Reverse Tullip Education

Do population and economic growth really effects pollution?

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Graphical Abstract
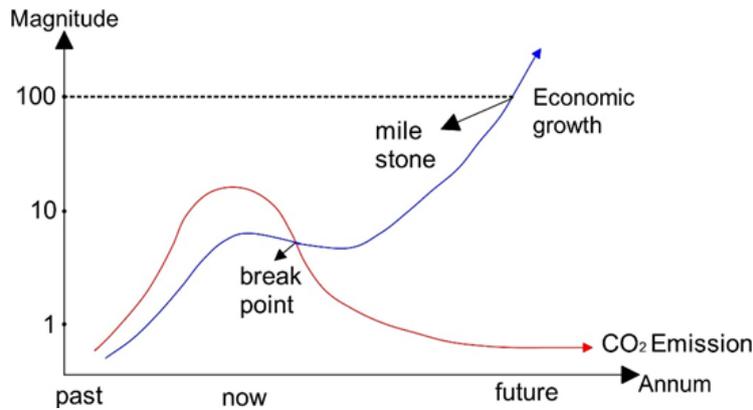
Abstract

Sustainable development, protection of environment, struggling against starvation and poverty, inhibition of terrorism and anarchy, and efficient supply of energy are the main topics of modern world and society as declared in United Nations General Assembly for multiple times. And these political discussions are generally based on developmental conditions of countries, cultures and religions in historic perspective and protection of possible environmental disasters. Generally, population and economic growth have been mentioned together with accumulation of wastes. The basic variables and indexes are Gross Domestic Products (GDP) is a purchasing power parities and CO2 emission values. The two variables are correlated to forecast the future trends. In this study, a broad perspective has been tried to be constructed in the politics of renewable energy resources by linking the economy, ecology and energy terms which are called 3 E's in literature. Sometimes instead of energy, equity is used. A connection was supplied from the most general ones to least specials by warp and weft style. Here, starting from sustainability, socio-scientific issues, production, wastes, ecology, sociology, energy are connected and interrelated in holistic manner by considering economy and industy. By this way, new insights can be obtained and deduced for better inhabitable world peacefully.

Keywords:Economy; Emissions, Energy, Environment

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Social Scientific Centered Issues Journal 2019; 1(2):43-51
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INTRODUCTION

Environment, energy and economy; 3 E's

Environment, energy and economy are three interacting terms along with society to reach sustainability. These are called 3 E's of sustainability (Mangla et al., 2020) . Environment is sometimes called nature and surroundings to identification of its importance. Both non-living and living things are continuous interaction with each other. The flora and fauna i.e. plants and animals along with intimate objects forms the environment. Energy is also a broad term that it can be defined as autonomous power. Economy sometimes takes the prime importance. The interaction of these broad subject has been shown as interacting circles. Sometimes the fourth cycle resembling the society can be added to these threes to reach sustainable development. Sustainable development is a state of endurance without harming future generations. In this instance, the recycling should be added to discussion (Nousheen et al., 2019). Because without considering the recycling process, the environmental pollution become the major issue and outburst the other topics. Recycling is also a broad term and comes as third after the 'do not consume' and 'consume less' stages. Today, economic development is not evenly distributed across the World (Şeker & Aydınlı, 2016). Moreover, the gap between the top rich and lowest poor become broadened. Now top riches earn 50 times more than the lowest ones. Also, north hemisphere consumes overwhelmingly more than south one. This does not seem sustainable if we do not find new living and production style.

The increase in population and consumption which triggers high production is another fundamental issue. And generally, the criteria for this economic labels. The need of society and protection of environment comes later. The technological development also fosters the production. At this point, the recycling process and environmental protection again take reconsideration. Today, environmental pollution reaches interstellar dimension (Sammarco et al., 2017) . The wastes accumulated during production and consumption have been tried to launched to space. If they come back, what type of disaster they will lead is unknown. There are various types of wastes. In broad sense, they can be industrial and home based. In other classification, they can be solid, liquid gas wastes. In other dimensions, they can be radioactive and nonradioactive. Also they can metallic, ceramic, polymeric and organic.

