Efficiency Environmental Policy: Input-Output Approach Orientation

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Abstract: - *This study has the objective to calculate and analyze environmental efficiency when a country ratified the Kyoto Protocol or not to ratify it both the developed and developing countries as well. Output to be analyzed is GDP and CO2 emissions, while the input to be analyzed is the use of energy, stocks traded and Labour. The analysis Metod of is Envelope Data analysis (DEA) with samples of G20 countries by 2004-2014. To be analyzed is the degree of efficiency after implementing the Kyoto protocol and how the processing results when viewed from based on the input and output targets. This is to answer the formulation of the problem posed in this study namely How the level of environmental efficiency if the Kyoto Protocol is implemented and how policy advice for each of the G20 countries based on the input and output targets. The study concluded the following: with the policy implemented Kyoto Protocol was able to further improve environmental efficiency in some other countries such as Russia, Argentina, China and Germany. This shows that the policy of the Kyoto Protocol been successful in carrying out its role as controller of the growth in emissions in developed countries and growing, especially G20 members. Besides, there are also countries that suffered losses in the level of environmental efficiency if not implement the Kyoto Protocol. But on the other side of some countries are not affected if there is no Kyoto Protocol, for example Italy, Mexico, Saudi Arabia, Australia and America. Efficiency is not the only primary standard to make a country become a standard for other countries, on the other hand the performance quality of the environment should also be considered. One country may succeed in reducing the environmental inefficiency by ratifying the Kyoto Protocol, and it has the efficient performance in relation to environmental quality and sustainable productive based on Malmquist index. Based on the criteria of the target input and target output, it can be seen that the member countries of G20 reach the optimal level when viewed from the variable GDP (positive output) and shares traded or stock traded (input) eg Argentina, Australia, Brazil, Canada and Indonesia. However, this is not optimal when viewed through the use of energy (input target), emissions (output targets), and labor (input target).*

Keywords: - *Emissions, GDP, Labour, Energy Use, Stock Traded.*

Introduction

Along with the development of increasingly massive industry sector, encouraging the use of energy makes increasingly less controllable environment conditions by increasingly degraded, especially air pollution. Environmental conditions are thus becoming its own demands for all countries to pay attention to energy utilization in the process of economic development in order to achieve economies notice sustainable. Energy utilization concept is to increase the process of industrialization and urbanization, and environmental issues all of them can be regarded as a process unit, which implicitly will encourage growth in the production and consumption of energy (Yang and Wang, 2013).

Review of literature

Pearce and Turner (1990) argues that the closely related among Economy, energy, and environment. Economy-environment relationships by Pearce and Turner (1990), that the economic activity of members of the negative environmental impact because as the environment as a reservoir emissions from their economic activity. This is because the economic system does not like the system

environment in a certain degree are able to recycle 'waste' as a result of the production process. Therefore, the economy and the environment have a negative relationship. System environment by recycling power automatically become a 'recycler' for the economic system as long as does not exceed the carrying capacity. The next economic relations and energy are also noteworthy. Pearce and Turner (1990) explain that economic activity cannot be separated from the role of energy. Various energy is used mainly primary energy such as petroleum, coal and natural gas and others, in the production process that involves energy-producing 'waste'. When waste exceeds the ambient quality, it will not be in recycle naturally (Fare et al. 1989). As per the law of the thermodynamics, that energy cannot be created or destroyed, so that every energy use will end up somewhere in the neighborhood (Pearce and Turner, 1990). Again, the environment becomes 'recycler' of residue resulting from the use of energy. But keep in mind that not all the 'waste' can be recycled (Pearce and Turner, 1990) (Kemfert.2009). Along with the second law of thermodynamics that the production process that produces waste and when the production process refuse to recycle 'waste material' will remain a 'waste'. The latter is the relationship between energy and the economy. The production process of the economic system is in need energy, the engine of economic

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growth which has a major role (Kemfert. 2009). It seems that energy is a central issue in this connection. Therefore, if it is associated with waste control policy as a residue of energy (CO_2 emissions), can the policy of the Kyoto protocol inefficiencies suppress the impact of waste from the production process as well as energy.

