A Review of Marine Current Energy and Types of Energy using MOORA Method

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Abstract

Energy in the oceans is diverse in forms, among them one is ocean current energy. Ocean current wave effects and sea water heat and salinity caused by differences. Marine energy, marine and hydrokinetic energy or marine renewable energy also called, this waves, waves and river and including ocean currents from the natural movement of water used renewable is a source of energy. A generator sea by coupling with turbine electricity from currents is produced and electricity under the sea via the cable is sent back to shore. One of the MCDM methods is the multi-objective optimization by ratio analysis (MOORA) method. It is a collection of attributes (prospective students). The value of criteria can be calculated, this is the perfect decision for decision makers type of prospective students to help take. Alternative: Government, Industrial, Household, Commercial. Evaluation Preference: Solar sourced energy, Hydraulic sourced energy, Hydrogen sourced energy, Marine current sourced energy, Geothermal sourced energy and Biomass sourced energy. From the result it is seen that Biomass sourced energy gets the first rank whereas Hydrogen sourced energy is having the lowest rank.
Keywords: Marine Current Energy, MOORA method.

I.   Introduction

Ocean currents are high and can carry water, it is mostly due to waves driven, it is the earth, planets of moon and sun of gravitational effects of motion result. Energy in the oceans exists in various forms; one of them is the ocean current energy. Ocean current wave effects and heating of sea water and caused by differences in salinity. In most business development scenarios, in water like wind turbines using submerged water turbines energy from ocean currents will be extracted. These turbines are rotor blades, for converting rotational energy into electricity a generator and power grid dissolve the current to connect will be a means of transport. Also, to stabilize the turbines there must be a way to keep them, i.e. pillars anchored to the sea floor or cables etc. In the turbine flow from additional components and blades to increase power output include surround concentrators or enclosures may be. Unlike air, since water is denser than air, needed to extract energy underwater the size of the turbine is the wind turbine will be much smaller than speed of currents if wind is less than speed. However, due to sea water that air 840 times denser, therefore one-tenth the speed of the wind can generate the same power.

II.   Marine Current Energy

Ocean currents are energy rich; another renewable energy resource has a great advantage over, because it's on long time scales predictable. Ocean current energy using devices. For routine sources of extraction a sustainable alternative to other renewable and mced provides a predictable alternative to energy technologies that uses the kinetic energy of waves, it is used by a wave barrier against potential energy. Mceds energy in the last decade increasingly the method of extraction has become a popular method. However, ocean current energy technologies in its current development due to an even larger scale are not economically viable. Ireland is a great ocean current powerhouse because it is an island country and enjoys excellent ocean currents. An excellent marine current energy resource. This evidence is still underutilized. Ireland's energy needs fossil fuel to be heavily dependent on imports [1]. Marine current energy conversion system (MCECS) is identical because of the structure; more technical challenges have to be overcome. Meanwhile, running under water inevitably surrounds some negative or positive in context. In this paper, this is ocean current energy shows interest and principle, too discusses advantages and disadvantages. Environment around device vulnerabilities, technical challenges and essential support structures are also provided. Advanced horizontal axis turbines, and their associated technologies and the rest of the projects are finally described. Ocean current energy is an evergreen energy resource. It is a benign and minimal visual exposure is coastal not like a windmill. Also, classical compared to wave energy, for this there is no need for dams on waterways [2]. Ocean current energy season and is first order independent of weather conditions, it is solar and wind power generation affects and degrades performance. This characterization of ocean currents in the energy grid is good for integration. Ocean current applying energy is a fluid motion based on converting it into electrical energy. In the first approach, wind power is used the same technologies used are marine for current energy applications it is assumed that it can be changed. However, this is well known technologies are always particularly tough because the underwater marine

