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on City Planning
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THE 12TH INTERNATIONAL SYMPOSIUM ON CITY PLANNING AND ENVIRONMENTAL MANAGEMENT IN ASIAN COUNTRIES

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The 12th International Symposium on City Planning and Environmental Management in Asian Countries

PREFACE

The 12th International Symposium on City Planning and Environmental Management in Asian Countries, held on November 1 to 4, 2019, at Chung-Ang University, Seoul, Korea, is organized by the Asian Urban Research Group. This Symposium was realized through the generous support of Southeast University and The Kyushu Branch of City Planning Institute of Japan (CPIJ). I would like to especially express my gratitude to Professor Junghyung Lee, Woonyong Lee and the colleagues of Chung-Ang University, who have devoted themselves to realizing this symposium.

This International Symposium is the 12th international conference organized by The Asian Urban Research Group starting from The Monbusho International Scientific Research Program: Joint Research Grant by Japan from 1989 -1997, support by The Kyushu Branch of CPIJ from 1998 to 2006, and JSPS from 2000 to 2002. The First International Symposium on Planning Support Expert Systems was held at Ujung-Pandang, Indonesia, the 2nd International Symposium on Environmental Planning at Mokpo, Korea, the 3rd International Symposium on Compact City at Ube, Japan, the 4th International Symposium on Environment and Urban Space at Seoul, Korea, the 5th International Symposium on Urban Problems and Land use planning at Tahara, Japan, the 6th International Symposium on Urban Analysis, Environmental and Landscape Planning at Jinju, Korea, the 7th International Symposium on Compact city and Urban Structure at Fukuoka, Japan, the 8th International Symposium on Sustainable Space and Design at Tianjin, China, the 9th International Symposium on “What is Resilience in Asian Urban/Regional Communities?” at Oita, Japan and the 10th International Symposium on Livable and Sustainable Asian Cites at Makassar, Indonesia, the 11th International Symposium on Nanjing, China. The Organization Committee intends to stimulate further academic interchange among researchers in Asia through invitation of paper contributions from various countries.

The number of accepted papers for 12th Symposium increases comparing that of the last symposium. This means increasing necessity and vitalization of research activities on urban planning and environment management for Asian countries. As the main theme of the 12th International Symposium, I chose “Asian Urban Design for the Next Generation”. In recent years, urban problems have shown a trend of complexity and globalization. This phenomenon is particularly evident in rapid-growing Asia, where more and more complex urban problems have emerged. However, in the way of pursuing rapid development, we should not compromise the ability of future generations to meet their own needs. We have to build good relationship and try to solve the problems we faced together, so that achieve the sustainable development goals. Therefore, this symposium was hoped to be a platform which could provide a good chance for us to build good relationship and make contribution to the settlement of the problems.

The papers printed in the proceedings were selected by the International Program Committee through a two-stage peer review process at the abstract and full paper level, and will be presented by the authors at the Symposium. We really hope that this International Symposium and the Proceedings are fruitful not only for our participating colleagues, but also for the further development of international cooperation among practitioners and researchers over the world for urban planning and design and environmental management in Asia.

15th October, 2019

Satoshi Hagishima
Advisor of International Program Committee
Professor Emeritus, Kyushu University, Japan

Akira Ohgai
Chairman of International Program Committee
Head of Asian Urban Research Group
Executive Trustee, Vice President, Professor Emeritus,
Toyohashi University of Technology, Japan

CONTENTS

SESSION 1: URBAN RENEWAL

1. Discussion on the Selection of Update Mode and Optimization Strategy of City Renovation Based on Cost Analysis. *1*
   Long Ma, Dachang Yuan

2. The Relation Between Urban Regeneration Policy and Population Recovery in Manchester *7*
   Aya Hagihara , Shinji Ikaruga, Takeshi Kobayashi, Junhwan Song and Rei Shiraishi

3. General Old Community Renewal and Reconstruction Strategies in Stock Context -Take Xigu Area of Tianjin as an Example- *13*
   Qian Kuo, Liang Weinan and Qu Ming

4. Urbanization and Historical Background of Urban Regeneration Process in Colombo Municipal Council Area, Sri Lanka *19*
   Abeyrathne Chalitha Supun, Bea Woongkyoo