The intensive consumption to natural resources (coal, oil and natural gas) is expected of grow on a yearly rate that 1.6 % in the after two decades (Liu et al., 2014). Concedes petroleum fuel sources as a valued supply in finite natural energy, its present depletion rate is whence in volume higher from its corresponding replenish cycle. The huge use to petroleum fuel sources rises the releases of damaging pollutants (as nitrogen oxides, sulfur dioxide and carbon dioxide), leading a chain of environmental problems (Kalogirou 2004). Carbon dioxide, as a powerful greenhouse gas emitted into the thermosphere at combustion of oil sources, contributes in global warming [Serrano-Ruiz and Dumesic 2011).

Despite a species of environmental issues resultant on the use for petroleum fuel sources, petroleum-derived liquid hydrocarbons still acted as the more attractive and doable transportation fuels, where they include gasoline and airplane fuel (Zhou et all 2011). For instance, 7 billion drums on petroleum fuel The United States in 2010; where 71% of petroleum fuel (5.2 billion drums) went throughout meeting the combined request for gasoline, oil, and diesel fuel (Bond et all. 2014). On this context, petroleum sources will be expended worldwide after 21. century without considering the predictable growing for consumption to petroleum fuels.

The energy and matter

The concept of energy is not only difficult to understand but also is secret which arises from perception differences of its potentials to do work which can be observed and its interpretation and symbolization on paper. The challenging thermodynamic laws of zeroth, first, second and third make the situation more cumbersome. The bodies more than one connected to each other assume the equal temperature that compromises the zeroth low which underestimates the variable of time. The first law declares the conservation energy i.e., energy cannot be created or destroyed but it transforms into another forms that it is fully contradictory to the energy deficiency in post-cosmopolitan modern World. The second law can be considered as the key which can explain the execution of work and depletion of energy under the concepts probability, entropy and Gibbs free energy. It explains the universe from the most heterogeneous to the most homogenous one. Of course border conditions and times i.e., the very initial and end points are invalid in our explanations.

The third law may be perceived the simplest one but which is also powerful in explanation of the driving force in universe again which is very similar to second law in context with changing from the most ordered phase in lowest temperature to the most disordered phase at probable highest temperature which is guessed to be 4 K. The aforementioned discussions are valid if the universe is really isolated systems. If all the things are resumed it implies that universe itself recycled and renewed in total because lots of sample cycles are occurring before our eyes. In this perspective, science perception of universe must be reconsolidated.

The material is a dantela screen over the energetic world. All the materials have its complementary electromagnetic wave. According to De Broglie as the materials goes to nulls, accompanying wavelength of the wave goes to infinity (Wesson and Overduin 2015). If the material is somehow constant in the universe then what lessens in it.

Wastes of any natural and synthetic is very broad subject due to entanglement of human into nature its management become complicated. There are lots of definitions and differentiation in broad title such as 1-reduce, re-use and recycle 2-hazardous and non-hazardous, 3- inorganic and organic, 4- municipal 5- solid, liquid and gas, 6- pure and mixture etc… in the perspective of physicochemical nature of waste management. Each of these can be title of many books and have their handling logic and processing technology which converges into sustainable energy supply without harming environment.

Economy Based on Wastes

Today, human being is called Homo Economicus. Money is main object in people's opinion first of all. Perception of person can be affected with profit at decision phase. With increased educational knowledge, financial investments change to social investments. The definitions of social investments are aimed to release emissions lower for global warming and pollutions down (Russ 2016) . So, environmentally educated investors are headed to markets that are based on carbon and natural factors something like weather, rain…

By the deficiency of environmental knowledge, administrations must take cautions to prevent the pollution and global warming. These cautions are named as Environment regulations in law terminology (Sharon 2018). Environment law regulations are composed to track pattern to decrease pollution. Proposals about the revising process from various protocols to up to date are highlighted the insufficient applications as noticed.

By the definition of environmental law regulations, the changed opinion by environmental education and the induced profit perception with efficient carbon markets, individuals will change their behavior. They become more protective and careful to stabilize the nature conditions. Their all behaviors include careful use of natural sources. These actions retrieval the environment and reduce the effects of global warming and pollutions.