environment is not conducive to containment. That is why the variety of original horizontal offshore current turbines axis and vertical axis created all over the world. The sea current is key to the power system; the challenge is both short-term and long-term phenomenon of power fluctuations in magnitudes is coordinate variable and e grid-tied renewable resources in stabilizing the power grid increasing difficulty and supply and balancing demand [3]. Two marine current energy converters technically well rated wind turbines when speed is considered than energy converters produce will be more. Smaller within the water layer and more manageable converters it also means that the bath can be installed the measurement water depth will be used at the site in favor of optimum size of turbines will be unlike wind power, bathymetry in ocean current potential limits the maximum amount, hence the marine energy converter or rated power of the turbine. Wave ocean, current energy, thermal energy, wave energy osmotic salinity gradient potential and marine bio energy. The sea multi current turbines (mct) around the world have been created. In the last few years reviews of mcts are some of the most sophisticated although found in research articles, mct when statements are written projects are multi-planning/designing were only in position [4] Ocean currents transform energy technology is now a business model technology is now a business model at various tidal current sites a single of significant size devices are functional. British islands, philippines and the far east, around the northeast coast of north America and the west coast of Canada measured significant flow at various european sites with speeds evidence of high availability of electricity have been known for a long time. Various methods of analysis using general and specific extractable energy from sites have been conducted to quantify area. The next step in the technological development path farms or offshore wind energy is to install arrays of converters. Queues grow in size and complexity as technology evolves will be formed. Tides and ocean currents equivalent between power devices the eu wants to develop protocols for testing as part of a sponsored project a concept developed by the authors is useful for classifying arrays [5] Ocean currents driven by waves a large amount of energy transport, especially the shores of England around. The atlantic ocean florida current or pacific curio current in the ocean and such as the bosphorus canal (turkey). Caused by variations in sea water density, other forms of ocean currents formed from global ocean circulation. In many ocean regions, ocean currents are exploited and considered too slow. However, for islands and mainland underwater in the strait between topography (bathymetry) and headlands flow velocity in surrounding shallow areas plays an important role in increasing this result in significant kinetic energy can be seen. Some of these sites are practical flows greater than 1 m s−1, ocean considered economically feasible [6]. An exception to this is tidal power. From ocean currents energy and other renewable energy at higher energy densities than conventional and at higher energy densities than conventional and the promise of predictable power generation provides earth, moon and sun gravity of planetary motion of as a result of the consequences, such currents driving waves are very predictable. Although the energy in ocean currents is generally distributed, restrictive such as islands and Straits Ocean flows through land masses in many places are accumulated. As will be shown later, power is dense 1000 times the cube of the velocity and that of the air the coefficient also depends on the liquid density for water. Both of these factors are ocean current energy density of air for converters that will be significantly greater than the energy indicates. The result is flowing sea predictable electricity when installed in currents small and very productive manageable modifiers can be installed [7]. The world's first commercial scale grid combined wave current power installation developed by marine current turbines ltd seagen offshore current turbine have seagon offshore current turbine the life cycle consists of successive stages, which is explained in materials and manufacturing. For manufacturing components of turbines complete method, raw material extraction and processing from first to supplemental component therapy. Transportation and installation includes energy consumption and emissions to the assembly floor and then to the installation floor includes from carrying. Of the installation process all materials used during and this includes processes. Operations and maintenance (o&m) means lifetime operation of turbines and any used during maintenance energy related to process or materials and include emissions. Installation transports to site repairs and include substitutes [8]. For offshore current turbines mainly emerging technologies in wind turbines and ship propellers relating to the works to be carried out. Several offshore current turbine electric generator topologies can be used if it is clear. Hence, the ocean current turbine universal behavior and variety of energy capture from platform simulation environments to evaluate it is necessary to create. For that purpose, the authors have previously elaborated on such an environment and have said in fact, this tool proof model, hydrodynamic turbine model and elec generator models incorporate the approach of metaphysics [9]. To tap ocean currents offshore current turbines the success of using them in predicting hydrodynamic efficiency depends on the physics of turbines and methods of describing operational performance to be installed, their design allows to explore and evaluate performance. Wind turbines and ships from the design and operation of propellers much can be changed. However, ocean currents in the design and operation of the turbine there are fundamental differences, more on this investigation, research and development will be required. Specific differences are in the Reynolds number modifications, different stall characteristics and cavitations are possible [10]. Ocean-current-power future scenario, and help achieve that goal technology introduces the solution. Improving technical and economic efficiency a floating sea-current ideology based on the power system introduces findings. Importantly, let's describe the features. Among these ocean-energy resources, tidal and ocean-current energy massive ocean-energy in the immediate future very promising for production emerges as preferences [11].