5. The Application of Participatory Mapping to Support Boundary Conflict Solving in Indonesia -Study Case : Rambah Sub Districts, Riau Province, Indonesia-Idham *25*
   Nugraha, Mardianto Manan, Puji Astuti, Arie Apriadi

SESSION 2: URBAN REGENERATION

6. Regularization of informal settlements in Mumbai: Evaluating policy outcomes and community participation *29*
   Jia Yen Lim, Haruka Ono

7. Developing and Implementing System of Landscape Plans in Japanese Local Government Areas *35*
   Suelki Kim, Takeru Sakai, Prasana Divigalpitiya, Chengkang Wang and Yifan Zhu

8. Community Regeneration: The Role of Co-operative Housing in the Urban Regeneration Process of the Historic Centre of San Salvador *41*
   Cristian Figueroa, Woongkyoo Bae

9. Study on Issues of Reorganizing Station Area from the View of Users in Local City - Focused on Areas round Ube-Shinkawa Station, Ube City - *47*
   Eriko Goh, Michio Okamatsu , Junhwan Song and Hitomi Murakami

10. Change of Land Use around Shinkansen Stations after Development *53*
    Satoya Kanefuji, Shichen Zhao and Siting Chen

SESSION 3: URBAN DEVELOPMENT

11. The Development Tendency of Shinkansen Station Areas under the Depopulation Background *59*
Siting Chen , Shichen Zhao and Sheng Dang

12. A Study on the Management and Operation of Transit-mall for Downtown Revitalization : Focused on Transit-Mall in Jungang-ro, Daegu *65*
Seunghui Lee, Junghyung Lee, and Woonyong Lee

13. Historical Urban Planning of Colonial Towns in Southeast Asia *69*
Ariel Panadero, Junichiro Asano

14. The Significance of Xishu Garden to Construction of Park City -The Case of Du Fu Thatched Cottage- *75*
Jing Xie, Xueqian Zhou, Shixian Luo and Dajiang Sun

SESSION 4: URBAN HERITAGE (1)

15. Study on the Rise and Fall Factors of Urban Agglomerations along the Grand Canal from the Perspective of Urban Multidimensionality- A Case Study of Shandong Section- *81*
Kangying Xu

16. The Use of Settlement Name as Label of Era in the Study of the Local Urban-Rural Space Change of Taiyuan Basin, China *85*
Sheng Dang ,and Shichen Zhao

17. Analysis of the Impact of Ancient City Walls on Urban Landscape Patterns by Remote Sensing *91*
Yifan Zhu , Chengkang Wang and Takeru Sakai

18. Research of Exhibition-participation Behavior Based on ULTRA-WIDEBAND Positioning System *97*
Chunyang Li ,Zao Li ,Hongting Shen and Maoshen Ye

SESSION 5: URBAN HERITAGE (2)

19. A Study on the Current State of Modern Architecture and the Actual State of Space Transformation in China - Case Study of Former Japanese Concession in Tianjin- *103*
Yichen Liu

20. Toolkits for Application of Historic Urban Landscape Approach in Yogyakarta City *107*
Danang Yulisaksono, Ikaputra and Laretna Trisnantari Adishakti

21. The Visibility Evaluation of Historic Urban Landmark Using 3D Isovist and Sequential Scene Analysis *111*
Herry Santosa, M. Satya Adhitama, Tito Haripradianto, and Adrian Widisono

22. Study on the Relevance Between the Characteristics of the Tourist Action and the Spatial Environment in Traditional Villages of Huizhou -Taking Pingshan Village in Yi County as an Example- *117*
Xiang Gao, Zao Li, Shichen Zhao

23. Business analysis and spatial organization optimization strategy research of Suzhou Pingjiang Road Historical Block based on big data analysis *123*
Hanyu Xiao, Dachang Yuan

SESSION 6: URBAN THEORY

24. Comparative Study on the External Space Perception of Traditional and Modern Commercial Districts Using Electroencephalography (EEG) Analysis *129*
Xia Sun, Zao Li, Weiyi Cui, and Xiang Gao

25. Proposed Design Guideline Based on the Urban Density of a Compact City -A Case Study of Portland City, Oregon- *135*
Reiko Sugihara, Shinji Ikaruga, Takeshi Kobayashi, Junhwan Song, Tom Armstrong, Nick Kobel, and Tyler Bump

