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Assessment Of Factors Affecting Service Quality In The Renewable Energy Industry. Evidence In Vietnam

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Abstract

This study is based on the SERVQUAL model to find out the influencing factors on service quality of enterprises in the renewable energy industry. Use Performance Importance Analysis (IPA) to design and analyze questions for the purpose of investigating and evaluating customer service quality for businesses providing renewable energy products. The study collected and processed 340 valid questionnaires. The study found 15 factors with greater satisfaction than perceived importance of service quality in the renewable energy industry. From there, the research will offer solutions to improve the service quality of the industry further.

Keyword: Renewable energy, Service quality, SERVQUAL model, IPA.

JEL codes: L15, L2, M1.

1. Introduction

The growth of renewable energy sources is unavoidable (Li, 2016). One of their important tools for realizing the renewable energy economy is to promote communication in the direction of the new driving force of the renewable energy economy, which is environmental protection, the development of clean production technology, and clean energy to achieve rapid and sustainable economic growth (Dincer, 2000; Viardot, 2013). Consider the United States, which is one of the leading countries in terms of renewable energy economic policy. They have adopted new policies to help the economy recover, such as energy development, renewable energy economic development, energy conservation policies, pollution reduction, and renewable energy policies to create energy (Painuly, 2001; Worighi et al, 2019). They support propaganda efforts to execute the energy conservation policy, with the objective of renewable energy sources accounting for around 25% of power output by 2025. Similarly, the European Union has set a goal of increasing renewable energy consumption from 8.5 percent to 20 percent by 2020, while substantially reducing emissions. Many Asian countries have likewise established an economic growth plan based on renewable energy. Korea is predicted to become one of the world's seven renewable energy economic powerhouse by 2020, and one of the world's five by 2050. (Bhattacharya et al, 2016; Kumar et al, 2010; Dai et al, 2016).

Vietnam has a lot of potential when it comes to utilizing renewable energy sources including hydropower, wind power, solar power, and biomass power (Tien et al, 2020; Hoi, 2020). In Vietnam, hydroelectricity is being developed to its full potential. By the end of 2018, hydropower has become our country's primary energy source, accounting for more than 40% of total national electrical capacity. Hydro and other types of renewable energy (including small hydropower) account for 2.1 percent of the overall capacity of the system, excluding medium and big hydropower. However, nothing remains constant. before the passage of time. Thanks to the FIT price support mechanism, more over 80 solar power facilities have been operational and closed as of mid-2019, whereas just two small-scale solar power plants were linked to the electricity grid at the end of 2018. The entire solar power capacity at the time was over 4460 MW, accounting for more than 8% of the system's overall producing capacity. Meanwhile, Vietnam's total wind power capacity was just 228 MW at the end of 2018, but by 2019, the number of wind power projects under development with a total capacity of 2,000 MW would be more than double that of the previous year. Commercial power generation from biomass energy is still progressing slowly due to the challenge of bagasse price support. However, considering the growing volume of municipal and agricultural waste, forestry products, and the government's work on the Renewable Portfolio Standard, the prospects for this energy source's expansion remain optimistic (Cuong et al, 2021; Tran, 2018).

However, this "rapid" development is also posing new challenges in terms of synchronous development of the power grid system, land use, electricity price mechanism, human resources/employment, and financial resources.

2. Literature review

2.1. Renewable energy

Renewable energy systems produce very little emissions into the atmosphere. Therefore, it will not cause urban smog and health problems for humans and the environment. Potential global climate change, caused by excess carbon dioxide and other gases in the atmosphere, is the latest environmental concern; systems using solar, wind and geothermal energy sources do not contribute any carbon dioxide to the atmosphere (Bull, 2001; Dincer, 2000; Mathiesen et al, 2011). Renewable energy has the following types of energy:

Photovoltaic Energy: Photovoltaic devices turn sunlight into electricity using semiconductor materials such as silicon. They do not have any moving parts and don't emit any emissions when they're running. Photovoltaic devices that are extremely modular can be employed in small cells, panels, and arrays. Photovoltaic systems have a median lifespan of roughly 20 years and require little servicing or maintenance.