Result of Research

Based on the results of data processing, it appears that the level of efficiency above the respective country varies with different conditions when the Kyoto protocol applied or not applied. The level of environmental efficiency increases compared to some countries if the country does not implement the Kyoto protocol over a span of years from 2004 to 2014. Countries that managed to increase its efficiency up perfectly with the implementation of the policy package Kyoto protocol in the country among other countries China, Russia, Argentina, Germany and the European Union.

Tabel 1 Score Efficiency

Negara	Skor Efisiensi	Rank	Negara	Skor Efisiensi	Rank	Efficiency Loss	Rata-Rata Gdp 2004-2010	Estimasi Biaya Kebijakan
Australia	100.00	1	Australia	100	1	0.00	na	na
Italia	100.00	1	Italia	100	1	0.00	na	na
Meksiko	100.00	1	Meksiko	100	1	0.00	na	na
Sau.Ar	100.00	1	Sau.Ar	100	1	0.00	na	na
Turki	100.00	1	Turki	100	1	0.00	na	na
Amerika	100.00	1	Amerika	100	1	0.00	na	na
Prancis	99.84	2	Prancis	99.98	2	0.14	$2,607,470,843,483.09	$374,527,630,245.75
Inggris	99.13	3	Inggris	99.6	4	0.47	$2,572,453,411,354.91	$1,216,068,885,367.73
Rusia	98.39	4	Rusia	100	1	1.61	$1,466,292,960,234.18	$2,359,398,672,376.82
Argentina	97.67	5	Argentina	100	1	2.33	$420,449,859,642.59	$978,501,491,531.84
Jerman	97.10	6	Jerman	100	1	2.90	$3,393,302,138,750.82	$9,840,576,202,377.39
China	96.01	7	China	100	1	3.99	$5,396,786,316,934.95	$21,538,083,573,949.50
Afsel	94.77	8	Afsel	98.45	5	3.68	$312,654,784,049.41	$1,149,716,910,436.24
Canada	94.49	9	Canada	97.34	6	2.85	$1,520,878,010,651.73	$4,333,119,713,984.10
Jepang	93.30	10	Jepang	99.67	3	6.37	$5,048,833,745,952.95	$32,161,070,961,720.30
India	92.65	11	India	94.57	7	1.92	$1,411,359,910,212.77	$2,703,395,755,289.36
EU	85.37	12	EU	100	1	14.63	$16,818,739,226,770.90	$246,012,285,598,858.00
Indonesia	82.02	13	Indonesia	89.27	8	7.25	$596,548,838,598.73	$4,326,063,714,092.76
Korsel	72.28	14	Korsel	75.2	9	2.92	$1,071,785,867,814.50	$3,127,666,032,440.51
Brazil	65.03	15	Brazil	67.21	10	2.18	$1,694,257,002,633.55	$3,698,100,966,657.41

While several other countries were able to increase the efficiency of the environment but cannot at the full efficient frontier line. Which means that the country - the country has not been able to suppress the growth rate of CO_2 emissions in order to increase the size of their GDP in those countries. Among the countries that experienced it is the country of South Africa, France, Britain, Canada, Japan, Indonesia, South Korea, Brazil and India. From the table above inefficiency score is calculated by the equation model scenarios it can be seen that six DMU namely Australia, Italy, Turkey, USA, Mexico and Saudi Arabia that operate efficiently during the implementation of the Kyoto Protocol as well as the policy if there is no such policy. It interpret with or without the state policy - the country is always found on the production frontier. And always allocate funds for environmental regulation cost (Yang and Wang, 2013) .Score efficiency biggest loss if there is no Kyoto Protocol occur in Indonesia, which have added level of environmental inefficiency of 7:25 per cent if it does not

implement the Kyoto Protocol policies. By participating in the treaty the Kyoto Protocol then automatically during the years 2004 - 2014 and tried to apply it, the State of Indonesia is able to reduce inefficiencies their environment although it has not yet reached full efficiency, it interpret right with the costs of implementing emissions reduction policies on the ratings of seven of more than 4 trillion dollars of total average - average GDP during the years 2004 - 2014, which means that Indonesia is able to suppress the bad growth rate of their output in the form of emissions and still be able to raise the level of their GDP which is good output but not been able to efficiently improve its environmental efficiency. Countries - other countries that succeed in reducing the level of inefficiency environment to zero and maximize efficiency their environment Russia, Argentina, Germany, China and the European Union.