26. Theoretical study on adaptability of “Vertical Forest city”in China from the Perspective of Sustainable Development *141*
Zheng Hong

27. From City Image to City Brand: Literature Review *147*
Andi Muhammad Yasser Hakim, Slamet Trisutomo, Ihsan and Sumbangan Baja

28. Land Value City of Makassar Based on Rent-Bid Curve *153*
Ihsan, Desi Tri Anita Sari, and Abdul Rachman Rasyid

SESSION 7: URBAN ANALYSIS (1)

29. Towards Ubiquitous Spatial Planning Through Bigdata, Text Mining and Geovisualization: The prototype new planning model in Malang City, INDONESIA *159*
Adipandang Yudono, Achmad Istamar and Aris Subagiyo

30. A Study on the Discovery of Issues to Derive Signals of Future Changes - Using Trend Analysis of Big Data - *165*
Yae Jin Jung, Hyojin Baek, Youn Taik Leem, and Sang Ho Lee

31. A Study on the Relationship with Regional Image and Place Characteristics in the Central Built-up Area *171*
Kojiro Watanabe, and Suguru Tsujioka

32. A Study on Effective Utilization Evaluation of Greenery for River Landscape -Using Semantic Segmentation Method for Extracting Landscape Elements- *177*
Rui Jiang, Takahito Yasuno, Daisaku Nishina, Masazumi Amakata, Tatsuya Sugimoto, and Kyohei Kaneko

33. Satisfaction Analysis of Urban Blocks Based on Big Data -A Case Study of HePing District in Tianjin- *183*
Junnan Gao, Dachang Yuan,Nuo Dong, and Xin Chang

SESSION 8: URBAN ANALYSIS (2)

34. Research on the Recognition and Generation Mechanism of Urban Hotspot with SNS Data *189*
Yujie Ren and Shichen Zhao

35. Research on the Vitality of Waterfront Space in the Ancient City of Suzhou based on the Analytic Hierarchy Process *195*
Xiaoyan Mi, Yingxiang Niu, Hongji Li, and Fusong Wei

36. Application of Urban Multi-source Spatiotemporal Data Fusion Analysis in Urban Planning and Urban Design *201*
Lei Deng, Xiaosu Ma, Takeru Sakai, and Prasanna Divigalpitiya

37. Introduction of ICT System to Festival Space and Its Effect throgh Demonstration Experiments at Toyohashi Oni Matsuti *207*
Naoki Nakagawa, Kazuhiro Takano, Kanta Maegawa, Takaharu Yamashita, Akihiro Mizutani, Ren Ohmura and Hiroshi Kimura

38. An Analysis of Visitors' Cafe Preferences using Flickr Geotagged Photographs - The Case of the Kiyosumi-Shirakawa Area in Tokyo, Japan- *213*
Mengying Gao, Kyunghun Min, Jiaying Shi, and Katsunori Furuya

SESSION 9: URBAN ANALYSIS (3)

39. Development of IT in Urban Planning in North Korea: From the Articles on <Chosun Architecture> *219*
Yountaik Leem

40. Determination of Ecological Habitat Location for Bajo Tribal Marine Settlement, in Bone Bay, South Sulawesi, Indonesia *225*
Syahriana Syam, Ananto Yudono, Ria Wikantari, Afifah Harisah, and Herdy Pratama Putra

41. Statistical model analyses of traffic accidents involving elementary students at intersections considering exposure factors *231*
Halimatusaadiah Sahdan, Kojiro Matsuo and Nao Sugiki

42. Evaluation of Location Opitimization Plan by Portland Compact City Model *237*
Yukino Yoshida, Shinji Ikaruga, Takeshi Kobayashi, Junhwan Song and Shichen Zhao

SESSION 10: SUPPORTING SYSTEM

43. A Method for Exploring Community Disaster Management Plan Using a Tool to Evaluate the Ability of Mutual Assistance *243*
*Kazuki Karashima and Akira Ohga*i

44. Development of Urban Micro-Simulation Model Using Open-Data *249*
Shogo Nagao, Nao Sugiki and Kojiro Matsuo

45. Examination of the Future Urban Structure Considering Population Trend and Person Trip -A Case Study of Toyota City- *255*
Shirou Tsuboi , Shinji Ikaruga and Takeshi Kobayashi