Environment consciousness is low in all over the world, so mayors and individuals overlook to be harmed the nature. Last word is that common actions can make big difference to save the planet. Consciousness of environment must be set into people's mind to keep the harm minimum to nature. By education effect, velocity of nature conditions change can be decrease, otherwise conditions like weather temperature, sea temperature or weather pollution will become worse. Education can bring in environment literacy ability to individuals (Xu 2019) . This ability generates environment literalists who bear wellness of nature in their minds. They focus nature in behavior. For example; an investor has an environment literalist ability whose financial decisions are firstly headed to social investment. Education make the generations more sensible to nature.

Global warming affects the financial applications due to increased carbon emission which leads concept of carbon finance. The aim of carbon finance is to transfer the pollution components into profit along with reaching the sustainable environment.

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This is the duty of ecological citizens. By environmental education the people gain environmental literacy ability. They exist a life style form in conscious of nature. Then the society which becomes of these people harms minimal damage to the nature by using renewable energy sources. So: contribution for curing the earth is done. Predicted lower limits aimed that firms, citizens and administrations must be obeyed under the framework of environmental law, decelerates the environmental corruption and minimize the pollutions effect. Definition of ecological citizenship on the environmental law provides that to be settled down of public consciousness (Asilsoy and Oktay 2018). To provide this obligation, increasing of ecological citizenship level has to be achieved by individuals in public.

METHOD and METHODOLOGY

In brief, the frontier of this subject points that there is no enough existing environmental system in compounded with education, law regulation or finance yet in World. So, it concludes that being theoretical idea transforms into practice.

Here; the relationship between GDP, CO_2 emission and population is investigated and the cause of increasing CO_2 emission can be modeled and forecasted. Firstly we have to introduce these terms; Gross Domestic Products (GDP): This is the accumulation of consumption, investment, government spending, import-export values of the year. It is obvious that GDP is occurred by investors, consumers and government so includes everyone in a country. It consumes the goods and services which are produced in country. The final product is based for valuing this term. At this work we used the GDP (purchasing power parities) of OECD Countries for modeling Emission Values.

CO_2 emission; (tones CO_2) these values are based from International Energy Agency (2011 edition handbook) (https 1, 2011) is evaluated by assumption of Fuel Combustion data.

Emission per capita is determined with total emission proportioned with OECD countries populations (https 2. 2019). This gives the released CO_2 tones for one person.

RESULTS

Correlation of economy and emission

The idea is that GDP affects CO_2 emissions to move upward. The figure 1 shows that GDP and Emissions moves together and aims to air pollution are increased by industrializationed of country or global. To analysis the relationship between them; needs to determine statistical structures of parameters, in a word moments. Especially third and fourth moments of these distributions are needs to be identified. Hence first and second moment mean and variance does not illuminate the bound between them. Third and fourth moments are skewness and kurtosis explains the similarity between distributions.

Skewness values of distributions are positive that shows curves of distributions headed to right side. The distributions of GDP and CO_2 emissions are not normally distributed. So: warped right side of distribution means that parameter values are increasing and includes of deterministic trend which have a positive slope.

Kurtosis values of distributions are under limit value 'three' that shows the distributions spread tightly around mean. The distribution looks like a uniform structure. That's why the quantify of observation for analysis is 20, instead of this is not preferred under 30.

So the brief of statistical structure of GDP and Emission parameters; these variables are closely similar and carry same impact on them (Table 1). This similarity gives a chance us to prove the main idea that developed economy make the nature be polluted and defiled.

