Journal of Electronics, Telecommunication, Electrical, and Physics Sciences (ETAPs)
Vol. 1, No. 1, October 2021, pp. 7-12
P-ISSN: 2963-4601 | E-ISSN: 2963-4490, DOI: xxxxxxxxxxxxxxxxxxx

Potential of Renewable Energy in North Sumatra Until 2028 Using LEAP

Muhammad Irwanto[1], David Prandi Purba[2], Indra Nisja[3]
[1,2]Department of Electrical Engineering, Faculty of Technology and Computer Science, University of Prima Indonesia, Medan, Indonesia
[3]Department of Electrical Engineering, Faculty of Technology Industry, University of Bung Hatta, Padang, Indonesia

Article Info

Article history:

Received September 16, 2021
Revised October 10, 2021
Accepted October 20, 2021

Keywords:

Renewable Energy;
LEAP;
Potential

ABSTRACT

Energy is needed to support human activities so far. The need for energy from year to year continues to increase. The current use of energy only comes from fossil energy such as coal and oil. This fossil energy reserve will decrease every year. To overcome this problem, a potential alternative energy source that can replace fossil energy is needed, namely new and renewable energy. The potential for new and renewable energy is one of the alternative sources of energy supply and security in North Sumatra Province. To ensure the resilience of new and renewable energy to run in a sustainable manner, it is necessary to analyze the potential of new and renewable energy in North Sumatra until 2028 using LEAP software. The results obtained are the potential for new and renewable energy in North Sumatra in 2028 which has great potential, namely water energy, wind energy and biomass energy. Hydro energy has a potential growth of 3.7 million megawatt-hours in 2028. Meanwhile, wind energy has a potential growth of 2.6 million megawatt-hours and biomass energy has a potential growth of 27.0 million megawatt-hours in 2028.

Corresponding Author:

Muhammad Irwanto
Department of Electrical Engineering, Faculty of Technology and Computer Science, University of Prima Indonesia
Jl. Sampul No. 4, Sei Putih Tengah, Medan Petisah, 20118, Indonesia
Email: muhammadirwanto@unprimdn.ac.id

1. INTRODUCTION

Energy is needed for human activities, especially for economic, household, industrial, business, and transportation. Most of the energy supply in the world comes from fossil fuels, a non-renewable resource. Energy needs are expected to continue to increase, while the source of oil and coal reserves numbers are dwindling. In addition, fossil fuels contribute energy against excess carbon in the atmosphere that causes global warming. Therefore, there is a need for a supply of alternative energy other than petroleum and coal. New energy and Renewable is one of the alternative sources.

Supply of energy, because in addition to having an impact low on environmental damage, to ensure energy sustainability for a long-time future. New and renewable energy is energy that comes from nature sustainable. Less fuel conventional in today's energy course renewable and alternative energy is needed. Meanwhile, the increasing demand for energy soaring. With fewer and fewer amounts derived from oil or coal, various alternatives emerged as a substitute for oil or coal energy.

Energy needs in Indonesia in particular and in the face of the earth in everyday life continue to increase due to population growth, monetary development and examples of energy use itself are always evolving. Contemplation energy and climate conservation surely expect us to immediately have the option to utilize effectively accessible sustainable energy and less harmful to the ecosystem including water, the geothermal, solar-based, wind, etc.

Even though the para energy executive is under the power of the government joint, state-run administration needs to recognize possible new sources of power and sustainability in their territory independently. Adjusting from the progress goals that can be supported on moderation and maintenance of energy ke in the Medium Term Development Plan Region (RPJMD) 2019-2023, the North Sumatra Provincial Government needs to review new elective points for providing energy that can be called Renewable Energy (EBT) at the provincial level.

2. METHODS

A. New Renewable Energy

In basic terms, sustainable power is characterized as the energy that can be recovered (inexhaustible) such as daylight, water, geothermal, and wind. Sustainable resources are harmless for the ecosystem of energy sources that do not pollute the climate and does not add to environmental changes and harmful atmospheric destruction such as sources other conventional. This is the basic justification for why is sustainable energy so closely related tossues of nature and the environment according to many pepeopleEnvironmentally friendly workers in Indonesia consist of: frlar osolar-oriented, wind energy, biomass, hydro energy, geothermal energy and ot,hers. Solar-based energy in Indonesia uses Solar powered PV that uses part direct sunlight to produce power. The wind speed in Indonesia has tremendous potential, especially in seaside areas. Biomass is energythe obtained from sources natural such as the feces of living things and sediment plplantsThis potential comes mainly from business sugar, palm oil ,and wood. Water energy also has tremendous potential, but the release of water fluctfluctuateshat the power generated becomes not healthy. Indonesia's geothermal potential reaches 29 GW (largesthe t on the planet) but a theimit that was introduced is still 1341 W (4.6%). The potential This is extraordinary because Indonesia is a route volcanic (ring of fire). Assuming the of use This new and environmentally friendly electricity is the ideal, of proportion public shock can reach 100%.