Wind Energy: The kinetic energy of the wind is converted into other forms of energy, such as electricity, using wind generating systems. Although the notion of wind energy conversion is straightforward, turbine design can be challenging. Most commercially available wind turbines have a horizontal shaft with two or three blades, a drive system that includes a gearbox and generator, and a tower to support the blades. Wind turbines typically range in size from 200 to 750 kW, producing power over a defined wind speed range.

Biopower: Biomass power plants use biomass resources ranging from agricultural and forest product leftovers to crops grown expressly for energy production to generate electricity. The biomass is burned in the boiler to produce steam, which is then expanded through a turbine/generator to produce power in the direct combustion system. Cofiring turns biomass into a gas that can be used to replace natural gas in turbine combustion; gasification converts biomass into a gas that can be used to replace natural gas in turbine combustion.

Biofuels: To enhance the octane rating of gasoline and promote cleaner combustion, ethanol is frequently used as a gasoline addition or transformed into another additive called tertiary ethyl ether-butyl.

Geothermal Energy: Dry steam, hot water, hot water dry ice, lava, and heat from the ground are all examples of geothermal resources. Commercially developed steam and water resources have been established to offer generated energy and ambient heat for use in geothermal heat pumps; further resource extraction methods are being investigated.

Concentrating Solar Power and Solar Buildings: Solar thermal systems, also known as concentrating solar energy, use the sun's heat to meet a variety of needs, including generating electricity, heating water for industrial processes, domestic or community water supplies, swimming pools, preheating building ventilation air, and direct heating of the building interior.

Hydrogen and Fuel Cells: Hydrogen is now created from natural gas with a limited market purpose, but it can also be produced from renewable sources and, in the long run, promises to make major contributions to global energy supply. The most plentiful element in the universe, hydrogen is the most basic chemical fuel (basically a carbon-free hydrocarbon) that generates a highly efficient, clean-burning energy carrier. It can power zero-emission vehicles, provide process heat for industrial operations, provide home heat via cogeneration, and assist in the generation of energy for centralization or distribution. provides a storage medium for electricity generated from renewable energy sources and distributes the power system. Some people believe that in the future, the entire economy will be built on hydrogen.

Distributed Power: The term "distributed power" refers to modular power generation from tiny relay generating units that range in size from a few kilowatts to tens of megawatts and are positioned at or near the point of use. Grid-connected or off-grid distributed systems are both possible. The goal of proponents of power distribution is to reinvent the grid such that, rather than producing electricity at huge, central plants and routing it in one direction, customers will have some degree of energy independence and the system will be accessible to millions of small suppliers.

2.2. Service quality

According to Hurbert (1995), before using the service, the customer has formed a "scenario" about that service. When the customer and supplier scenarios are not the same, the customer will feel dissatisfied. Zeithaml (1987) explains that service quality is the customer's assessment of the superiority and general greatness of a reality. It is a form of attitude and consequences resulting from a comparison between what is expected and the perception of what is received. Lewis and Booms state: Service quality is a measure of how well the service delivered to the customer matches the customer's expectations. Creating a quality service means meeting customer expectations consistently.

Parasuraman, Zeithaml and Berry (1985, 1988) define: Service quality is considered as the gap between service expectations and customers' perception when using the service. This statement demonstrates that service quality is related to customer expectations and their perception of the service. Parasuraman (1991) explains that, to know customers' expectations, it is best to identify and understand their expectations. It is necessary to develop a system to quantify the customer's expectations, then we have an effective service quality strategy.

The renewable energy service quality measurement model is quite specific when it comes to assessing service quality based on what is served and how it is served, for example: technology, attitude, employee behavior towards customers. Therefore, the quality model Parasuraman (1991) proved more reasonable for the research on service quality measurement when focusing on two main aspects of service quality, namely functional quality (performed by enterprises) and technical quality (what service does the business provide). According to Parasunaman's SERVQUAL model, quality service is measured through 5 factors (Reliability, Tangibility, Empathy, Responsiveness and Assurance). SERVQUAL model developed by Parasuraman and other authors (1985, 1986, 1988, 1991, 1993, 1994), SERVQUAL is the most used approach to measure quality of service, compare customer expectations before a service and the customer's perception of the service is delivered (Parasuraman et al, 1985). SERVQUAL is combined with a 5-way Likert scale.