The table of backward shows the chosen moments and Jarque-Bera Test which is normality test. Test values establish the visual inference that can be seen in Figure 1.
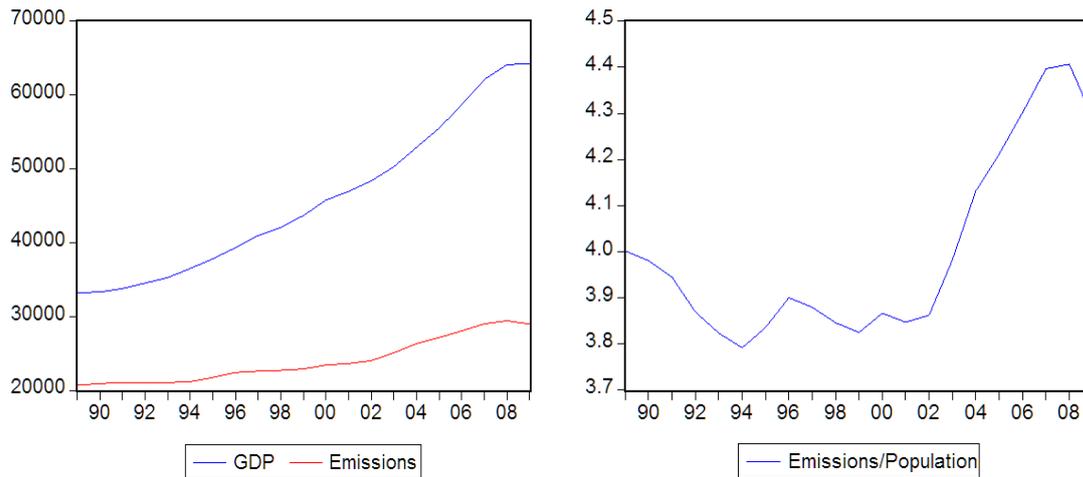
Figure 1. GDP (purchasing power parities), CO2 Emission (released tonnes CO2 per year) and Emission per capita (proportion of emission with population) time series

If there is such similarity, can GDP parameter be used to explain Emission or pollution factor? Can we model pollution or waste accumulation with economic growth? These questions are more important than answer, and the answers include just the results but the questions contain the salvation of nature. By the way, the correlation between these parameters should be checked. The correlation term means the behavior of variables in time series form is similar. Pearson correlation matrice between GDP and Emission is listed in Table 2.

Table 1. Statistical properties of GDP and Emission series

	GDP	**Emission**
Skewness	0.483492	0.659353
Kurtosis	1.957674	2.006985
Jarque-Bera	1.768812	2.384434
Probability	0.412959	0.303548
Observations	21	21

Table 2. Correlation Matrice of GDP with Emission

	GDP	Emission
GDP	1.000000	0.991750
Emission	0.991750	1.000000

The correlation value shows that these parameter acts more common. This is so high value and one of their lagged value time serie can be used to explain other one. The behavior of these series is nearly matched and can be accepted as similar. Emission can be modeled 0.991750 percent by GDP. The result of this similarity can be brief as the economic growth can explain the pollution. At the hand, we can model or forecast pollution by using economic parameters. This is horrible to remind that the Money defiles to reshape the nature until worst.

At the beginning, in visual analysis, we suspect that these variables carries the same effect on them. This situation is called cointegration. Cointagrated series are highly correlated and their behaviour is similar. This effect can be interpreted as there is a deterministic or stochastick (random) trend by the time. Under same effect variables can react as common. The reaction can be tricky to cheat us they are obviously explain each other at excellent level. To prove obligation of cointegration effect; Maximum Eigenvalue and Trace tests should be used. These tests let us to determine if similarity between variables can be observed after removing trend effect and memory element. At visual evaluation phase we realized that variables contains trend on their time values which are not randomly but also contains in a short memory perception.

By removing this trend effect, the real behavior of variables can be generated. Table 3 shows the results of Trace and Maximum Eigenvalue tests.

Table 3. Cointegration Test Results

Trace Test				
Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**Critical Value**	**Probability**
None	0.482162	21.02171	18.39771	0.0210
At most 1	0.361295	8.517945	3.841466	0.0035
Maximum Eigenvalue Test				
Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**Critical Value**	**Probability**
None	0.482162	12.50376	17.14769	0.2091
At most 1	0.361295	8.517945	3.841466	0.0035

Table 4. Granger Causality Test Results

Granger Causality Tests		
Null Hypothesis:	**F-Statistic**	**Probability**
Emission does not Granger Cause DPG	4.44934	0.06352
DPG does not Granger Cause Emission	1.36375	0.37092

Trace Test and Maximum Eigen value test results shows there is a cointegration between GDP and Emission by concluding if they have an intercept and quadratic trend which affects their value. The result can be explained by the null hypothesis of test are same as they have no cointegration under these circumstances. Comparing the test result can be obtained by probabilities (Table 3.) which are lower than 0.05 the confidence interval. So there at least one connection and solidarity between these parameters by sending away trend effect.

