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Simulating water efficiency management at UNNES Campus, Semarang, Indonesia using EDGE application

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Abstract. Climate change is very influential in human life. Climate change has a strong correlation with water usage and its existence in the world. This research was conducted to analyze the water efficiency as an effort to modify climate change. The research area was conducted on the social cluster buildings campus of Semarang State University (UNNES), Semarang, Indonesia. The building of social clusters consists of three faculties, the Faculty of Social Science, the Faculty of Economic, the Faculty of Law. The research area was chosen due to located on the hilly preserved area. The lack of management will lead to worse conditions, and it will harm the surrounding area considering its area function. Database simulation on this research was analyzed by using the EDGE application that was initiated by the World Bank. By using the EDGE application, the project analysis is getting faster, easier, efficient, and more affordable. The result revealed that water efficiency in social cluster buildings is 0 %. This percentage was classified as a low score under the minimum percentage of water efficiency standards (20%). Based on the low-level water efficiency, this research carried out five-level simple scenarios considering the condition of building management in the social cluster of Semarang State University. Furthermore, by implementing the water efficiency scenarios, the percentage increase up to 37.86% with 19,095.02 m^3/yr of water-saving calculated by EDGE application and extra 82,250 m^3/yr calculated by manual calculation.

1. Introduction

Climate change is highly influential in human life. As a global phenomenon, climate change has spread its effect widely. As evidence, the effect of climate change, as shown by the high evaporation and precipitation rate occurrences [1]. Global warming, either as a consequence of climate change, is also increasing the ice melting that affects the sea level rise. Furthermore, the phenomena of global warming will also increase the tidal flood effect in the coastal area [2].

Numerous effects of global warming are worsened by energy exploitation. Energy resources need to be managed wisely to control their effect as well as their savings. Energy efficiency is one of the activities to save the energy itself as an attempt to protect the environment. Energy efficiency is either interpreted as the attempt of water savings activities.

Water is one of the renewable natural resources. However, the population growth following high urban growth requires high water consumption. This condition will reduce not only the quantity of water but also quality. Wasteful water behavior will cause a more unprivileged community to access clean water. There are numerous ways to save and protect the water resources, such as control the water usage in order to get the water efficiency.

Several urban areas in Indonesia give responsibility to the big buildings for conducting energy efficiency. As conducted by the Special Region of Capital City of Jakarta that explicitly being controlled by Governor Law started by 2012 [3]stated that Governor Law is not only controlling the energy problem but also managing other problems, i.e., water usage. This caused by water resource is having a high correlation to the energy usage in a building. A present of community awareness of energy is essential to growing the habits of energy-saving as well as its efficiency, particularly for the future life [4]. There are numerous ways to save energy i.e., water-saving,in terms of groundwater

extraction or waste management. As conducted by the previous research [5], the greenhouse effect is a consequence of exaggerating fossil fuel usage, conducting to the climate change, and harming water resources availability.

Universitas Negeri Semarang (UNNES) campus has never conducted a calculation of water use and savings. This condition is contradictive to the primary campus commitment as the University of (nature) Conservation [6]. This commitment was initiated due to the campus is located at the top of the hill. Moreover, it is getting worse confirming that the campus is located in the preserve area of the upper stream of the main watershed in Semarang City, namely Garang River [7], as had been stated on the Regional Regulation Number 14/2011 for Regional Spatial Planning of Semarang City. Not only contradictive to the campus commitment but also the national university green index, namely UI GreenMatrix. The UI GreenMatrix is a ranking for all the universities in Indonesia related to how the universities maintain their green environment conservation.

Some alternative savings can be conducted so that the use of water b[12]mes more efficient than before. The determination of the alternative will be carried out by the EDGE (Excellence in Design for Greater Efficiencies) method. EDGE is a certification system that proves that every building to be built applies environmentally responsible practices [8]. If the developer wants to get an EDGE certificate, the developer must have a sustainable energy-saving system. The main aspects of EDGE in developing Green Buildings include aspects of energy efficiency, water efficiency, and material efficiency in buildings. The basis for obtaining EDGE certification, building indicators must save 35% Water, Building Materials 48%, and Energy 31%.