III. MOORA (Multi-objective Optimization on the basis of Ratio Analysis)

Multi-objective by ratio analysis (MOORA) optimization obtained in this way dimensionless numbers are MOORA's second it will also be the basis. Finally measures well-being differences between ten counties of Lithuania based on all objectives. The three well-off districts contrast sharply with some of the worst-off districts. In addition, labour drain from all other districts to Vilnius district is a serious problem that represents income automatic redistribution. Instead

commercialization and industrialization regions should occur [12]. Multi-objective optimization concrete concurrently improves within constraints or more conflicting attributes (notes) is the system. Multi-goal optimization problems product and with process design there are many fields, wherein most efficient choices ought or between conflicting motives in the presence of trade exchanges to be done. Maximizing revenue and reducing the cost of a product increasing efficiency and decreasing car gasoline intake; and minimizing weight at the same time as maximizing issues [13]. There are three fundamental reasons why we select MOORA over different multiple standards decision making (MCDM) methods. First MOORA means a brand new MCDM technique that is built knowing the susceptible factors of older methods. So, we think it ought to be a completely useful one. The 2d motive is the computational time required by MOORA to remedy the hassle, as indicated with the aid of the literature on MCDM. Finally, MOORA calls for little or no set-up as the literature suggests time and has a fixed character [14]. The MOORA gadget is a choice support gadget for choosing college students who get hold of scholarships to increase instructional fulfillment. As the university has a designed selection assist device, in facilitating decision making MOORA to solve various problems using the machine selection makers can quickly decide scholarship recipients to grow educational success consistent with the advantage of needy students [15]. MOORA is an amazing green multi-criteria method of selection for complete assessment of alternatives dealing with sizable heterogeneity and multiplicity of useful elements. The MOORA technique is offered to effectively solve complex decision-making problems multi-objective optimization methods as one. This technique, usually hard and fast conflicting grades considers and tries to select the best alternative both beneficial and unfavorable standards concurrently, some of which bless MOORA on some decision-making recognized for technique techniques [16]. A MOORA is a multi-objective optimization method. There are several types of attributes technique referred to for some at the same time to undergo and improve MOORA is all about taking approaches and a functional method of approach [17]. The MOORA technique cannot forget all attributes with their relative importance, resulting in a higher evaluation of alternatives. The MOORA technique may be very smooth to recognize and clean to use. The proposed technique is a general technique and may be any size and quality considering the attributes simultaneously, provides additional targeting and a simple choice-making approach. Furthermore, this approach can be extended to any kind of choice problem [18]. Multi-goal optimization primarily based on ratio analysis (MOORA), additionally called multiple criteria or multiple characteristic optimization, two or more conflicting attributes (notes) the situation simultaneously for positive controls is an upgrade system. This time has an extensive variety of programs for selection making in the conflict and a complex part of the supply chain environment, selection of warehouse area, selection of supplier product and method design choice and many others. Where most effective choices are required, MOORA may be used [19]. It can be seen that each one of the recognized failures are ranked in awesome priorities according to the failure prioritization that finished the usage of the extension in MOORA. In other words, failure uncertainty of methods and concepts of credibility by connecting the use of range concept, the proposed technique tries to put off a number major disadvantage of rpn scoring, and in addition for selection method in regular MOORA provides reliability. Finally presenting sensible outputs to the decision maker. This technique comparing the results with the two different traditional strategies suggests that full prioritization of disasters is performed and disasters are detected [20]. MOORA's analysis is again the work of past researchers more consistent and consequently, MOORA and MOORA technique may be assumed to apply the ultra-modern statistics to be had for the initial selection method basically. From the above discussion, for the decision problem, MOORA et MOORA method all conditions complementary, therefore diverse non-conventional methods are very robust in a production environment. At the cost of the denominator of this ratio, if expressed, this ratio is beneficial and the value becomes the same for the ratio; it is a preferred performance for economic welfare. Therefore, this MOORA and the MOORA approach is ideological regular with different mounted performance measurement techniques [21]. Both ratio gadget and reference MOORA method with components factor component. Since we're handiest concerned with a simulation of port making plans, we decided the kind and importance of targets and alternatives. The applicable stakeholders are national and neighbourhood authorities and collaborating institutions. Consumer sovereignty is handiest implicitly worried within the subject of production. Nevertheless, the authorities have been additionally taken as legitimate representatives of clients [22]. MOORA is a team subjective and inaccurate, inconsistent information CNC machine tool included to solve valuation problems and decision making environments. Because this time integrates the fuzzy number and helps the decision makers to integrate multiple fuzzy information represented as a linguistic variable. In this article, the variety of multi-MOORA ranking orders given by regions the result is summarized by comparison [23].
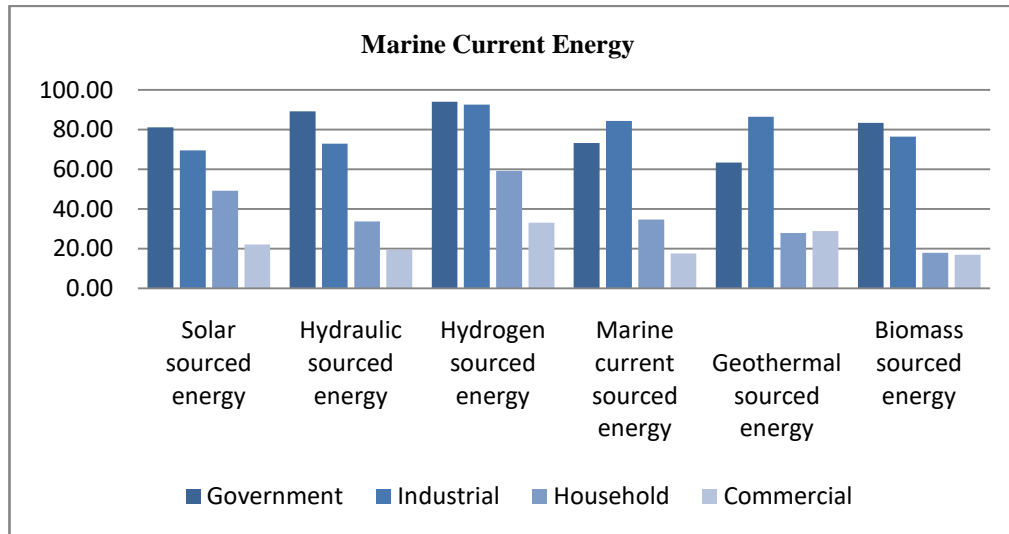
IV.   Analysis and Discussion