Furthermore, the results will be compared with the input-oriented perspective (reduction of inputs to produce the same output) compared with output oriented perspective

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(with the same input produces the maximum output). It can be concluded that the orientation of the input several more countries can avoid the efficiency loss that can occur if it is not applied to the Kyoto protocol. Some of them the possibility of efficiency loss from Indonesia, for example, using input oriented Indonesia from the original use output oriented efficiency loss that can occur at 9.75 percent can be reduced to 7:25 percent, some countries others who are experiencing similar things is a South Korean original use output oriented efficiency loss that can occur at 6:32 percent can be pressed to figure 2.92 percent if the orientation was changed to input oriented, as well as with Brazil if the switch to input oriented initially have efficiency loss of 9:19 per cent if it does not implement the Kyoto protocol can be pressed to figure 2:18 percent by using input oriented. More efficiency of decreasing the risk of loss that may occur may be implicated in the increased efficiency in the cost of the policy. The cost of a policy for environmental improvements in some countries also decreased, which means the country can increase the efficiency of their environment without increasing costs sole discretion, some countries which decreased the cost of policies, among others, India, Korea, Brazil, France, India, and Japan.

Based on the results of the run efficiencies above, using a CRS and VRS input oriented, some countries increased environmental efficiency than if the state - the country does not implement the Kyoto Protocol during the years 2004-2014. Countries that managed to increase its efficiency to perfection by applying a policy package Kyoto protocol in the country, among others, Russia, Argentina, Germany, China and the European Union. While, several countries were able to increase the efficiency of the environment but it cannot match at the full efficient frontier line. Which means that the country has not been able to suppress the growth rate of CO2 in order to increase their GDP in those countries. Those countries are France, Britain, South Africa, Canada, Japan, India, Indonesia, South Korea, and Brazil. From the table above inefficiency score is calculated by the equation model scenarios it can be seen that six DMU namely Australia, Italy, Turkey, USA, Mexico and Saudi Arabia that operate efficiently during the implementation of the Kyoto Protocol as well as the policy if there is no such policy. It interprets with or without the state policy - the country is always found on the production frontier. And always allocate funds for environmental regulation cost

(Yang and Wang, 2013). Score efficiency biggest loss if there is no Kyoto Protocol occurs in Indonesia, which have added level of environmental inefficiency of 7:25 per cent if the case does not implement the Kyoto Protocol policies. By participating in the treaty the Kyoto Protocol then automatically during the years 2004 - 2014 Indonesia is able to reduce inefficiencies of the environment although it has not yet reached full efficiency, it interprets the costs of implementing emissions reduction policies on the ratings of seven of more than 4 trillion dollars of total average - average GDP for the year 2004 - 2014, which means that Indonesia is able to suppress the bad growth rate of their output in the form of emissions and still be able to raise the level of their GDP which is good output but not been able to efficiently improve its environmental efficiency. Countries - other countries that succeed in reducing the level of inefficiency environment to zero and maximize effency of the environment Russia, Argentina, Germany, China and the European Union.

It can be compared on the use of input oriented (reduction of inputs to produce the same output) with the use output oriented (with the same input produces the maximum output) it can be concluded with an orientation input some countries are more able to avoid the efficiency loss that can occur if you do not apply the Kyoto protocol , Some of them the possibility of efficiency loss from Indonesia, for example, using input oriented Indonesia from the original use output oriented efficiency loss that can occur at 9.75 percent can be reduced to 7:25 percent, some countries others who are experiencing similar things is a South Korean original use output oriented efficiency loss that can occur at 6:32 percent can be pressed to figure 2.92 percent if the orientation was changed to input oriented, as well as with Brazil if the switch to input oriented initially have efficiency loss of 9:19 per cent if it does not implement the Kyoto protocol can be pressed to figure 2:18 percent by using input oriented. More efficiency of decreasing the risk of loss that may occur may be implicated in the increased efficiency in the cost of the policy. The cost of a policy for environmental improvements in some countries also decreased, which means the country can improve its environmental efficiency without increasing costs sole discretion, some countries which decreased the cost of policies, among others, India, Korea, Brazil, France, India, and Japan.