Proving that there is strong and unbiased relationship between variables is achieved. The other question is which of variables causes the other one make change. At the beginning, we consider that GDP direct Emission. Basic logic of human mind let us think first industrialized growth causes the accelerating of consumption and savings. In financial literacy, saving means construction and activates more factories. Factory can be counted as a pollution factor in the front line. That's why increased GDP generates more waste and emissions. So, we have to decide our logic idea is true or not How our perceptions are twisted by green lovers like Greenpeace. Granger causality test proves that which variable affect the other to move along by time.

Causality Test results points if confidence interval bring up to 10% that Emission does not cause DPG hypothesis can be accepted (Table 4). This means Emissions does not affect the DPG. Other "DPG does not cause Emission" hypothesis should not be accepted. In brief; DPG may help the nature be polluted. The other viewpoint is that emission cannot make the DPG increase or decrease. (Maybe decreasing can occur by the health bill goes longer.). Other important point is there are used 5 lagged variables to prove the situation. This means Pollution at the time t can be generated by DPG at the time t-5. Lagged DPG can react the pollution.

Hence; we achieve to get relationship between pollution and economic factors DPG, there is not any working model have been built. Until this step we gather some information about these variables. There are:

• Emission and DPG distributions are similar
• Emission can be explained with satisfied by DPG.
• Emission and DPG are highly correlated variables. This correlation does not belie, because of cointegration of series.

At last step; we could model positing Pollution factor as Emission by using DPG. The linear model is established to forecast pollution can be seen in Table 5.

Table 5. Linear modeling of integrated Emission.

Variable	Coefficient	Standart Error	t-Statistic	Probability
I(1)DPG	41.80923	8.260964	5.061060	0.0001
TREND	-2096043	1246308.	-1.681802	0.1109
MA(1)	0.712970	0.180428	3.951538	0.0010
Model Statistics				
R-squared	0.768005	Mean dependent var	41332285	
Adjusted R-squared	0.740712	S.D. dependent var	42761273	
S.E. of regression	21774181	Akaike info criterion	36.76783	
Sum squared residuals	8.06E+15	Schwarz criterion	36.91719	
Log likelihood	-364.6783	Durbin-Watson stat	2.140876	

The first differenced Emission (Emission Change) variable is determined by using Differenced DPG, trend element and lagged residual term in success. Using differenced Emission and DPG terms cannot be suprising. As noticed the variables have same trend effect and it must be removed. If it does not removed, there will be false regression model.

Model contains lineer and deterministic trend, this can be analysed by view. After all the original time serie have a quadratic trend, then we differenced it. Quadratic trend transforms lineer one and can be added into model. In addition Unit root test shows us differenced Emission variable stil have a trend. (Unit root test, corelograms and portmentau tests are used upto these stage, but this chapter is not about statistics!)