The application of the EDGE application on the UNNES campus for water efficiency will be designed through a simulation of water use scenarios. The results of the calculation will obtain the optimal amount of water use. The EDGE application can simultaneously predict the amount of savings or water efficiency of the UNNES Campus.

This research aims to analyze the water efficiency as an attempt to modify climate change by using EDGE application. EDGE application is a well-measured system for optimizing the building construction plan to suitable to invest and more marketable. With fast and low purchasing process, EDGE is in line with the developers needs to stay in a front line in green building era.

2. Methods

The research was conducted in the social cluster of UNNE[8]ampus, Semarang City, Indonesia. Social cluster buildings are consisting of three faculties, namely Faculty of Social Science, Faculty of Law, and Faculty of Economics. The research area was chosen due to located in the hilly preserved area. The lack of management will lead to a lousy effect related to the area function. The research data was simulated by using the EDGE application that was initiated by the World Bank. The research data was taken from the actual condition of water management at the UNNES Campus. The data consisted of:

Table 1. Research Data

No	Parameters	Processing
1	Water Closet Management	EDGE
2	Building Roof Utilization	
3	Water-efficient Landscaping	
4	Grey Water Treatment	
5	Main Water Resources	Manual Calculation
6	Intensive Water User	

Data were [6]alculated by using the EDGE application. This application is an open-source application that is managed by the International Finance Corporation (IFC) as a World Bank Group organization. Furthermore, calculating another parameter out of the EDGE application, i.e., primary water resources and the most intensive water user. The primary water resources are divided into two sources, namely groundwater and rainwater, for the advance scenario. The intensive water user is defined as wudhu, and this term is not available on EDGE application due to c[9]sified as a special issue for Muslim domination campus. The processes of this research are shown in Figure 1.

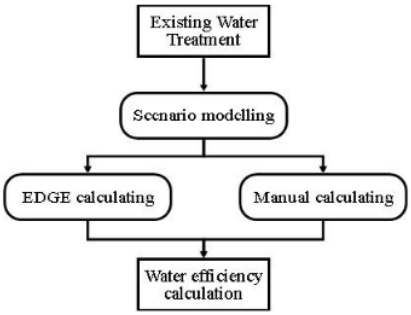

Figure 1. Flow chart research

3. Results and Discussion

Energy saving is an activity to reduce the impropriate usage of energy [9]. Energy saving in building management is divided into three parameters, namely, materials, electricity, and water efficiency. In this research, water efficiency is chosen as the main parameter that will be discussed profoundly, considering its flexibility for being managed.

The idea of energy saving is strongly connected with the topic of carbon emission. Water management is defined as the first control parameter to reduce the emission of carbon as an output of electricity utilizing [10]. This research conducted the scenario regarding the existing condition of the university building. The scenario was considered as the most applicable scenario considering the stock condition of most of the buildings in Indonesia (Table 2). The energy-saving, in terms of water efficiency in Indonesia, as well as the UNNES campus, is possibly achieved when UNNES campus can implement and promote the scenario discussed.

Table 2. Water Efficiency Scenario

Scenario	Fresh Water		Gray Water		Black Water	
	Input	Output	Input	Output	Input	Output
1st	Groundwater	Watering Tap Sink Flush	-	-	Groundwater	-
2nd	Groundwater Rain Collecting	Watering Tap Sink Flush	-	-	Groundwater	-
3rd	Groundwater Rain Collecting Water surplus	Tap Sink	Tap Sink	Watering	Tap Sink	Flush
4th	Groundwater Rain Collecting Water surplus	Tap Sink Flush	Tap Sink	Watering	Tap Sink	Flush
5th	Groundwater Rain Collecting Water surplus	Tap Sink	Tap Sink	Watering	Tap Sink	Flush

As had been shown in Table 2, freshwater was collected either from groundwater or from rain collecting. The rain collecting was conducted by reducing the wastewater from the roof using arranged fullers and pipes. This method was considered as the most suitable method for water efficiency due to the meteorological condition in Indonesia with a high rainfall rate. This method will also reduce the overland flow that decreases the land quality due to the existence of the kinetic energy, which is possibly eroding the surface soil, particularly for the UNNES Campus located in preserve hilly area. For further benefit, this scenario will lead to the "zero runoff" building concept, a concept for minimizing the total runoff. This concept in line with the national program, as mentioned by the

Ministry of Public Works, by improving the drainage system to reduce runoff [11]. The rain collecting model is shown in Figure 2.