46. Study on the Concentration Urban Structure based on Wide Area Collaboration Using Expert System *261*
Shinya Miyazaki, Shinji Ikaruga and Takeshi Kobayashi

SESSION 11: URBAN ENVIRONMENT

47. Study on the Impact of Landscape Elements Allocation on Outdoor Thermal Environment in Lhasa Residential Area in Winter *267*
Lixing Chen , Yingzi Zhang

48. Study on Microclimate Measurement of Enclosure Space in Lhasa Block *275*
Shuling Xiao and Yingzi Zhang

49. Energy-driven Urban Design Based on Urban Energy Simulation *281*
Yanxia Li, Chao Wang, Sijie Zhu, Junyan Yang, and Xing Shi

50. A Residential Building Classification Method Based on Energy Consumption *287*
Lu Wang and Xing Shi

SESSION 12: URBAN TRANSFORMATION

51. The Change of Industrial and Traffic Characteristics of The Peninsulas in Japan *293*
Yiran Hao, Takeru Sakai, Prasanna Divigalpitiya and Dongki Hong

52. The Characteristic of Formation at a Village Based on Livelihood and Climate *299*
-Case Study on the Isolated Island Himeshima in Oita, Japan-
Nanami Hamada, Yuka Himeno, Ayano Sashikata

53. Development of the Campus and Ambient Surroundings during University Relocation *305*
Won Yong Jeong , Takeru Sakai, Divigalpitiya Prasanna and Dongki Hong

54. Vicissitude of Urban Underground Shopping Street and Its Influence on the Vicinity *311*
Youlu Che, and Shichen Zhao

SESSION 13: PLANNING AND MANAGEMENT

55. Incentives and Disincentives Mechanism at the Down Town City of Makassar *317*
Muhammad Ainun Fikri, Ananto Yudono, Fathur Rahim, and Abdul Rahman Rasyid

56. Architectural and Urban Design Workshop as Formal Educational and Collaborative Platform – ASEAN Dual-City Joint Workshop2017-20 *323*
Katsushi Goto, Sophanna Kim, Nam Phan Lam Nhat Hiroyuki Sasaki, Tomoaki Tanaka, and Masami Kobayashi

57. Analysis of Existing Models of Domestic Tourism-Through Train *327*
Lv Zhaowen, Liang Weinan and Qian Kuo

58. Research on the Fine Management of "Urban Village" under the Background of Smart City *333*
Weinan Liang, Qu Ming and Qian Kuo

59. Optimalization Strategy of Social Community Reinforcement by Growth Pole and Endogeneous Development Concept to Overcome Regional Disparities in Siak Regency *339*
Ade Wahyudi , Puji Astut

SESSION 14: COMMUNITY AND LIVELIHOOD

60. Analysis of Neighborhood Character and Its Vulnerability to Projected Development *345*
Masami Kobayashi, Theodore Kofman, Hiro Sasaki

61. Spatial Characteristics and Pedestrian Activities in a Fine-grained, Mixed-use Neighborhood in Tokyo: A Case Study of Onden, Shibuya 351
Hiroyuki Sasaki, Masami Kobayashi, and Asuka Mogi

62. Unlocking Opportunities Investments in Risky and Poor Urban Neighborhoods in Kinshasa: Competitive Neighborhood Livelihood Vulnerability Index for an effective urban resilience planning at East Kisenso neighborhoods 357
Chrioni Tshiswaka Tshilumba, Bae Woongkyoo

63. Verify the Influence of Age and Gender on the Effect of Virtual Window System -Relation between Virtual Window System and Brightness of the Wall Preferred - 365
Shota Murano , Mitsunori Miki , Wataru Bando and Minoru Ito

64. Carrying out Residual Space in Marginal Waterfront Settlement 371
Diana Ayudya, Mona Anggiani and Bambang Heryanto

SESSION 15: PUBLIC SPACE (1)

65. Women's Roles and Participation in Slums Housing:The Case of Dharavi, Mumbai, India 377
Hiroko Mitsui, Jia Yen Lim, Haruka Ono