From related studies and based on the SERVQUAL scale, the study designed a questionnaire.

Table 1: Questionnaire survey

No	Code	Questions	References
Reliability			
1	RE1	Does the company fully introduce the content of the contract with your unit in terms of technique and usage when your unit wants to join?	

2	RE2	Does the company handle problems as soon as problems arise?	Vo Nhat Thanh (2019) Phan Van Hoa & Ngo Thanh (2014) Nguyen Thanh Dung & Luu Tien Thuan (2020) Ibáñez, V. A., Hartmann, P., & Calvo, P. Z. (2006) Deng, N. Q., Liu, L. Q., & Deng, Y. Z. (2018)
3	RE3	Does the company properly perform the service as the contract?	
4	RE4	Does the company make mistakes when calculating electricity bills?	
Assurance			
5	AS1	Do you feel very safe when dealing with Company employees?	
6	AS2	Are the Company's staff knowledgeable enough to answer all your questions related to the solar power system?	
7	AS3	The company always meets your electricity needs	
8	AS4	Company employees are very quick to fix when the solar power system has a problem?	
9	AS5	The behavior of the Company's staff instills confidence in you?	
Responsiveness			
10	RS1	Company staff tell your unit about the plan to implement solar power services?	
11	RS2	Does the company strictly follow the payment schedule and electricity schedule?	
12	RS3	Does the company maximize its power generation capacity?	
13	RS4	Quality of solar power system is guaranteed?	
14	RS5	Complaints of your unit are resolved quickly and thoroughly?	
Tangible			
15	TA1	Does the company have enough funds for the management, operation and maintenance of the solar power system?	
16	TA2	Do Company employees wear protective clothing when on duty?	
17	TA3	Does the company provide manuals on management and operation of the solar power system for your unit?	
18	TA4	Are the company's solar power equipment of good quality?	
19	TA5	Is the maintenance and maintenance of the solar power system done regularly?	

Empathy			
20	EM1	Company employees always work at convenient hours for your unit?	
21	EM2	Questions about your unit's solar power service are always interested and resolved by the company?	
22	EM3	Does the company adjust the power cut schedule to suit the change of weather?	
23	EM4	Employees of the Company always understand the needs of the unit.	
24	EM5	The company always takes the interests of your unit as a sustainable development goal?	

Source: Synthetic author

3. Methodology

Scores are compiled from research evaluations. Then, they are analyzed and compared to select the scales that best match the research objectives and context. Since most of the scales are highly abstract, the scale is used in this study to increase the selection of the subjects under investigation. The official questionnaire has 24 items. The content of the scales is compiled by the author from the officially published studies, then translated into Vietnamese and discussed with the business group participating in expert interviews to adjust some concepts for fit. However, in the process of conducting the survey, the author must also explain to the respondents the opinions that the question content has not conveyed. To record the respondent's assessment of the questions, the author uses a 5-point Likert scale as follows: 1: Completely disagree; 2: Disagree; 3: No opinion/neutral; 4: Agree; 5: Totally agree.

4. Results

4.1. Demographic Data

The study collected 340 questionnaires, of which 47.06% were male and 52.94% were female. Regarding the survey area, the study randomly selected some northern provinces of Vietnam including 6 provinces: Ha Noi (23.53%), Vinh Phuc (14,71%), Thai Binh (17,65%), Nam Dinh (16,18%), Phu Tho (13,24%), and Hung Yen (14,71%).

Table 2: Description of the respones

Characteristics	Categories	Frequency	Percentage (%)
Gender	Male	160	47.06
	Female	180	52.94
Occupation	Officer	45	13.24
	Business	100	29.41
	Freelancer	150	44.12

	Other	45	13.24
Location	Ha Noi	80	23.53
	Vinh Phuc	50	14.71
	Thai Binh	60	17.65
	Nam Dinh	55	16.18
	Phu Tho	45	13.24
	Hung Yen	50	14.71
Type of renewable energy used	Hydroelectric	190	55.88
	Photovoltaic Energy	150	44.12
	Wind Energy	0	0