Figure 2. the rain collecting model in UNNES campus. The model was constructed to be utilized for watering purpose.

The rainwater model showed in Figure 2 was considered a success story at the UNNES campus. It is proved when the dry season is coming, the rain that had been collected during the rainy season can be utilized for watering the garden. For this mode, the rain collecting utilization is considered only for watering due to the advance study has never been conducted before to analysis the water quality for other utilizations.

UNNES campus also conducted another rain collecting model to reduce the runoff impact [11]. The model is shown in Figure 3. Briefly, the second model showed in Figure 3 was conducted by installing the fuller in the lowest part of the roof where the water is coming down. Then the pipe was installed on the edge of the fuller to transfer the water to the culvert.

Figure 3. the rain collecting model in UNNES campus. The model was constructed to reduce the run off effect.

Another water type of gray water was collected from reused water from the sink, which not coming fromthe domestic uses. The highlighted idea that was taken from gray water utilizing was watering. Growing plants and gardens are no longer a concern due to reuse the gray water that recently using water-saving from freshwater. Another water type is black water from the toilet uses that cannot be utilized.

By implementing the water treatment scenario, water-efficient will be achieved with water-saving up to 19,095.02 m^3/year, as showed in Table 3. In addition, the water savings will be added with an extra 82,250 m^3/year as the water-saving of wudhu activity, assuming that per one person using 5 l of water for wudhu [12] [13], two times a day for 275 productive days in campus.

Table 3. Water Calculation

No	Project Name	Water Efficiency (WE)	Water Savings (WS) (m^3/Year)	Information
1	Water Efficiency	37.86%	19,095.02	Building type: education Country: Indonesia WE had reached the minimum efficiency in 20% as had been stated by EDGE. The volume of WS up to 19,095.02 m3/year equal to the total volume to live almost 400 people with their water domestic uses in a day [14].

Source: EDGE Calculation

The calculation of EDGE application obtained water efficiency percentage up to 37.86 % with the consideration of certain aspects i.e., rainwater harvesting or collecting from the roof, watering efficiency by utilizing gray water, other optimization of input, and output of gray water, and flush toilet type. The consideration of water calculation also involved the one-year total of average rainfall up to 3.257 mm/year. This one-year total of average rainfall was obtained from the default number of EDGE application by considering the research country located.

The percentage of water efficiency that had been obtained in this study is one of the basic requirements in conducting the green building certification [15]. Based on the total percentage of the water efficiency through the treatment observation and data processing using the EDGE application, the results for about 37.86% indicate that UNNES campus has met the water-saving standardization determined by the EDGE application system.

The efforts to improve water efficiency are closely related to energy savings [9]. Every day humans use energy, and most do not realize that they had spent much energy. The examples related to water energy are reckless behavior of water or water-saving attitude. The water savings will ease the pressure on nature both because of groundwater extraction and from the wastewater. According to the theory [16], the greenhouse effect that is caused by excessive use of fossil energy can affect climate change, which also has an impact on the water availability on the Earth.

Energy efficiency is also related to energy conservation. According to Government Regulation No. 70 of 2009, Energy Conservation referred to energy conservation in a systematic, planned, and integrated effort to conserve domestic energy resources and increase the efficiency of their utilization [17].

4. Conclusions

By using the EDGE application, the research obtained a total of water efficiency up to 37.86 %. By the percentage, total water saving is up to 19,095 m3/year accumulated with additional water saving up to 82,250 m3/year. This efficiency was obtained by implementing the water efficiency scenario of rain collecting and optimizing the gray water scenario.

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References

[1] Mizyed N. 2008. Impacts of Climate Change on Water Resources Availability and Agricultural Water Demand in the West Bank dalam jurnal Water Resour Manage. Springerscience Vol 23, 31 Oktober.

[2] Numberi, F. 2009. Climate Change and Its Implications for Life on the Sea, Coastal and Small Islands (in Bahasa: Perubahan Iklim dan Implikasinya Terhadap Kehidupan di Laut, Pesisir, dan pulau – pulau kecil). Fortuna, Jakarta.

