Modeling for climate change in the aspect of nuclear energy priority: Nuclear power energy-based convergence social-humanity analysis

Tae Ho Woo *
Systemix Global Co. Ltd., 3 F, 494-48, Yonggang-dong, Mapo-Gu, Seoul, 121-876, Republic of Korea

**Corresponding author: thw_kor@hotmail.com*

1. Introduction

Following the industry expansion, the energy consumptions have increased steeply, which have produced the global warming in our lives by carbon production energies. This climate change has provoked significant natural disasters which have damaged to social as well economic matters. Considering the non-carbon production which is the major factor of global warming, nuclear energy is a newly spotlighted source as the green energy source.

It is known of several causes to climate changes where most experts say that the cause is human's carbon induced greenhouse effect [1] including the effects of carbon dioxide, chlorofluorocarbons (CFCs), and some other hazard gases. Furthermore, the causes of the earth's climate change were the natural matters like the earth's motion and orbit, volcanoes, and solar energy [2] in minor portion. In fact, the role of nuclear energy is under question in near future, it is clear that the non-carbon production energy source is attractive comparing to the other fossil fuels which have produced carbon pollutions. The energy sources in 2010 and 2050 are listed in the Table 1 [3]. Fig. 1 shows the characteristics of the convergence meaning in this study.

2. Methods and Results

In this paper, the causes of the climate change are considered as 5 reasons of Sea, Human, Orbit, Magnetic Field, and Plate Motion. Additionally, regarding the formula, assuming ocean radiates and conducts heat away from itself, into the atmosphere some average temperature, T^*, that the ocean surface maintains (approximately), in this process [4]. So, if the ocean temperature rises above T^*, and A is positive constant. Then it will cool according to Newton's Law of cooling [4, 5],

$$T' = -A\,(T - T^*) \tag{2.1}$$

Human affects climate through its role in the carbon, water cycles and such mechanisms as albedo, evapotranspiration, cloud formation, and weathering [6, 7, 8].The formulation for correlation between geometric albedo and diameter is [9],

$$R = (1{,}329 \times 10^{-M/5} / L)^2 \tag{2.2}$$

where R is the astronomical albedo, L is the diameter in kilometers, and M is the absolute magnitude. Also, summations of evaporation and plant transpiration from the Earth's surface are the evapotranspiration within the basin (W) with inputs and exports [10],

$$\Delta W = R - MF - S - G \tag{2.3}$$

The input is precipitation (R), and the exports are evapotranspiration (which is to be estimated), stream-flow (S), and groundwater recharge (G). If the changes in storage, precipitation, stream-flow, and groundwater recharge are all estimated, the missing flux, MF, can be estimated by rearranging the above equation as follows [10] :

$$MF = R - \Delta W - S - G \tag{2.4}$$

The cloud formation is analyzed by the way of saturation from air [11]. In the simulation, Orbit, Magnetic Field, and Plate Motion are done by the reasonable random sampling where the expert judgments are incorporated. The other variables as A, H, D, P, ET, Q, and D (other one) are also decided by expert's decision. The strategy of this study is that the human induced carbon gas and the nuclear priority are key issues.

Fig. 2 is the climate change factor which is composed of the explained factors in previous section. The human factor is a role of the carbon gas productions. Fig. 3 is the nuclear priority by climate change factor. The nuclear percentage is changed linearly for 6 % in 2010 to 13 % in 2050 [3]. The nuclear priority by climate change factor is simply obtained by nuclear percentage multiplied by climate change factor. Fig. 4 shows the graph for nuclear priority by climate change factor. For the case of human factor consideration in Fig. 4, the initial value is 1,211.64 in 2011 and the last value is 2,656.95 in 2050, which are dimensionless values. These values are compared each other for the meaning of designed characteristics. The nuclear priority due to the climate change increases 2.193 times in 2050. In addition, the value for 'without human factor' in Fig. 5 is 2,567.53 in 2050 and the value for 'with human factor' in Fig. 5 is 2,656.95 in 2050. The nuclear priority due to the climate change increases 1.035 times for the ratio of human factor existence over non-existence in 2050. Hence, human factor consideration is minimized in the case of nuclear energy consideration. The human considered case is higher of 3.5 % for the nuclear priority. Then, the rate can be obtained by (difference between human induced carbon and non-human induced carbon) / (non-human induced carbon). Using the data, one can find out the future temperature. It is important to find out the effect of the simulated result.

Therefore, the future temperature could be obtained with weighting of the simulations. The temperature is analyzed by the annul anomaly. This means that the temperature difference from the annul temperature is found by the amount of the annual anomaly [12]. So, if the value is positive, the temperature is higher than that of annual average temperature. Then, the graph for annual anomaly weighted by nuclear priority of climate change factor from 2011 to 2050 is in Fig. 5 which shows the graph increases in the minus values. The weighting is done with the trend line of the annual anomaly until 2010 as follows;

Temperature = (0.006 × (Year) + 12.49) + {(human induced carbon) – (non-human induced carbon)} / (non-human induced carbon) (4.1)

where 0.006 is the slope of the trend line and 12.49 is the y-intercept. So, the value is added with the difference rate of the human induced carbon. This means that the nuclear energy's effects are well done to the climate change aspect, because the increasing of temperature is reduced.