Source: Author calculation

4.2. Cronbach's alpha

Application validation can be done by testing the measurement model as an external model and checking the reflectance and reliability. Cronbach's alpha are all greater than 0.7, the structure meets the reliability criteria (Hair, et al., 2014)

Table 3. Cronbach's alpha results

Items	Important	Satisfaction
RE	0.888	0.814
AS	0.876	0.862
RS	0.885	0.876
TA	0.867	0.900
EM	0.853	0.890

Source: Author calculation

4.3. Pearson correlation coefficient

The correlation matrix shows that between the independent factors and the dependent factors, the positive correlation coefficient is quite high and significant at 0.05 level (Table 4). Thus, the factors are strongly correlated with the customer satisfaction factor.

Table 4. Correlation matrix

		RE	AS	RS	TA	EM
RE	Pearson Correlation	1	.680**	.610**	.591**	.562**
	Sig. (2-tailed)		.000	.000	.000	.000
AS	Pearson Correlation	.680**	1	.848**	.714**	.715**
	Sig. (2-tailed)	.000		.000	.000	.000

RS	Pearson Correlation	.610**	.848**	1	.833**	.788**
	Sig. (2-tailed)	.000	.000		.000	.000
TA	Pearson Correlation	.591**	.714**	.833**	1	.780**
	Sig. (2-tailed)	.000	.000	.000		.000
EM	Pearson Correlation	.562**	.715**	.788**	.780**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
**. Correlation is significant at the 0.01 level (2-tailed).						

Source: Author calculation

4.4. IPA matrix

The importance and satisfaction of service quality in renewable energy industry is 3.78 and 3.88. After analyzing the two axes referencing the X-axis and the Y-axis. Among them, consumers think that high importance, but low satisfaction is the key to improving priorities, and more attention must be paid, as shown in Figure 1.

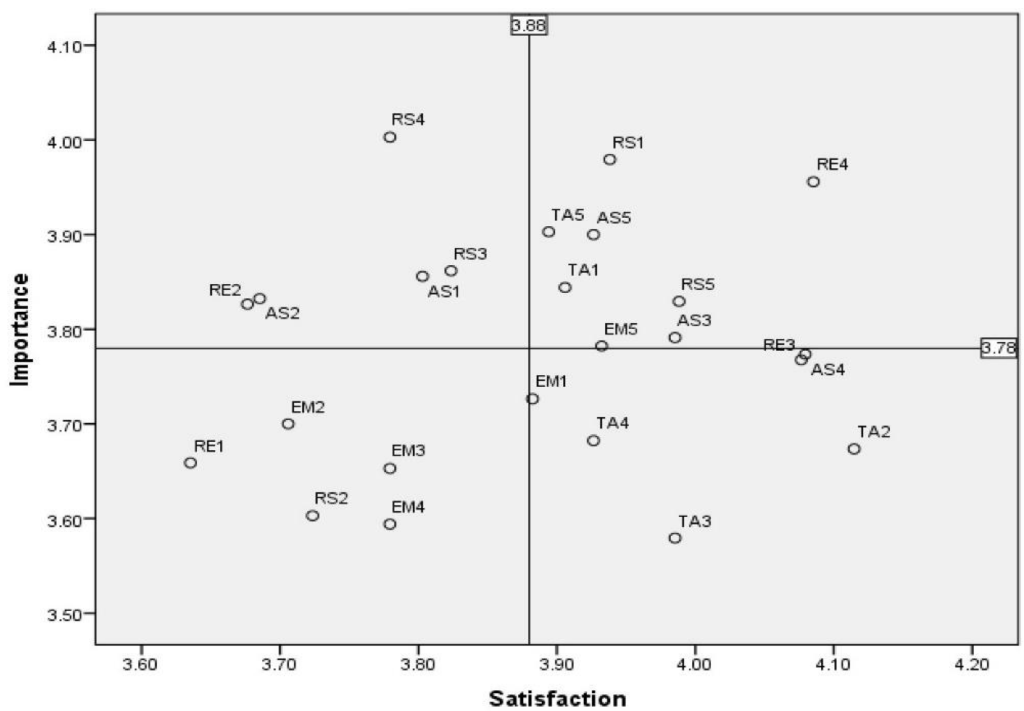

Figure 1. IPA matrix

Source: Author calculation

The corresponding factors for each quadrant are shown in Table 4 as:

Quadrant I – high importance, high satisfaction are 8 factors: RS1, RE4, TA5, AS5, TA1, EM5, RS5, AS3.