B. Long-range Energy Alternative Planning System (LEAP)

Long-range Energy Alternative Planning System or commonly abbreviated as LEAP. The methodology that used LEAP is a view structure with an accounting system approach. This design can be used to create an energy framework model with factors about skeleton drawing actual energy, cost, and ecological effects. Something outside creates a market-side approach to organic energy, LEAP can be used to break down the effect of implementing energy regulation. Furthermore, the bookkeeping system is used as an instrument to detail the consequences of the implementation of some situation of interest or energy supply to achieve the targets that have been previously determined. Likewise, LEAP with the bookkeeping system approach can also be used to investigate important energy sources, ecological effects, and social costs arising from multiple choice situations.

The bookkeeping structure enjoys the benefits of: following :

1. Direct, straightforward, and adaptable, and need very important information direct.
2. Simulations are not carried out with suspicion of the ideal contest.
3. Can be used to test innovation options or costs in the development of energy systems.
4. Very valuable in application development limit.

Then again, the bookkeeping structure has several drawbacks, including:

1. Does not naturally distinguish cost frameworks smallest, i.e. makes no sense to the framework very complex work where estimation of the smallest cost required.
2. It is not feasible to provide cost estimates reliable, i.e. energy demand that is projected may conflict with the expanded energy supply design.

In turn, LEAP can be thought of as half breed model that combines upgrading, recreation, and bookkeeping. To have the choice to work as a half-breed model, LEAP work in two phases, become relationship-specific basic bookkeeping as an office that is attached, and LEAP clients can add models recreation of the results obtained by LEAP. Office the current progress estimate is being made in LEAP. Estimation of improvement should be possible to decide on the most appropriate spending framework minimal. Jump is not directly used to determine the minimum cost framework, however, the LEAP result as text is used as a contribution to the Open Source upgrade module Energy Modeling System (OSeMOSYS). The consequences of calculating the progress of OSeMOSYS were placed once again into LEAP for display as a side effect of the skskeleton'smallest expenditure.

As for the ongoing process of implementation, This research will be explained in Figure 1.

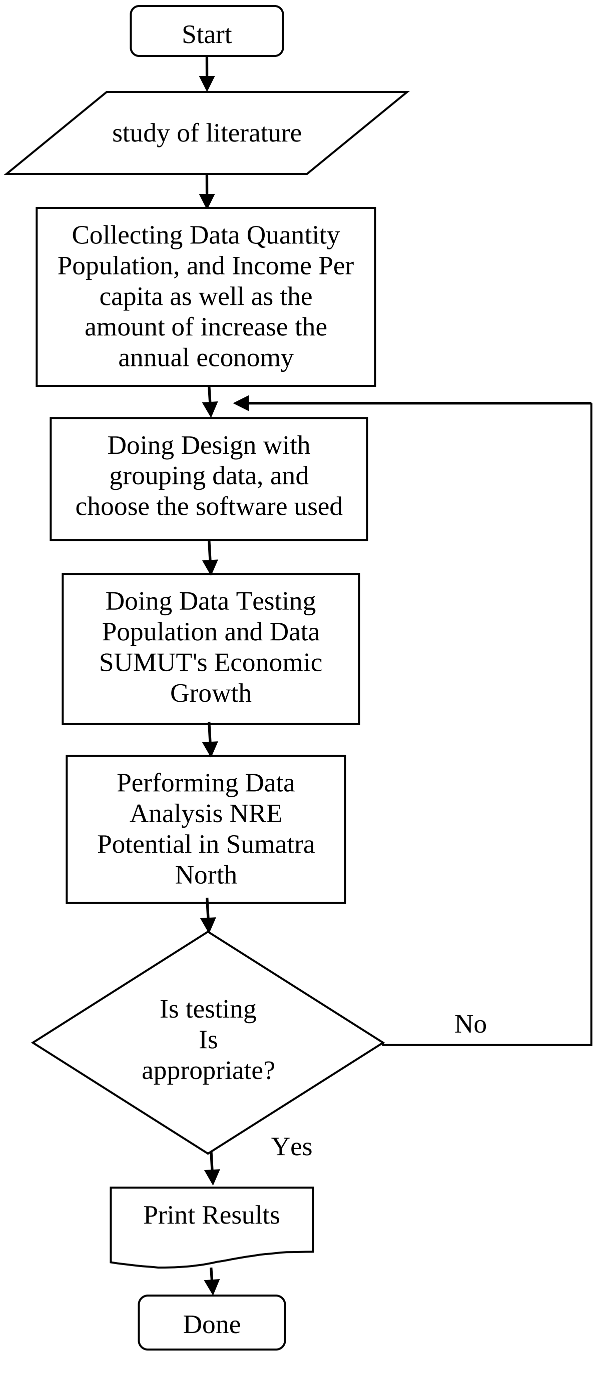

Figure 1. Research Flowchart

3. RESULTS AND DISCUSSION

A. Research Data

The research data obtained from the Central Bureau of Statistics of Indonesia, Province of Sumatra North can be seen in table 1.