Determining of Differenced Emission variable, lagged residual term (MA(1)) is added to model. This shows model has a short term memory and contains events that happened one term ago. Model is accepted as satisfying one to forecast Emission Changes then Emission itself. Instead of model is accepted satisfying one, but Forecasting analysis statistics are not eligible to trust them. So this model can be used for known DGP and short time intervals. (for example to examine the one term later emission)
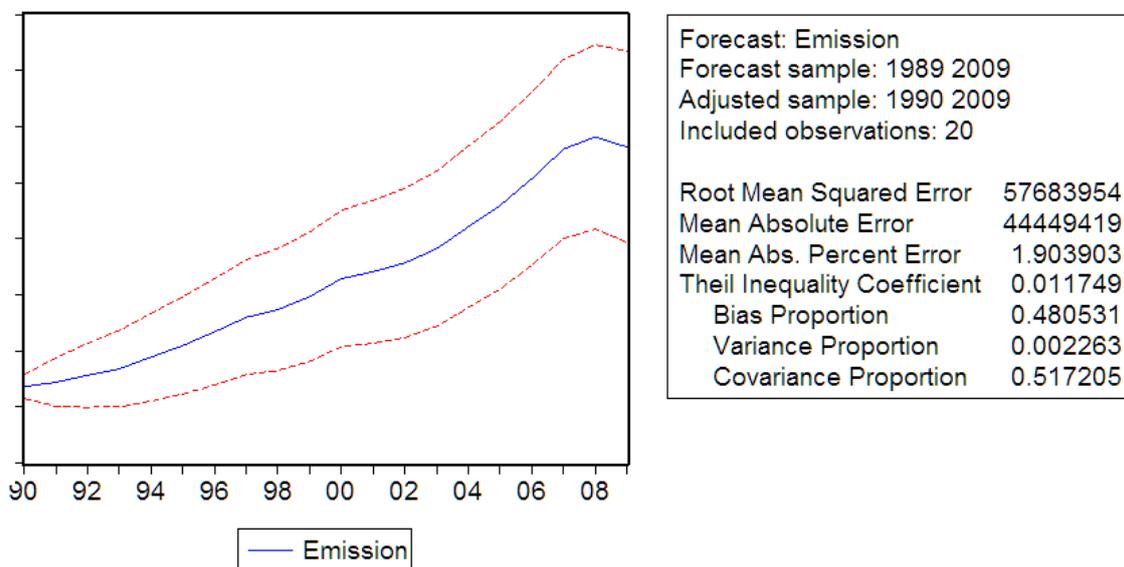
Figure 2. Forecasting of Emission serie and model forecasting statistics

Then introducing pollution by using Economic parameters, there is still important question in our minds. How does population affect the pollution? Logically it can be thought that population can be positively correlated with pollution. In brief, when population increases, pollution will increase too.

We focus into Pollution ratio for one person that can be calculated as proportion total pollution to population. This ratio can be related our first model standard deviation serie by time. The point is explaining the deviation of Emission changes by pollution per capita. To investigate it, we should use the Granger causality test. Test result can be seen in Table 6.

Table 6. Causality test results between Pollution per capita with standard deviation of pollution serie

Pairwise Granger Causality Tests		
Null Hypothesis:	**F-Statistic**	**Probability**
Population Ratio does not Granger Cause Standart Deviation	21.7307	0.00026
Standart Deviation does not Granger Cause Population Ratio	6.30653	0.02314

Granger test results show us these two hypotheses cannot be accepted. Neither population ratio does not cause standard deviation of Emission nor the reverse situation is not true. Population can not be related with pollution effect. This result is stunning, but can be acceptable. At the first, the time serie figure of pollution/population the values are nearly constant. The reason of this stability the pollution grows at the ratio of population growth. This makes the ratio nearly constant. In brief, Standard deviation of emission change is already dependent with population growth. The deviation of pollution can be explaining Pollution per capita parameter as well as possible.
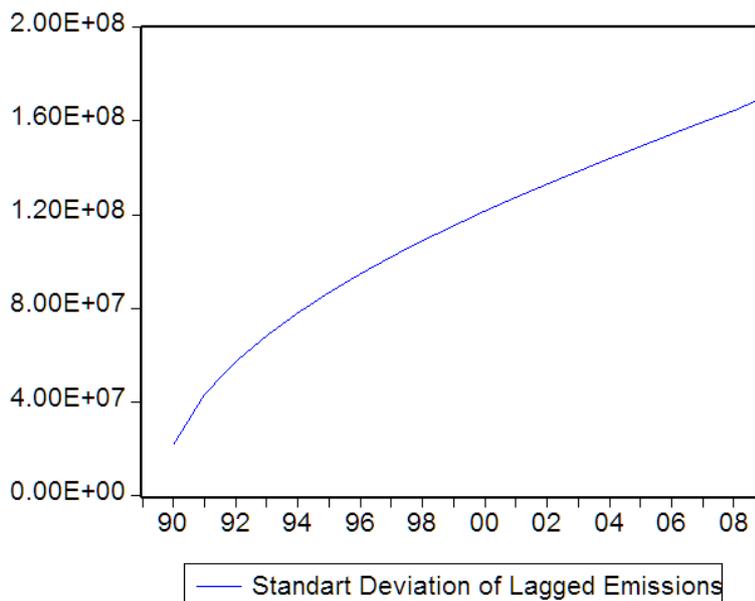
Figure 3. Standart deviation serie of Emission serie

CONCLUSION

Pollution, emission and waste concepts are only defined in multidisciplinary view. In economics; they are free products or services for now. Because there is no demand for getting them. In future these wastes will be refined and somehow get into the process. They will be evaluated to common goods. Then they will be valuing, trading, marketing, and also consuming. Until that day, wastes are accepted as trash and must be reduced to spread out of nature.