Quadrant II - low importance, high satisfaction are 6 factors: EM1, RE3, AS4, TA2, TA3, TA4.

Quadrant III - low importance, low satisfaction are 5 factors: EM2, EM3, RE1, RS2, EM4.

Quadrant IV - high importance, low satisfaction are 5 factors: RS4, RS3, AS1, RE2, AS2.

Table 4. Detailed results of the IPA model of renewable energy industry

No	Items	Importance (1)	Satisfaction (2)	GAP (1-2)	Quadrant
1	RE1	3.66	3.64	0.02	III
2	RE2	3.83	3.68	0.15	IV
3	RE3	3.77	4.08	**-0.31**	II
4	RE4	3.96	4.09	**-0.13**	I
5	AS1	3.86	3.80	0.05	IV
6	AS2	3.83	3.69	0.15	IV
7	AS3	3.79	3.99	**-0.19**	I
8	AS4	3.77	4.08	**-0.31**	II
9	AS5	3.90	3.93	**-0.03**	I
10	RS1	3.98	3.94	0.04	I
11	RS2	3.60	3.72	**-0.12**	III
12	RS3	3.86	3.82	0.04	IV
13	RS4	4.00	3.78	0.22	IV
14	RS5	3.83	3.99	**-0.16**	I
15	TA1	3.84	3.91	**-0.06**	I
16	TA2	3.67	4.11	**-0.44**	II
17	TA3	3.58	3.99	**-0.41**	II
18	TA4	3.68	3.93	**-0.24**	II
19	TA5	3.90	3.89	0.01	I
20	EM1	3.73	3.88	**-0.16**	II
21	EM2	3.70	3.71	**-0.01**	III
22	EM3	3.65	3.78	**-0.13**	III
23	EM4	3.59	3.78	**-0.19**	III
24	EM5	3.78	3.93	**-0.15**	I

Source: Author calculation

Through Table 4, there are 15 factors with greater satisfaction than the perceived importance of service users in the renewable energy industry. Those factors are RE3, RE4, AS3, AS4, AS5, RS2, RS5, TA1, TA2, TA3, TA4, EM1, EM2, EM3, EM4, EM5. These are the factors that need to be promoted to improve the service quality of the product. Besides the factors that have not met customer satisfaction, it is necessary to have measures to solve and meet more.

5. Conclusion

Population increases, general demand increases, and the demand for energy use also increases. In addition, the speed of urbanization in recent years has taken place very quickly, traffic works, infrastructure construction, and power grid system have changed very strongly, creating a change in population, the demand for services using energy increases. After determining the level of influence of service quality components on customer satisfaction, together with the analysis of the status of service quality in the renewable energy industry. The study offers several corresponding solutions to improve the current situation, as well as contribute to improving the level of customer satisfaction.

Improve the ability to respond to customer request information within 30 minutes to respond to customers accurately and specifically. Standardize information on power outages to ensure accurate outage time to major customers even in the event of unexpected power outages. In case of power shortage in the dry season, it is necessary to have a communication method to forecast specific power supply capacity and transparent information sources, shorten the time to solve galvanometer services such as installation and replacement of galvanometers in 01 year. day (currently 5 days), repair minor damage at customer's house within 02 hours. Effectively invest in power grids, substations, galvanometers, etc. to improve power quality to meet demand. electricity is increasing.

Renovate, upgrade, and develop the distribution network to operate safely, reduce power loss, reduce breakdowns, and improve the reliability of power supply. Improve the efficiency of grid investment in the direction of accurately forecasting demand to have an investment strategy close to reality. Reform, learn from the inefficient wasteful investment in the past. Structuring and diversifying forms of electricity service business towards a competitive electricity market, contributing to improving business efficiency and service quality in line with the common goal of developing electricity services like that of countries in the region.