Table 1. Population and Economic Growth Data in North Sumatra

Growth Data	Amount
Population	12.98 million
PDRB	118.51 billion
Income per capita	9.13 million
Revenue Growth	6.10%
Population Growth Rate	1.28%

B. New and Renewable Energy Potential in Sumatra North

When entering data into software LEAP, can be seen in Figure 2.

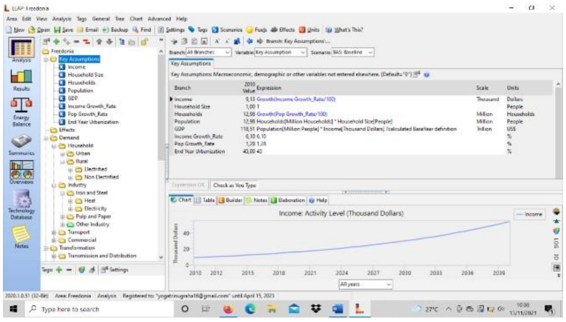

Figure 2. Entering population data, per capita income and SUMUT's economic growth rate in 2010

Figure 3, shows the software display LEAP which includes population data, GDP, and the rate of population growth and rate of economic income growth after that will show the population and economic development in North Sumatra. Can be seen in Figure 3 and figure 4.

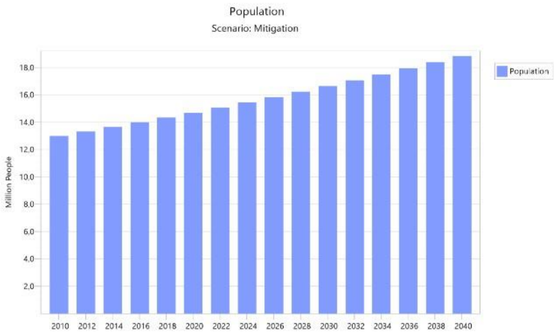

Figure 3. Population Growth of Province of North Sumatra 2010-2028

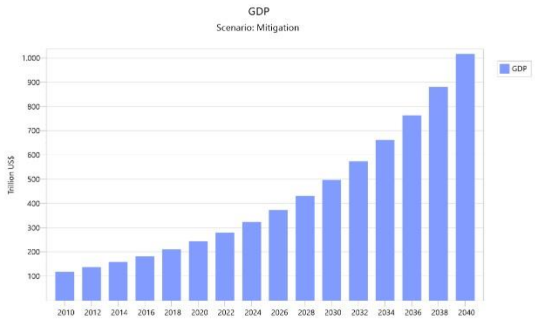

Figure 4. Provincial GDP Economic Growth of North Sumatra 2010-2028

The data above will be processed to see the results potential for new and renewable energy in North Sumatra. The results of the data that have been processed can be seen in figure 5.

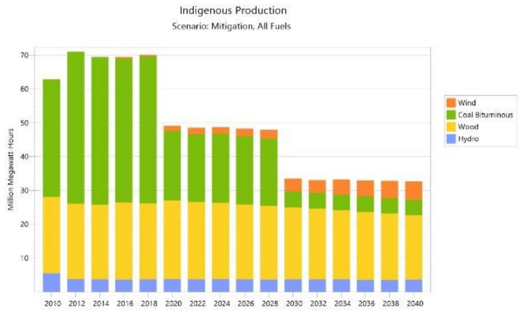

Figure 5. Results of New and Renewable Energy Potential in North Sumatra Year 2028

Based on the results obtained by LEAP software, the potential for new and renewable energy in North Sumatra Province in 2028, namely hydro energy, wind energy, and biomass energy. The potential new and renewable energy in Sumatra Province North in 2028 can be seen in table 2.