Table 2 Output Target Relating to GDP

Country	GDP (Current US$)		
	Rata-rata	**Output Target**	**Selisih**
Argentina	282917983458.91	*	*
Australia	856112670484.68	*	*
Brazil	1272979574540.86	*	*
Canada	1312366039497.32	*	*
China	4009790363737.18	*	*

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European Union	15528728734035.70	*	*
France	2402735586103.68	*	*
Germany	3143003378960.59	*	*
India	1239950214069.36	*	*
Indonesia	438258057396.50	*	*
Italy	1923818872290.45	*	*
Japan	4744326892077.68	*	*
Korea, Rep.	1003184963808.27	*	*
Mexico	981638958531.41	*	*
Russian Federation	1087477232165.82	*	*
South Africa	287782493077.32	*	*
Turkey	605996696845.14	*	*
Saudi Arabia	441942231811.82	*	*
United Kingdom	2477474406729.68	*	*
United States	14045744507222.50	*	*

Source: Data processed

From data in table 2, it can be concluded all member countries of the G20 have reached efficiencies perfect surroundings when seen from the GDP of each country.

Table 3 Emissions Magnitude G20 countries based Output Target

Country	Emisi CO_2 (kt)		
	Rata-rata	**Output Target**	**Selisih**
Argentina	176616.10	156170.00	20446.10
Australia	376333.52	348757.00	27576.52
Brazil	379453.22	574033.00	-194579.78
Canada	527484.36	552349.00	-24864.64
China	7235610.19	5288166.00	1947444.19
European Union	3833871.29	4068782.00	-234910.71
France	370021.85	390103.00	-20081.15
Germany	768101.95	825896.00	-57794.05
India	1788628.09	1657522.27	131105.82
Indonesia	405746.43	371371.95	34374.48
Italy	431973.38	472768.00	-40794.62
Japan	1185517.87	1259655.00	-74137.13
Korea, Rep.	516677.40	588388.91	-71711.51
Mexico	443924.21	410744.00	33180.21
Russian Federation	1664594.77	1602963.00	61631.77
South Africa	456755.63	427132.00	29623.63
Turkey	275741.66	225407.00	50334.66
Saudi Arabia	431211.99	395834.00	35377.99
United Kingdom	508363.30	540409.00	-32045.70
United States	5558471.51	5790765.00	-232293.49

Source: Data processed

Table on the emission of each country from the processing of the data, describe some States are still too many producing CO_2 emissions. Based on the advice of the table the results of running the data it appears that several countries to increase their efficiency should lower their industrial activities or redesign the construction industry for more environmentally friendly so its CO_2 emissions can be reduced by suggested by the results of processing the data in Table 5. The State should suppress emissions example Argentina is a country, which should reduce CO_2 emissions by 20446.10 Kilo Ton to achieve perfect environmental efficiency. Likewise, Australia, China, India and Indonesia. For the details can be explained in detail each country on this following explanation. Australia had to suppress the production of CO_2 emissions amounting to 27576.52 to achieve perfect environmental efficiency. Brazil to become

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more efficient still has a quota of CO_2 emissions amounting to 194579.78 to achieve perfect environmental efficiency. Canada to become more efficient still has a quota of CO_2 emissions amounting to 24864.64 to achieve perfect environmental efficiency. In the contrary, China should reduce the production of CO_2 emissions by 1947444.19 to achieve perfect environmental efficiency. European Union and France to be more efficient still has a production quota of CO_2 emissions amounting respectively to 234910.71 and 20081.15 to achieve perfect environmental efficiency. Also Germany to become more efficient still has a quota of CO_2 emissions amounting to 57794.05 to achieve perfect

environmental efficiency. But India must reduce the production of CO_2 emissions amounting to 131105.82 to achieve perfect environmental efficiency. Indonesia too, should reduce the production of CO_2 emissions amounting to 34374.48 to achieve perfect environmental efficiency. While, Italy, Japan, and Korea become more efficient still has a production quota of CO_2 emissions. It means they can still emit some emission to be efficient in production. It is not like United Kingdom and United States, countries like Mexico, Russian Fed, South Africa, Turkey, and Saudi Arabia should reduce the production of CO_2 emissions in certain amount to achieve perfect environmental efficiency.