Table 1. According to the Government it is seen that Hydrogen sourced energy is showing the highest value while geothermal sourced energy is showing the lowest value. Industrially it is seen that Hydrogen sourced energy is showing the highest value while solar sourced energy is showing the lowest value. Household it is seen that Hydrogen sourced energy is showing the highest value while Biomass sourced energy is showing the lowest value. Commercially it is seen that Hydrogen sourced energy is showing the highest value while Biomass sourced energy is showing the lowest value.

TABLE 1. Marine current energy

	Government	Industrial	Household	Commercial
Solar sourced energy	81.08	69.53	49.15	22.05
Hydraulic sourced energy	89.12	72.97	33.69	19.30
Hydrogen sourced energy	94.08	92.58	59.18	33.10
Marine current sourced energy	73.17	84.28	34.60	17.59
Geothermal sourced energy	63.33	86.41	27.96	28.89
Biomass sourced energy	83.33	76.41	17.96	16.89

Table 1 shows the Marine current energy for Alternative: Government, Industrial, Household, and Commercial. Evaluation Preference: Solar sourced energy, Hydraulic sourced energy, Hydrogen sourced energy, Marine current sourced energy, Geothermal sourced energy, and Biomass sourced energy.

FIGURE 1. Marine current energy

Figure 1 shows the graphical representation of Marine current energy for Alternative: Government, Industrial, Household, and Commercial. Evaluation Preference: Solar sourced energy, Hydraulic sourced energy, Hydrogen sourced energy, Marine current sourced energy, Geothermal sourced energy, and Biomass sourced energy. Government it is seen that Hydrogen sourced energy is showing the highest value for geothermal sourced energy is showing the lowest value. Industrially it is seen that Hydrogen sourced energy is showing the highest value while solar sourced energy is showing the lowest value. Household it is seen that Hydrogen sourced energy is showing the highest value while Biomass sourced energy is showing the lowest value. Commercially it is seen that Hydrogen sourced energy is showing the highest value while Biomass sourced energy is showing the lowest value.

TABLE 2. Divide & Sum

6573.9664	4834.4209	2415.7225	486.2025
7942.3744	5324.6209	1135.0161	372.4900
8851.0464	8571.0564	3502.2724	1095.6100
5353.8489	7103.1184	1197.1600	309.4081
4010.6889	7466.6881	781.7616	834.6321
6943.8889	5838.4881	322.5616	285.2721
39675.8139	**39138.3928**	**9354.4942**	**3383.6148**

Table 2 shows the Divide & Sum matrix formula used this table.