3. Conclusions

The climate change factor is affected by the carbon productions made by humans. Then, the nuclear energy increasing rate with the climate change factor affects to the temperature change which is expressed by annual anomaly. Fig. 6 is the protocol for climate change investigation incorporated with the nuclear industry where the climate factor like the temperature is an important index to find out the priority of nuclear energy. The increased environmental pollutions can give the expanding of nuclear energy due to the carbon gas of fossil fuels. This study showed the effectiveness of the nuclear energy by the simulations. The seasonal climate disaster like the very cold winter and very hot summer can increase the necessity of nuclear energy development which could appeal to the general public persons as well as the politicians. So, it is important for the nuclear energy manager to make people understand the importance of the nuclear energy comparing to the oil or coal fuels. The regeneration energy has been considered as the alternative source. However, the cost and efficiency are comparatively very lower and the industrial aspect can't take the massive productions of the energy, although the pollution productions are low in the solar, wind, and biological sources.

ACKNOWLEDGEMENTS

Author thanks to Prof. B. Ayyub in the University of Maryland for crucial ideas of this work.

REFERENCES

[1] NASA. Global climate change. http://climate.nasa.gov/causes, 2013.
[2] EPA, Causes of climate change, http://www.epa.gov/climatechange/science/causes.html, 2013.
[3] HSBC, Global Economics & Climate Change, Energy in 2050. HSBC Bank Plc, London. UK, 2011.
[4] NSF, The El Niño / Southern Oscillation. Department of Mathematics, IDEA: Internet Differential Equations Activities, http://www.idea.wsu.edu/El-Nino/.
[5] L. F. Jiji. Heat Convection, 2nd Ed., Springer-Verlag Berlin Heidelberg, Germany, 2014.
[6] D. Spracklen, et al. Boreal forests, aerosols and the impacts on clouds and climate. Philosophical Transactions of The Royal Society A: Mathematical, Physical and Engineering Sciences 366, pp. 4613-4626, 2008.
[7] B. C. Christner, C. E. Morris, C. M. Foreman, R. Cai, D. C. Sands.Ubiquity of biological ice nucleators in snowfall, Science 319 (5867), pp. 1214, 2008.
[8] W. S. David, V. Tyler. Biotic enhancement of weathering and the habitability of Earth, Nature 340, pp. 457-460, 1989.
[9] B. Dan. Conversion of Absolute Magnitude to Diameter for Minor Planets. Department of Physics & Astronomy (Stephen F. Austin State University), 2008.
[10] D. Kendall, J. J. McDonnell. Isotope Tracers in Catchment Hydrolog, Elsevier Science B.V., Amsterdam, Netherlands, 1998.
[11] M. Pidwirny, S. Jon. CHAPTER 8: Introduction to the Hydrosphere, http://www.physicalgeography.net/fundamentals/8e.html, University of British Columbia Okanagan, Canada, 2014.
[12] NOAA, Global Surface Temperature Anomalies. http://www.ncdc.noaa.gov/monitoring-references/faq/anomalies.php, 2014.

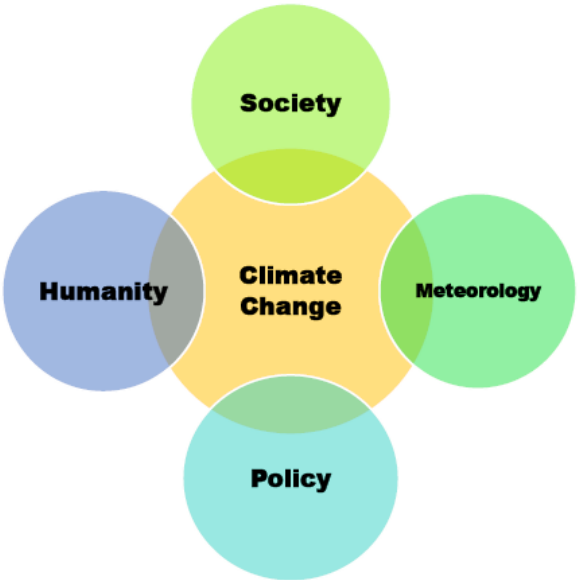
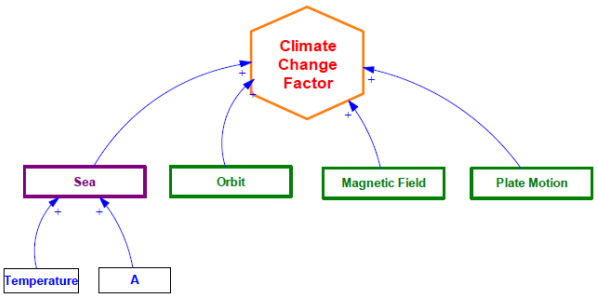
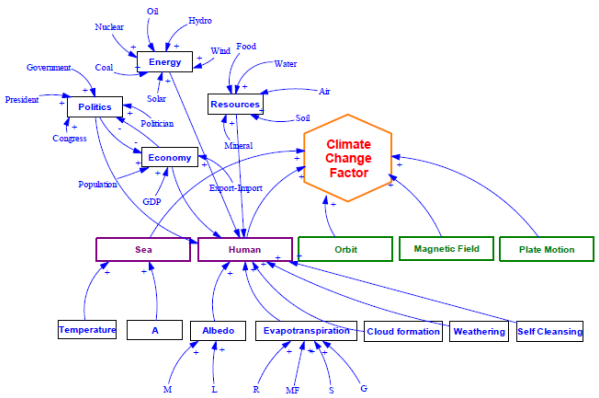


