Energy Production scheduling for Thermal-Hydro Electric Power Systems, 2009 Asia-Pacific Power and Energy Engineering Conference
63. Jianmin Zhang ; Qianzhi Zhang, Feasibility and simulation study of high-rise building Micro-grid with PV and mini-hydro pumping, 2013 IEEE Power & Energy Society General Meeting
64. Janet Roveda ; Susan Lysecky ; Young-Jun Son ; Hyungtaek Chang ; Anita Annamalai "Interface model based cyber-physical energy system design for smart grid" 2011 IEEE/IFIP 19th International Conference on VLSI and System-on-Chip
65.Ibrahim Yuksel ; Hasan Arman ; Ibrahim Halil Demirel, "Water resources planning hydropower for sustainable and green energy in Turkey" , 2018 5th International Conference on Renewable Energy: Generation and Applications (ICREGA)
66. Michael G. Tyagunov ; Thu Yein Min, "Analysis of ways of solving the problem of hybrid energy complexes based on reserve for power supply of autonomous rural consumers in Myanmar", 2018 Renewable Energies, Power Systems & Green Inclusive Economy (REPS-GIE)
67. Evelyn Brudler ; Michel Golba ; Andreas Günther ; Hans Holtorf, Leonie Ibing, Edu Knagge, Udo Kulschewski,"24 years postgraduate program renewable energy" 2nd International Conference on the Developments in Renewable Energy Technology (ICDRET 2012)
68. Ionut Bogdan Stoenescu ; Sorina Costinas ; Gheorghe Marius Deaconu"Assessment of Hydropower Plants Energy Production Cost Influenced by Operational Decisions and Control Strategy", 2019 22nd International Conference on Control Systems and Computer Science (CSCS).

AUTHORS

Qasim Rauf got his bachelor's degree BSc Electrical Engineering from Gujranwala institute of Future Technology (GIFT)Gujranwala ,Pakistan. Currently, he is doing his Master's (MS) in Power engineering from North China University of Water Resources and Electric Power (NCWU) Henan, China. He have taken an interest voluntary in Blood Donating Society (GIFT Blood Group Society), was also the Vice President of GIFT Character Building Society. He got best presentation awards at International Conference in 2019. He is the co-author of different research papers His current research areas encompasses Power engineering & Renewable energy.

Yanpin Li received her master's degree from the North China University of Water Resources and Electric Power. Five years later, and Ph.D. in engineering from the School of Water Resources and Hydropower, Xi'an University of Technology. Two years later, she obtained a postdoctoral degree from Jiangsu University. Now, the main research direction of Teacher Li is the research and development of fluid machinery for waste energy recovery. In 2015,she also undertook the National Natural Science Foundation project of " High-pressure Recovery Turbine Model Multi-stage Hydraulic Turbine Flow Path Optimization and Design Theory".

Anam Ashraf got her master's degree MS (SE) National University of Sciences &Technology (NUST), Islamabad, Pakistan. Currently, she is doing PHD in Management Sciences and Engineering from North China University of Water Resources and Electric Power (NCWU) Henan, China. She has an experience of over one year in the capacity of Information Security at Ultra Spectra Pvt. Ltd, Islamabad. She also had the experience of Quality Testing and Web Designing while working as a Software Quality Test Engineer at Center for Advanced Research in Engineering (CARE) Pvt. Ltd. Moreover, she had teaching experience at multiple institutes as Lecturer. Her research areas encompasses Internet of Thing (IoT) Smart Home technology, Usability Engineering ,Inclusive Education Management, and Artificial Intelligence.