TABLE 3. Normalized Data

Government	Industrial	Household	Commercial
0.4071	0.3515	0.5082	0.3791
0.4474	0.3688	0.3483	0.3318
0.4723	0.4680	0.6119	0.5690
0.3673	0.4260	0.3577	0.3024
0.3179	0.4368	0.2891	0.4967
0.4183	0.3862	0.1857	0.2904

$$X_{n1} = \frac{X1}{\sqrt{((X1)^2 + (X2)^2 + (X3)^2 \ldots)}} \quad (1).$$

Table 3 shows the various Normalized Data Government, Industrial, Household, Commercial. Normalized value is obtained by using the formula (1).

TABLE 4. Weight

Weight			
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25

$$X_{wnormal1} = X_{n1} \times w_1 (2).$$

Table 4 shows the Weight ages used for the analysis. We have taken same weights for all the parameters for the analysis. All weight value same 0.25.

TABLE 5. Weighted normalized decision matrix

Weighted normalized decision matrix			
0.101763	0.087864	0.127044	0.094767
0.111854	0.092211	0.087082	0.082948
0.118079	0.116992	0.152969	0.142258
0.091835	0.106503	0.089435	0.075599
0.079485	0.109195	0.072271	0.124164
0.104587	0.096558	0.046423	0.07259

Table 5 shows the Weighted normalized decision matrix Government, Industrial, Household, Commercial. the weighted default result is calculated using the matrix formula (2).

TABLE 6. Assessment value & Rank

	Assessment value	Rank
Solar sourced energy	-0.0322	5
Hydraulic sourced energy	0.0340	2
Hydrogen sourced energy	-0.0602	6
Marine current sourced energy	0.0333	3
Geothermal sourced energy	-0.0078	4
Biomass sourced energy	0.0821	1

Table 6 shows the Assessment value & Rank value used. Assessment value for Solar sourced energy=-0.0322, Hydraulic sourced energy=0.0340, Hydrogen sourced energy=-0.0602, Marine current sourced energy=0.0333, Geothermal sourced energy=-0.0078, Biomass sourced energy=0.0821. the final rank of this paper the Solar sourced energy is in 5th rank, the Hydraulic sourced energy is in 2nd rank, the Hydrogen sourced energy is in 6th rank, the Marine current sourced energy is in 3rd rank, the Geothermal sourced energy is in 4th rank and the Biomass sourced energy is in 1st rank. The final result is done by using the MOORA method.

$$\text{Assesmentvalue} = \sum X_{wn\,1} + X_{wn\,2} - X_{wn\,3} \qquad (3).$$
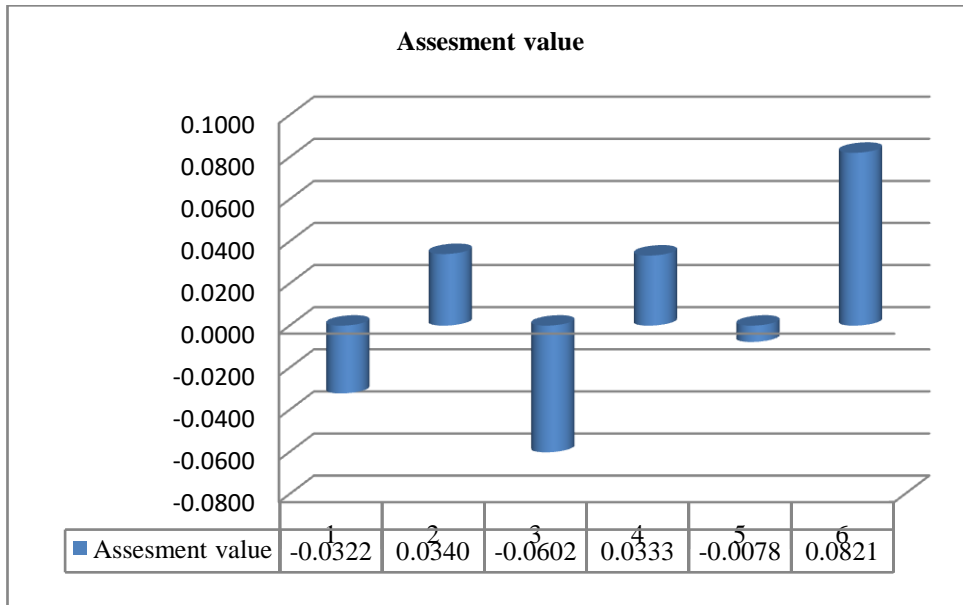