66. Study on the First Wave of People's Plan Projects in Metro Manila, Philippines 383
Rei Shiraishi, Melissa Quetulio Navarra and Kenichi Tanoue

67. A Study on the Planning and Construction of Urban Fitness Space in Chinese Jiangnan Water Town Based on Public Health Promotion: A Case Study of Suzhou City 389
Xiaofang Wei, Junfeng Jiao and Ting Sun

68. Informal Space Analysis and Optimization Research in Old Communities 397
Siyao Chen

SESSION 16: PUBLIC SPACE (2)

69. Changes in the Psychological Health of the Elderly after Walking between Urban Park and Street in Winter and Spring in Matsudo City 403
Qiongying Xiang, Prita Indah Pratiwi and Katsunori Furuya

70. Optimization of Urban Street Space Design from the Perspective of Public Health 409
Ting Sun, Junfeng Jiao, Yalan Fang and Xiaofang Wei

71. Research on Urban Blind Road Design Based on the Use Needs of the Visually Impaired-- Take Shijingshan District of Beijing as an Example 415
Wentao Ma, Weinan Liang and Qu Ming

72. Ramification of Urban Park on Millennials' Physical Activities 421
Levana Salsabila, Haryo Winarso and Bagas Dwipantara Putra

SESSION 17: HEALTHY CITY

73. Study on the Impact Mechanism of Urban Parks on Residents' Mental Health Effect-Taking the Urban Parks in Chaoyang District of Beijing as An Example- 427
Bonan Fang,Shufen Wang and Chenyu Wang

74. Evaluation of Visual Connectivity between Buildings and a River 435
Daichi Yogo and Takefumi Kurose

75. Relationship Between Municipality Structures and Supply of Welfare and Medical Facilities for the Elderly in the Islands of the Seto Inland Sea 441
Sachiko Mishima, Yasuyuki Okaki , Tomohisa Hosoda and Mahito Nakazono

76.Study on Spatial Characteristics of Healthy Cities and Their Facilities for Health Promotion 447
Shinri Matsuo, Shinji Ikaruga, and Takeshi Kobayashi

77. Research on the Correlation between General Hospital Outdoor Space and User Behavior -Take First Affiliated Hospital of Anhui Medical University as an Example- 453
Weiyi Cui, Zao Li and Qingtao Li

SESSION 18: DEVELOPMENT STRATEGIES

78. The Analysis of Medical Efficiency of The Medical Mall and The Optimal Location 461
Go Higuchi, Shichen Zhao, Feifan Xu, and Yong He

79. Study of Energy Resource Development Priorities in Siak Regency, Riau Province Indonesia 467
Muhammad Ariyon, Febby Asteriani and Ryanda Prima

80.Study on Sustainability of Suburb-type Farm Stay: A Case Study of the Initiative of Yokosuka West Coast Area 473
Tomoko Ohba, Mahito Nakazono

81. Planning Process and Size of Public Utility Facilities in the Dispersed Villages of Mountainous Areas: A Case Study of Okuizumo Town, Shimane Prefecture 479
Tomohisa Hosoda, Noriyuki Mori, Sachiko Mishima, Mahito Nakazono and Akira Ushijima

82. A Study on Transition and Effective Use of Farmland in Urbanization Promotion Area in Area Divided Cities 485
Hayato Fukui, Shinji Ikaruga and Takeshi Kobayashi

Study of Energy Resource Development Priorities in Siak Regency, Riau Province Indonesia

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Abstract

Preparation of Database and Geographical Information System Electrical System Siak, Siak set Including Electrical system into isolated zones in Riau Province. Siak actually has a potential energy resource that can be utilized and developed to meet the electrical energy needs of Siak. The amount of potential energy resources in Siak require priority in the use and development of energy resources will be so developed can be utilized Effectively, efficiently, and of course sustainable.

The purpose of this study was to (1) identify potential energy resources are developed in Siak (2) Prepare the priority development of energy resources that can be developed by using Analytical Hierarchy Process Method (3) to formulate policy development of energy resources in Siak. The results of this research study is to (1) the energy resource that can be developed in Siak is palm oil, sunlight, soil, peat, petroleum, and natural gas (2) Based on the AHP the combined result of palm oil first priority then sunlight, peat, petroleum and natural gas. (3) Energy resource development policy must be environmentally sustainable Siak and to the increase of the role of community and cooperation with the business world with the rule of law.