Research limitations:

The study only covers a few provinces in the North of Vietnam, so the study may not fully reflect customer satisfaction in the entire territory of Vietnam. The surveyed customers mainly use 2 types of renewable energy: hydroelectricity and solar energy. This is also a limitation of the research that has not yet assessed the customer's feelings when using all types of renewable energy that Vietnam is providing to the market.

References

Bhattacharya, M., Paramati, S. R., Ozturk, I., & Bhattacharya, S. (2016). The effect of renewable energy consumption on economic growth: Evidence from top 38 countries. Applied Energy, 162, 733-741.

Bull, S. R. (2001). Renewable energy today and tomorrow. Proceedings of the IEEE, 89(8), 1216-1226.

Cuong, T. T., Le, H. A., Khai, N. M., Hung, P. A., Thanh, N. V., Tri, N. D., & Huan, N. X. (2021). Renewable energy from biomass surplus resource: potential of power generation from rice straw in Vietnam. Scientific reports, 11(1), 1-10.

Dai, H., Xie, X., Xie, Y., Liu, J., & Masui, T. (2016). Green growth: The economic impacts of large-scale renewable energy development in China. Applied energy, 162, 435-449.

Deng, N. Q., Liu, L. Q., & Deng, Y. Z. (2018). Estimating the effects of restructuring on the technical and service-quality efficiency of electricity companies in China. Utilities Policy, 50, 91-100.

Dincer, I. (2000). Renewable energy and sustainable development: a crucial review. Renewable and sustainable energy reviews, 4(2), 157-175.

Dung, N. T., & Thuan, L. T. (2020). Influence of service quality and social consensus on customer satisfaction using electricity - The case of Hau Giang power company. ECONOMY AND BUSINESS ADMINISTRATION, 15(3), 193-204.

Hoa, P. V., & Thành, N. (2014). Improving the quality of daily-life electricity services of Thua Thien Hue Power Company in Hue city. Hue University Journal of Science (HU JOS), 90(2).

Hoi, H. T. (2020, October). Potential for Clean Energy Development in Vietnam. In 2020 IEEE 3rd International Conference on Renewable Energy and Power Engineering (REPE) (pp. 80-84). IEEE.

Ibáñez, V. A., Hartmann, P., & Calvo, P. Z. (2006). Antecedents of customer loyalty in residential energy markets: Service quality, satisfaction, trust and switching costs. The Service Industries Journal, 26(6), 633-650.

Kumar, A., Kumar, K., Kaushik, N., Sharma, S., & Mishra, S. (2010). Renewable energy in India: current status and future potentials. Renewable and sustainable energy reviews, 14(8), 2434-2442.

Li, Y., Wei, L., Chi, Y., Wang, Z., & Zhang, Z. (2016, October). Study on the key factors of regional power grid renewable energy accommodating capability. In 2016 IEEE PES Asia-Pacific Power and Energy Engineering Conference (APPEEC) (pp. 790-794). IEEE.

Mathiesen, B. V., Lund, H., & Karlsson, K. (2011). 100% Renewable energy systems, climate mitigation and economic growth. Applied energy, 88(2), 488-501.

Painuly, J. P. (2001). Barriers to renewable energy penetration; a framework for analysis. Renewable energy, 24(1), 73-89.

Tien, N. H., Phuc, N. T., Thoi, B. V., Duc, L. D. M., & Thuc, T. D. (2020). Green economy as an opportunity for Vietnamese business in renewable energy sector. International Journal of Research in Finance and Management, 3(1), 26-32.

Tran, H. N. (2018). Renewable Energy in Achieving Sustainable Development Goals (SDGs) and Nationally Determined Contribution (NDC) of Vietnam. Renewable Energy in Developing Countries, 41-56.

Viardot, E. (2013). The role of cooperatives in overcoming the barriers to adoption of renewable energy. Energy Policy, 63, 756-764.

Vo Nhat, T. (2019). Factors affecting customer satisfaction about service quality at Long Phu electricity, Soc Trang province (Doctoral dissertation, Tra Vinh University).

Worighi, I., Maach, A., Hafid, A., Hegazy, O., & Van Mierlo, J. (2019). Integrating renewable energy in smart grid system: Architecture, virtualization and analysis. Sustainable Energy, Grids and Networks, 18, 100226.