Table 2. Final Results of New and Renewable Energy Potential in the Province of North Sumatra in 2028 (Millions) Megawatt-hours)

Years	Hydro	Wind	Biomass
2010	5,5	0	22,6
2011	3,8	0	22,8
2012	3,8	0	22,9
2013	3,7	0	23,1
2014	3,7	0	23,2
2015	3,6	0	24,5
2016	3,6	0,4	24,6
2017	3,7	0,4	24,8
2018	3,7	0,4	24,9
2019	3,7	1,0	25,1
2020	3,8	1,5	26,3
2021	3,8	1,5	26,4
2022	3,7	1,8	26,5
2023	3,7	1,8	26,6
2024	3,8	1,9	26,7
2025	3,7	1,9	26,8
2026	3,7	2,2	26,9
2027	3,7	2,2	27,0
2028	3,7	2,6	27,0

4. CONCLUSION

This research provides results, namely the potential renewable energy in North Sumatra in the year 2028 namely water energy, wind energy, and energy biomass. Water energy has growth potential by 3.7 million megawatt-hours by 2028. Meanwhile, wind energy has a potential of 2.6 a million megawatt-hours and biomass energy has potential growth of 27.0 million megawatt-hours by 2028 using LEAP software.

REFERENCES

[1] M. A. Lusi, P. Sahupala, C. W. Wullur, D. Parenden, K. A. Rahangmetan, and F. Sariman, Tide Utilization Study For Power Generation,‖ J. MJEME, vol. 2, no. 2, pp. 44–49, 2020.

[2] E. Liun, Potential of Alternative Energy in Indonesian Electrical System,‖ Semin. Nas. developer. Nuclear Energy. IV, pp. 311–322, 2011.

[3] T. Zulhadi and S. Fazli, Source Identification Renewable Energy (SET),‖ Balitbang, pp. 197–211, 2010.

[4] I. Kholiq, Alternative Energy Utilization Renewable Energy To Support Fuel substitution, Curr. Opinion. environment. Sustain., vol. 4, no. 1, p. i, 2012, doi: 10.1016/s1877-3435(12)00021-8.

[5] F. Husain and W. Widianingrum, Energy Utilization of Ocean Currents in the Gulf Average as an Alternative Energy Source Sustainable, Zo. Sea J. Inov. Science And Technol. Marine., vol. I, no. 3, pp. 107–115, 2020, doi:10.20956/zl.v1i3.12011.

[6] N. Aryanto, A. Jaya, and C. Hudaya, New Renewable Energy Modeling Through a Dynamic Approach to Resilience Sumbawa Regency Energy 2017-2027,‖ J. TAMBORA, vol. 4, no. 2A, pp. 122–132, 2020, doi: 10.36761/jt.v4i2a.783.

[7] F. Adzikri, D. Notosudjono, and D. Suhendi, Renewable Energy Development Strategy in Indonesia,‖ J. Online Mhs. bids. Tech. electrical, vol. 1, no. 1, pp. 1–13, 2017, [Online]. Available: http://jom.unpak.ac.id/index.php/teknikelektro/ article/view/667.

[8] J. S. Setyono, F. H. Mardiansjah, and M. febrina K. Astuti, Development potential new energy and renewable energy in the city Semarang, Riptek, vol. 13, no. 2, pp. 177–186, 2019.

[9] L. M. Parera and C. E. Pelamonia, Potential New Renewable Energy For Development Tourism in Ambon City,‖ J. Symmetric, vol. 9, no. 1, p. 179, 2019, doi:10.31959/js.v9i1.311.

[10] B. Pranoto, S. N. Aini, H. Soekarno, A. Zukhrufiyati, H. Al Rasyid, and S. Lestari, Potential of Micro-hydro Energy in Irrigation Area (Case Study in the Serayu River Basin Opak),‖ J. Irig., vol. 12, no. 2, p. 77, 2018, doi: 10.31028/ji.v12.i2.77-86.

[11] R. B. Astro et al., The Energy Potential of Water As Friendly Power Source, J. Educator. Fis., vol. 4, no. 2, pp. 125–133, 2020.

[12] D. G. Cendrawati, H. Soekarno, and S. Nasution, Potential of wind energy in the district Serdang Bedagai, North Sumatra Province, Electricity and Renewable Energy, vol. 14, no. 1, pp. 15–28, 2015.

[13] A. Prasetyo, D. Notosudjono, and H. Soebagja, WIND POWER POWER PLANT In the preparation of this Final Project, the meaning and the objectives are: a . System review application and development of wind power plant in Indonesia is a developing country. b. Assessing wind potential and technology on PLT Wind System,‖ pp. 1–12, 2018.

[14] M. and P., Analysis of Waste Potential as Power Plant Raw Materials Garbage (Pltsa) in Pekanbaru,‖ SainETIn, vol. 1, no. 1, pp. 9–16, 2017, doi: 10.31849/sainetin.v1i1.166.

[15] D. Budi Heri Pirngadie, Utilization Potential Garbage Turns into Electricity at Tpa Cilowong Serang City, Banten Province,‖ Electricity and Renewable Energy, vol. 14, no. 2, pp. 103–116, 2015.