Keywords: analytical hierarchy process; development; energy resources; priority; sustainable development

1. Introduction

Indonesia has an abundant variety of natural resources, i ncluding one of theregency in Riau Province, namely Siak Regency which has a lot of natural resources including ene rgy resources.

Based on the preliminary report on the compilation of the Siak Regency Database and Geographical Information System in 2011, Siak Regency is an isolated area of the electricity system so that the availability of electricity in Siak Regency is limited and there are still areas where electricity is not available. This event can hamper the development can slow down the economic improvement of the Siak Regency community. This problem can be solved with the availability of other energy resources found in Siak Regency which can be developed.

The purpose of this study was to (1) identify potential energy resources are developed in Siak (2) Prepare the priority development of energy resources that can be developed by using Analytical Hierarchy Process Method (3) to formulate policy development of energy resources in Siak.

2. Research Methodology

2.1 Identification of Potential Energy Resources in Siak Regency.

The identification of energy resources is carried out using a quantitative descriptive method where the collected data is calculated to obtain a new amount or value, For example, the number of infrastructure facilities, the area of oil palm plantations. The result of the analysis is explained descriptively to identify potential energy resources developed in Siak Regency.

2.2 Arrange the Priority Level of Energy Resource Dev elopment in Siak

In the stage of preparing the priority level of development of energy resources in Siak Regency, it uses descriptive quantitative-qualitative methods, include sampling activities using an analytical hierarchy process (AHP) questionnaire distributed to various agencies related to this research, and then questionnaires that have been disseminated to various agencies become inputs for this AHP analysis with using Expert Choice software, processed to obtain a value that describes the priority level of energy resources that have the potential to be developed in Siak Regency and then explained again descriptively.

The speakers acquired are experts on the utilization of natural resources and energy in an integrated system (integrated and comprehensive-macro and micro conditions) both practitioners, academics, and bureaucrats. Respondents in this study amounted to 28 people: from Development Planning Agency at Sub-National Level Siak Regency, Regional Environmental Impact Management Agency of Siak Regency, Regional Regulatory Agency of Siak Regency, Mining and Energy Office of Riau Province, Siak Regency Spatial Planning and Development office , Promotion and Investment Office of Siak Regency, Forestry and Plantation Office of Siak Regency, PT Kuantan Graha Marga, PT Holistika Primaghita, Regional Road and Irrigation Office Siak Regency, Association of young Riau entrepreneurs and Academics. The selection of respondents

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based on consideration of their level of recognition and expertise on the priority assessment of the utilization of natural resources and energy for sustainable development in Siak Regency is considered to be able to answer/solve this issue. Assessment by the respondents is based on the ability to perception, reasoning, insight, and instinct to develop siak regency that relied on their experience.

2.3 Formulate a Strategy for Developing Energy Resources in Siak

In the stage of compiling the energy development efforts or strategies in Siak Regency uses a descriptive method, guided by local government policies and then adjusts the preparation of priority levels of energy resource utilization and development in Siak Regency for sustainable development.

3. Result and Discussion.

3.1 Identification of Potential Energy Resources in Siak Regency.

Siak Regency has natural resources that can be utilized as an energy source to meet the needs of electrical energy in Saik district and accelerate development in various fields and touch the entire area in Siak Regency. Here are the potential energy resources found in Siak Regency.

1) Petroleum

Indonesia is a country rich in natural resources, one of which is petroleum. Based on data from the Directorate General of Oil and Gas, petroleum resources in Indonesia approximately 7,408.24 MMSTB consisting of proven reserves of 3,741.33 MMSTB and potential reserves of approximately 3,666.91 MMSTB. The distribution of potential petroleum reserves in Indonesia can be seen in Figure 1.