FIGURE 2. Assessment value

Figure 2 graphical view of MOORA method using the analysis Assessment value Biomass sourced energy is showing the highest value for Hydrogen sourced energy is showing the lowest value.
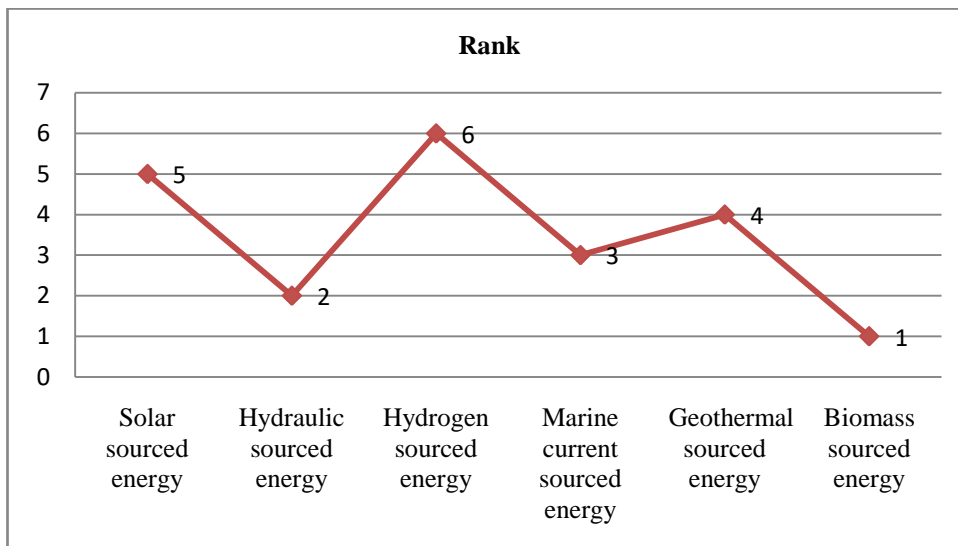

FIGURE 3. Rank

Figure 3 shows the graphical view of the Solar sourced energy is in Fifth rank, the Hydraulic sourced energy is in Second rank, the Hydrogen sourced energy is in Sixth rank, the Marine current sourced energy is in Third rank, the Geothermal sourced energy is in Fourth rank and the Biomass sourced energy is in First rank.

V.   Conclusions

Marine energy, marine and hydrokinetic energy or marine renewable energy also called, this waves, waves and river and including ocean currents from the natural movement of water used renewable is a source of energy. A generator sea by coupling with turbine electricity from currents is produced and electricity under the sea via the cable is sent back to shore. One of the MADM methods is the multi-objective optimization by ratio analysis (MOORA) method. It is a collection of attributes of prospective students. The value of criteria can be calculated, this is the perfect decision for decision makers type of prospective students to help take. As a result, biomass energy has the top ranking, while hydrogen energy has the lowest ranking.

References

[1] Rourke, Fergal O., Fergal Boyle, and Anthony Reynolds. "Marine current energy devices: Current status and possible future applications in Ireland." *Renewable and Sustainable Energy Reviews* 14, no. 3 (2010): 1026-1036.

[2] Chen, Hao, Tianhao Tang, Nadia Aït-Ahmed, Mohamed El Hachemi Benbouzid, Mohamed Machmoum, and Mohamed El-Hadi Zaïm. "Attraction, challenge and current status of marine current energy." *IEEE Access* 6 (2018): 12665-12685.

[3] Zhou, Zhibin, Mohamed Benbouzid, Jean Frédéric Charpentier, Franck Scuiller, and Tianhao Tang. "A review of energy storage technologies for marine current energy systems." *Renewable and Sustainable Energy Reviews* 18 (2013): 390-400.

[4] Zhou, Zhibin, Mohamed Benbouzid, Jean-Frédéric Charpentier, Franck Scuiller, and Tianhao Tang. "Developments in large marine current turbine technologies–A review." *Renewable and Sustainable Energy Reviews* 71 (2017): 852-858.

[5] Myers, L. E., and A. S. Bahaj. "An experimental investigation simulating flow effects in first generation marine current energy converter arrays." *Renewable Energy* 37, no. 1 (2012): 28-36.

[6] Bahaj, AbuBakr S. "Marine current energy conversion: the dawn of a new era in electricity production." *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 371, no. 1985 (2013): 20120500.