[3] Governor Law of Special Region Capital City of Jakarta Number 38 2012 on Green Bulding, News of Special Region Capital City of Jakarta 2012 Number 38 (in Bahasa: Peraturan Gubernur Daerah Khusus Ibukota Jakarta Nomor 38 Tahun 2012 tentang Bagungan Gedung Hijau, Berita Daerah Khusus Ibukota Jakarta Tahun 2012 Nomor 38)

[4] Madonna S. 2014. Efisiensi Energi Melalui Penghematan Penggunaan Air (Studi Kasus: Institusi Pendidikan Tinggi Universitas Bakrie). Jurnal Teknik Sipil, Volume 12, No. 4, Apri 2014, halaman: 267-274.

[5] Maestri, M., Armaroli, N., Balzani, V., Constable, E. C., Thompson, A. M. C. 1995. Complexes of the Ruthenium (II)-2, 2': 6', 2"-terpyridine Family. Effect of Electron-Accepting and-Donating Substituents on the Photophysical and Electrochemical Properties. Inorganic Chemistry, 34(10), 2759-2767.

[6] Prihanto T. 2018. Green campus management based on conservation program in Universitas Negeri Semarang. AIP Conference Proceedings 1941(1).

[7] Setyowati, DL., Arsal, T., Hardati, P., Suroso, Prabowo, KZ. 2018. Morphoconservation Analysis on Kali Garang as a River Conservation Effort. IOP Conference Series: Earth and Environmental Science, 243(1). doi:10.1088/1755-1315/243/1/012007.

[8] Faradibha N. 2018. EDGE, Efficiency Solutions for Apartment Design and Management (in Bahasa: EDGE, Solusi Efisiensi Design dan Pengelolaan Apartemen). Accessed http://www.propertynbank.com/edge-solusi-efisiensi-design-dan-pengelolaan-apartemen/

[9] IFC. 2019. EDGE. Accessed https://app.edgebuildings.com/?_ga=2.155060280.1688338412.1563920038214535174 7.1558921924&_gac=1.58795615.1563750850.CjwKCAjwmtDpBRAQEiwAC6lm4zRBi8mXnLglO6Ln3Gm34wFx3zzJRTqsnqrCQ6Pkp43eyJUW9Tn_RoCfuoQAvD_BwE#/.

[10] Setyowati, DL., Hardati, P., Astuti, TMP., Amin, M. 2019. Awareness of Electrical Energy as Realization A Conservation in Universitas Negeri Semarang Campus. IOP Conference Series: Earth and Environmental Science, 256(1). doi:10.1088/1755-1315/256/1/012046.

[11] Ministry of Publik Work. 2019. Zero Run Off, Environmentally Insightful Drainage. Accessed http://litbang.pu.go.id/puskim/.

[12] Mohamed RMS, Adnan MN, Mohamed MA, Kassim AHBM. 2017. Conventional Water Filter (Sand and Gravel) for Ablution Water Treatment, Reuse Potential, and Its Water Savings. Journal of Sustainable Dev 9(1): 2016 DOI: 10.5539/jsd.v9n1p35.

[13] Zaied RA. 2017. Water use and time analysis in ablution from taps. Applied Water Science 7(5): 2329-2336.

[14] UN. 2015. The Human Right to Waterand Sanitation. Media Brief. UN, Spain.

[15] Pamungkas AR., Sucipto TLA., Murtiono ES., Farkhan A. 2017. Implementation of Green Building for Water Conservation in UNS Hospital Based on the Edge Certification System (in Bahasa: Implementasi Green Building Konservasi Air Rumah Sakit UNS Berdasarkan Sistem

Sertifikasi Edge). Proceeding of 2nd National Seminar of Vocational Education 2017. Pusat Pengembangan Pendidikan Vokasi FKIP-UNS.

[16] Balzani, V. and Armaroli, N., 2010. Energy for a Sustainable World: from the oil age to a sun-powered future. John Wiley & Sons.

[17] Madonna Sandra. 2014. Energy Efficiency through Water Savings (Case Study: Bakrie University Higher Education Institutions) (in Bahasa: Efisiensi Energi Melalui Penghematan Penggunaan Air (Studi Kasus: Institusi Pendidikan Tinggi Universitas Bakrie)). Jurnal Teknik Sipil 12(4): 267-274.

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