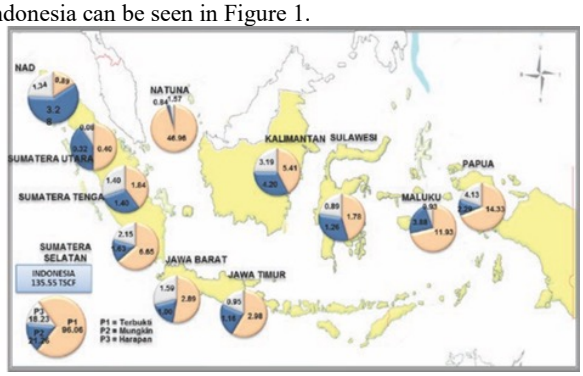

Fig.1. Petroleum Distribution Map in Indonesia

Based on figure 1, it can be seen that Indonesias most oil reserves in central Sumatra are approximately 3,685.95 MMSTB, which includes Riau province with one of the oil-producing districts of Siak Regency is located in the Minas district and Apit River.

According to the final report on the preparation of Database potentials and investment opportunities Regency/city in Riau Province in 2012, the CPP block from Indonesian Chevron Pacific was handed over to the Siak Regency government on August 8, 2002. Since that moment the CPP block is managed by PT. Bumi Siak Pusako and Pertamina Hulu with the establishment of a Joint Operation Agency (BOB).

On 31 January 2008, the Siak Regency Government established another regional owned enterprise named PT. Siak Pertambangan dan Energi. Regional owned enterprises are engaged in the drilling over services and handle the maintenance of oil wells managed by PT. Bumi Siak Pusako, with the presence of this regional owned enterprise, the potential of petroleum in Siak Regency can be more exploited by its potential.

2) Palm Oil Waste (Biomass)

In the beginning, Siak Regency was mostly forest land which has now been converted into plantation land. The potential of plantations in Siak Regency is very large, some of the leading commodities are plantation products of Siak Regency, namely oil palm, rubber, coffee, pineapple, pondoh snakefruit, sago, coconut, and cocoa.

The most potential of Siak Regency plantations is palm oil waste which utilized as an energy resource. Oil palm is a commodity that is very widely available in Siak Regency with the most production yield and the largest plantation area in Siak Regency. The potential of oil palm as an energy resource comes from the oil palm waste produced. The waste is utilized and processed into biomass and then becomes a source of energy.

Table 1. Area and Productivity of Palm Oil in Siak Regency

No	Sub-district	Area (Ha)	Productivity (kg/ha)	Production (Ton)
1	Siak	5,320.00	12,000.00	19,116.00
2	Mempura	6,158.00	14,000.00	49,266.00
3	Bunga Raya	3,927.00	15,000.00	40,530.00
4	Sungai Apit	3,594.00	16,000.00	38,032.00
5	Sabak Auh	4,028.00	15,000.00	29,850.00
6	Dayun	25,263.00	21,000.00	507,738.00
7	Tualang	22,658.70	17,000.00	317,061.90
8	Sn. Mandau	20,503.00	19,750.00	271,440.05
9	Kerinci Kanan	35,656.00	23,000.00	806,794.00
10	Kandis	82,347.00	15,000.00	918,255.00
11	Minas	41,149.00	19,000.00	697,870.00
12	Koto Gasip	13,200.00	15,000.00	197,505.00
13	Lb.Dalam	10,886.19	18,000.00	179,802.00
14	Pusako	3,873.00	14,000.00	48,412.00
	Total	278,590.39		4,121,671.95

Source: Siak in Figures, 2017

Based on table 1, the total area of oil palm land in Siak Regency is 278,590.39 Ha, the area of the peoples plantations is 210,270.19 Ha and 68,321 Ha belongs to the private company.Based on the report of the plantation statistics of Siak Year 2012 there are 19 companies in Siak Regency and can contribute to producing palm oil waste. The extent of community plantations and with the number of companies engaged in the processing of oil palm that can be processed into biomass to be converted into energy resources in Siak Regency.

3) Natural Gas

Indonesia is one country rich in natural resources that can be utilized to meet the needs of its population. One of the potential natural resources in Indonesia that can be utilized to meet energy needs is natural gas.

According to data obtained from the Directorate General of Oil and Gas in 2017, the natural gas potential in Indonesia amounted to 159.63 TSCF (Trillion standard Cubic Feet). For parts of Central Sumatra including Riau Province there are 10.57 TSCF

of natural gas reserves, in Riau Province one of the natural gas producing districts is Siak Regency which is located in Sungai Apit District, Tanjung Buton Industrial Area (KITB) Sungai Rawa Village.