[7] Bahaj, A. S., and L. Myers. "Analytical estimates of the energy yield potential from the Alderney Race (Channel Islands) using marine current energy converters." *Renewable energy* 29, no. 12 (2004): 1931-1945.

[8] Douglas, C. A., G. P. Harrison, and J. P. Chick. "Life cycle assessment of the Seagen marine current turbine." *Proceedings of the Institution of Mechanical Engineers, Part M: Journal of Engineering for the Maritime Environment* 222, no. 1 (2008): 1-12.

[9] Benelghali, Seifeddine, Mohamed El Hachemi Benbouzid, and Jean Frédéric Charpentier. "Generator systems for marine current turbine applications: A comparative study." *IEEE Journal of Oceanic Engineering* 37, no. 3 (2012): 554-563.

[10] Batten, W. M. J., A. S. Bahaj, A. F. Molland, and J. R. Chaplin. "The prediction of the hydrodynamic performance of marine current turbines." *Renewable energy* 33, no. 5 (2008): 1085-1096.

[11] Ponta, F. L., and P. M. Jacovkis. "Marine-current power generation by diffuser-augmented floating hydro-turbines." *Renewable energy* 33, no. 4 (2008): 665-673.

[12] Brauers, Willem Karel M., RomualdasGinevičius, and ValentinasPodvezko. "Regional development in Lithuania considering multiple objectives by the MOORA method." *Technological and economic development of economy* 16, no. 4 (2010): 613-640.

[13] Chakraborty, Shankar. "Applications of the MOORA method for decision making in manufacturing environment." *The International Journal of Advanced Manufacturing Technology* 54, no. 9 (2011): 1155-1166.

[14] Akkaya, Gökay, BetülTuranoğlu, and Sinan Öztaş. "An integrated fuzzy AHP and fuzzy MOORA approach to the problem of industrial engineering sector choosing." *Expert Systems with Applications* 42, no. 24 (2015): 9565-9573.

[15] Siregar, Victor MarudutMulia, Mega RomaulyTampubolon, EkaPratiwiSeptaniaParapat, Eve Ida Malau, and Debora Silvia Hutagalung. "Decision support system for selection technique using MOORA method." In *IOP Conference Series: Materials Science and Engineering*, vol. 1088, no. 1, p. 012022. IOP Publishing, 2021.

[16] Dabbagh, Rahim, and Samuel Yousefi. "A hybrid decision-making approach based on FCM and MOORA for occupational health and safety risk analysis." *Journal of safety research* 71 (2019): 111-123.

[17] Sutarno, S., M. Mesran, S. Supriyanto, Y. Yuliana, and A. Dewi. "Implementation of Multi-Objective Optimazation on the Base of Ratio Analysis (MOORA) in Improving Support for Decision on Sales Location Determination." In *Journal of Physics: Conference Series*, vol. 1424, no. 1, p. 012019. IOP Publishing, 2019.

[18] Attri, Rajesh, and Sandeep Grover. "Decision making over the production system life cycle: MOORA method." *International Journal of System Assurance Engineering and Management* 5, no. 3 (2014): 320-328.

[19] Dey, Balaram, BipradasBairagi, Bijan Sarkar, and SubirSanyal. "A MOORA based fuzzy multi-criteria decision making approach for supply chain strategy selection." *International Journal of Industrial Engineering Computations* 3, no. 4 (2012): 649-662.

[20] Ghoushchi, SaeidJafarzadeh, Samuel Yousefi, and Mohammad Khazaeili. "An extended FMEA approach based on the Z-MOORA and fuzzy BWM for prioritization of failures." *Applied Soft Computing* 81 (2019): 105505.

[21] Sarkar, Asis, S. C. Panja, Dibyendu Das, and Bijon Sarkar. "Developing an efficient decision support system for non-traditional machine selection: an application of MOORA and MOOSRA." *Production & Manufacturing Research* 3, no. 1 (2015): 324-342.

[22] Brauers, Willem Karel M. "Multi-objective seaport planning by MOORA decision making." *Annals of Operations Research* 206, no. 1 (2013): 39-58.

[23] Sahu, Anoop Kumar, Nitin Kumar Sahu, and Atul Kumar Sahu. "Application of modified MULTI-MOORA for CNC machine tool evaluation in IVGTFNS environment: an empirical study." *International Journal of Computer Aided Engineering and Technology* 8, no. 3 (2016): 234-259.