Table 4 Based Input Target relating to Labor Force

Country	Labor Force (Total)		
	Rata-rata	Input Target	Selisih
Argentina	18319297.32	17450419.00	868878.32
Australia	11393802.27	10229629.00	1164173.27
Brazil	99905354.05	66515091.26	33390262.79
Canada	18628949.82	17583498.00	1045451.82
China	774161385.86	*	*
European Union	242757112.41	*	*
France	29512309.18	*	*
Germany	41770319.05	40743681.00	1026638.05
India	467935455.32	*	*
Indonesia	112805140.41	27918164.32	84886976.09
Italy	24960491.32	24731410.00	229081.32
Japan	66167136.55	66634317.00	-467180.45
Korea, Rep.	24887208.32	23806662.00	1080546.32
Mexico	49191515.45	44117855.00	5073660.45
Russian Federation	76233575.41	74660649.00	1572926.41
South Africa	18544170.32	16958748.00	1585422.32
Turkey	24773055.91	21864556.00	2908499.91
Saudi Arabia	9477030.55	7753305.00	1723725.55
United Kingdom	31786099.68	30345295.00	1440804.68
United States	156468034.36	*	*

Source: Data Management

Table 4 shows Argentina should reduce the employment of 868878.32 to achieve perfect environmental efficiency. Australia had to reduce employment by 1164173.27 to achieve perfect environmental efficiency. Brazil must reduce the employment of 33390262.79 to achieve perfect environmental efficiency. Canada should reduce employment RGI amounting 1045451.82 to achieve perfect environmental efficiency. China has attained a perfect environmental efficiency when seen from the side of labor. The European Union has reached a perfect environmental efficiency when seen from the side of labor. Frace already achieve efficiencies perfect surroundings when seen from the side of labor. Germany had to reduce employment by 1026638.05 to achieve perfect environmental efficiency. India has reached a perfect environmental efficiency when

seen from the side of labor. Indonesia reduced employment by 84886976.09 to achieve perfect environmental efficiency. Italy had to reduce employment at 229081.32 to achieve perfect environmental efficiency. Japan must increase employment amounting to 467180.45 to achieve perfect environmental efficiency. Korea Rep. should reduce the employment of 1080546.32 to achieve perfect environmental efficiency. Mexico must reduce the employment of 5073660.45 to achieve perfect environmental efficiency. Russian Fed. Should reduce the employment of 1572926.41 to achieve perfect environmental efficiency. South Africa had to reduce employment by 1585422.32 to achieve perfect environmental efficiency. Turkey should reduce employment by 2908499.91 to achieve perfect

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environmental efficiency. Saudi Arabia should reduce the employment of 1723725.55 to achieve perfect environmental efficiency. United Kingdom should reduce the employment of 1440804.68 to achieve perfect

environmental efficiency. United States has reached a perfect environmental efficiency when seen from the side of labor.

Table 5. The amount of energy use G20 countries Based Input Target

Country	Energy Use (kt of oil eq.)		
	Rata-rata	Input Target	Selisih
Argentina	75578.39	67303.00	8275.39
Australia	122077.20	112696.00	9381.20
Brazil	246731.85	210042.00	36689.85
Canada	259644.59	267619.00	-7974.41
China	2272391.22	1639854.00	632537.22
European Union	1726008.01	1783907.00	-57898.99
France	259907.89	269777.00	-9869.11
Germany	323811.70	340676.00	-16864.30
India	659484.00	519165.00	140319.00
Indonesia	196236.53	152402.44	43834.09
Italy	171659.73	181990.00	-10330.27
Japan	488008.93	522488.00	-34479.07
Korea, Rep.	237074.50	208284.00	28790.50
Mexico	179344.11	159324.00	20020.11
Russian Federation	688334.11	647392.00	40942.11
South Africa	138103.35	128722.00	9381.35
Turkey	101518.50	80858.00	20660.50
Saudi Arabia	169741.34	143706.00	26035.34
United Kingdom	203878.16	221558.00	-17679.84
United States	2231815.20	2307819.00	-76003.80