Fig. 1. Characteristics of the convergence meaning.



(a)



(b)

Fig. 2. Climate change factor (a) Without human factor, (b) With human factor.

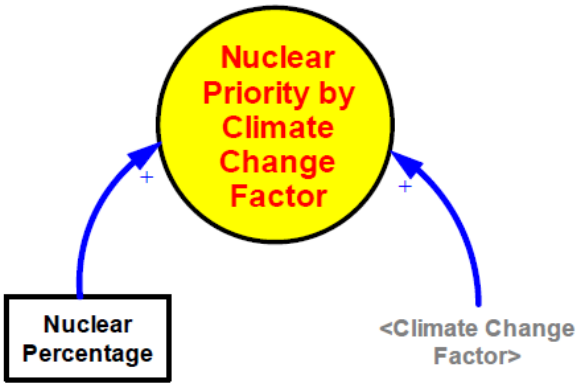
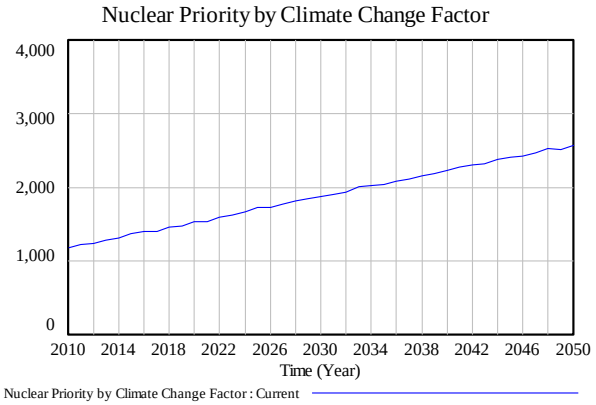
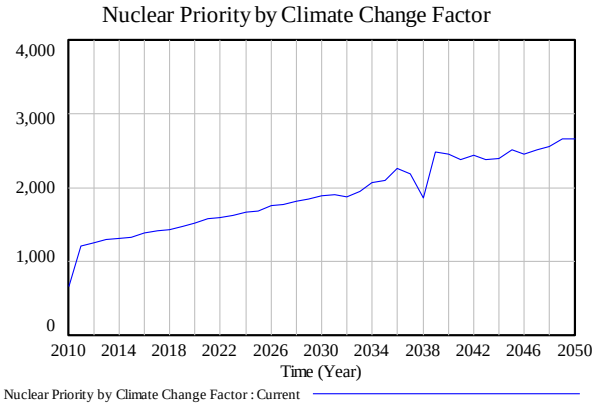


Fig. 3. Graph for nuclear priority by climate change factor.



(a)



(b)

Fig. 4. Graph for nuclear priority by climate change factor (a) Without human factor, (b) With human factor.

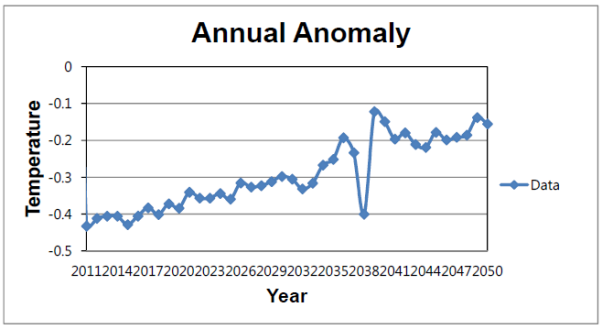


Fig. 5. Graph for annual anomaly weighted with nuclear priority by climate change factor from 2011 to 2050.

Fig. 6. Protocol for climate change factors in nuclear industry.

Table I: List of energy sources

	2010[a]	2050[b]
Coal	28	14
Oil	32	13
Gas	21	16
Nuclear	6	13
Hydro & Other Renewable	3	23
Biomass & Waste	10	21

[a, b] The unit is the percentage.