At this section, we choose CO2 Emission as a pollution agent for modeling it. Without positive or negative perception, GPD and Population variables used to explain pollution. The pollution modeling is achieved in satisfying conditions, but the forecasting pollution with this model seems not to work properly. Model is designed to work in short terms. Pollution is highly correlated with GPD and also has cointagration obligation between them.

The real problem is who is the killer? Attrition of nature gives you luxury and comfortable life style. We assume it but never calculate it before. The economy is a game that is still playing when the time start. The real monster is still us, instead of we pollute the earth. The population growth is harmless. Calculations show us; every person have same pollution ratio. The pollution is about the perception of humans. The consumption and investment affects the GDP value. We should improve our perception to decrease the consumption. It seems only way to decelerate the pollution of earth.

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REFERENCES

Asilsoy, B., & Oktay, D. (2018). Exploring environmental behaviour as the major determinant of ecological citizenship. Sustainable cities and society, 39, 765-771.

Ayesha Nousheen, Sajid Ali Yousuf Zai, Muhammad Waseem, Shafqat Ali Khan.(2019). Education for sustainable development (ESD): Effects of sustainability education on pre-service teachers' attitude towards sustainable development (SD). Journal of Cleaner Production.

Bond, J. Q., Upadhye, A. A., Olcay, H., Tompsett, G. A., Jae, J., Xing, R., ... & Foster, A. (2014). Production of renewable jet fuel range alkanes and commodity chemicals from integrated catalytic processing of biomass. Energy & Environmental Science, 7(4), 1500-1523.

Kalogirou, S. A. (2004). Solar thermal collectors and applications. Progress in energy and combustion science, 30(3), 231-295.

Liu, C., Wang, H., Karim, A. M., Sun, J., & Wang, Y. (2014). Catalytic fast pyrolysis of lignocellulosic biomass. Chemical Society Reviews, 43(22), 7594-7623.

Mangla, S. K., Luthra, S., Jakhar, S., Gandhi, S., Muduli, K., & Kumar, A. (2020). A step to clean energy-Sustainability in energy system management in an emerging economy context. Journal of Cleaner Production, 242, 118462.

Russ, M. (2016). The probable foundations of sustainabilism: Information, energy and entropy based definition of capital, Homo Sustainabiliticus and the need for a "new gold". Ecological Economics, 130, 328-338.

Sammarco, M., Tse, R., Pau, G., & Marfia, G. (2017). Using geosocial search for urban air pollution monitoring. Pervasive and Mobile Computing, 35, 15-31.

Seker, F., & Aydinli, B. (2016). The Didactic of Sustainable Development Terms in Science Education. European Journal of Social Science Education and Research, 3(2), 123-132.

Serrano-Ruiz, J. C., & Dumesic, J. A. (2011). Catalytic routes for the conversion of biomass into liquid hydrocarbon transportation fuels. Energy & Environmental Science, 4(1), 83-99.

Sharon, O., Fishman, S. N., Ruhl, J. B., Olander, L., & Roady, S. E. (2018). Ecosystem services and judge-made law: A review of legal cases in common law countries. Ecosystem services, 32, 9-21.

Xu, X., Wang, S., & Yu, Y. (2019). Consumer's intention to purchase green furniture: Do health consciousness and environmental awareness matter?. Science of The Total Environment, 135275.

URL-1 https://www.iea.org/areas-of-work/data-and-statistics/manuals

URL-2 https://www.oecd.org/turkey/

Wesson, P. S., & Overduin, J. M. (2015). Waves and causality in higher dimensions. Physics Letters B, 750, 302-305.

Zhou, C. H., Xia, X., Lin, C. X., Tong, D. S., & Beltramini, J. (2011). Catalytic conversion of lignocellulosic biomass to fine chemicals and fuels. Chemical Society Reviews, 40(11), 5588-5617.