Source: Data processed

From the table of energy use appears once that almost all countries in the G20 inefficient in its use of energy, better use of excess energy (negative sign) and the shortage of energy use (a positive sign). For the excess should reduce the use of energy, while the shortage of energy use must increase its energy for industry and households. Argentina must reduce energy use by 8275.39 to achieve perfect environmental efficiency. Australia must reduce energy use by 9381.20 to achieve perfect environmental efficiency. Brazil must reduce energy use by 36689.85 to achieve perfect environmental efficiency. Canada must increase energy use by 7974.41 to achieve perfect environmental efficiency. China must reduce energy use by 632537.22 to achieve perfect environmental efficiency. The European Union must increase energy use efficiency of 57898.99 to achieve perfect environment. France must increase energy use by 9869.11 to achieve perfect environmental efficiency. Germany should increase the use of energy of 16864.30 to achieve efficiency perfect environment. India must reduce energy use by 140319.00 to achieve perfect environmental efficiency. Indonesia should reduce energy use by 43 834 to achieve environmental efficiency perfect. Italy must increase energy use efficiency of 10330.27 to achieve

perfect environment. Japan must increase energy use efficiency of 34479.07 to achieve perfect environment. Korea Rep. must reduce energy use by 28790.50 to achieve perfect environmental efficiency. Mexico must reduce energy use by 20020.11 to achieve efficiency perfect environment. Russian Fed. must reduce energy use by 40942.11 to achieve perfect environmental efficiency. South Africa must reduce energy use by 9381.35 to achieve efficiency perfect environment. Turkey must reduce energy use by 20660.50 to achieve perfect environmental efficiency. Saudi Arabia must reduce energy use by 26035.34 to achieve perfect environmental efficiency. United Kingdom should increase energy use efficiency of 17679.84 to achieve perfect environment. United States must increase energy use efficiency of 76003.80 to achieve perfect environment.

From the table 6 it appears that the stock traded input target is not at all to bring up the numbers of each State. This means that additional input or reduction suggested for each country is not required. This would suggest that each G-20 member countries has reached almost perfect environmental efficiency when seen from the data stock traded each country.

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Table 6. Input Targets Related to Stock Traded

Country	Stock Traded (Current US$)		
	Rata-rata	Input Target	Selisih
Argentina	22513054734.93	*	*
Australia	984393205925.18	*	*
Brazil	629577397410.25	*	*
Canada	1289843972193.20	*	*
China	5432055507584.39	*	*
European Union	12652220554102.20	*	*
France	1825332706196.77	*	*
Germany	1877493577284.91	*	*
India	768213775783.93	*	*
Indonesia	94299907949.70	*	*
Italy	957227428973.16	*	*
Japan	4629369779060.55	*	*
Korea, Rep.	1526703908889.64	*	*
Mexico	95174125232.43	*	*
Russian Federation	659755160700.34	*	*
South Africa	321687900656.59	*	*
Turkey	299240026902.80	*	*
Saudi Arabia	581315262087.25	*	*
United Kingdom	4194263430060.00	*	*
United States	32714420545984.40	*	*

Source: Data processed

Ideally this is so that the environment is not being subjected increasingly impact of stock trading in which was a reflection of the increasingly good financial performance or the production of each of the company. Ideal production performance should give no harmful impact on the environment.

CONCLUSION

Based on the results of research and discussion in the previous chapter, it can be concluded in some sentences. This research shows that the policy of the Kyoto Protocol been successful in carrying out its role as controller of the growth in emissions in developed countries and growing, especially G20 members. Some of which are South Africa, and the UK Argentina, China, Brazil, Canada, European Union, France, Germany, India, Indonesia, Japan, South Korea, Russia, Besides, there are also countries that suffered losses in the level of environmental efficiency if not implement the Kyoto Protocol. But on the other side of some countries are not affected if there is no Kyoto Protocol, for example Italy, Mexico, Saudi Arabia, Australia and America. Efficiency is not the only primary standard to make a country become a standard for other countries, on the other hand the performance quality of the environment should also be considered. One country may succeed in reducing the environmental inefficiency by ratifying the Kyoto Protocol, and it has the efficient performance in

relation to environmental quality and sustainable productive based on Malmquist index. Based on the criteria of the target input and target output, it can be seen that the member countries of G20 reach the optimal level when viewed from the variable GDP (positive output) and shares traded or stock traded (input) eg Argentina, Australia, Brazil, Canada and Indonesia. However, they are not optimal when viewed through the use of energy (input target), emissions (output targets), and labor (input target).

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