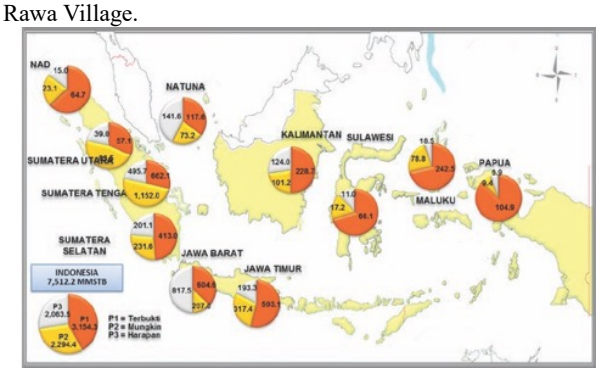

Fig.2. Indonesia Natural Gas Reserves Map

The potential of natural gas in Siak Regency can be used as an energy resource in gas-powered electric generator (PLTG), to cover electricity shortages in Siak Regency. The latest technology and innovation that can be applied in the utilization of natural gas is Fuell Cells, a highly effective and efficient technology used for the construction of power plants, because fuell cells can produce electricity without combustion reactions but use electrochemical reactions so that the emission produced is very small.

4) Peat (Biomassa)

Peat is a type of soil that comes from the remnants of plants that have been decomposed or half-decaying and contain many organic elements. Peat soil that contains many organic elements can be utilized as an alternative energy resource, it can reduce the energy crisis that occurred in Siak Regency.

The availability of the worlds peat soil is equal to 8 billion Joule impressions and the energy can be produced is equivalent to 1 million times the power of Hiroshimas nuclear bombing. Indonesia is the number 4 country that has the largest peatland in the world, which is about 17 million hectares and the most region that has peat in Indonesia is the region of Sumatra, Kalimantan and Papua. Riau Province is a province with a large enough peatland, one of them is in Siak Regency which is a vast land of the area reaches 456.091 hectares and this is a considerable potential to be utilized.

Table 2. Area of Peatland

Peat Area	GBT Area (Ha)	MDW Area (Ha)	Total
Buatan	5.070	3.358	8.428
Bukit Batu	28.513	5.083	33.596
Kandis	56.060	2.123	58.183
Merempan	7.166	6.927	14.094
Siak Kecil	51.275	19.717	70.992
Sn.Mandau	81.535	30.681	49.216
Zamrud	129.581	92.001	221.582
Total Area	296.201	159.890	456.091

Source: Siak in Figures (2017)

The area of peatland in Siak Regency is 456,091 hectares, with that vast peat area Siak Regency has considerable potential to develop peat as an energy resource to meet the needs of electricity in Siak regency.Peat soil which has large water and calorie content so that peat can be referred to as low-quality coal, and peat soil also belongs to natural resources that can be renewed because the formation process does not take a long time. Peat soils can be utilized as biomass energy resources that make use of organic materials produced by the remnants of aquatic vegetation or the terrestrials, the residue from forestry or agriculture, in this case, peat can be used to establish a peat steam power plant.

5) Sunlight

Indonesia is located between 6 ° N – 11 ° S and 95 ° E-141 ° E and passed through the equator line. Indonesias astronomical location causes Indonesia to have a tropical climate, and Indonesia will be illuminated by the sunlight with a duration of 10 to 12 hours per day or around 2000 hours per year with average solar radiation of 4.8 kWh / m^2 per day. This potential is enormous for use as an alternative energy and power generation provider in Indonesia. It is also found in Siak Regency which is located between 1 ° 1630 "N - 0 ° 20`49``N and 100 ° 5421" - 102 ° 1059 "E also gets plenty of sunlight where it can be utilized as an alternative energy resource to overcome electricity supply shortages in Siak Regency, especially in peak days.

This sunlight or commonly called solar energy can be utilized as an energy resource in the solar power electric generator (PLTS) and Solar Home System (SHS) which are minimally used to power on the household electrical appliances.

3.2 Energy Resource Development Priorities in Siak Regency

The priority of developing energy resources in Siak Regency is the main objective of this research. The method used is the Analitycal Hierarchy Process (AHP).

The formulation of the Hierarchy is divided into five levels, level 1 is the main objective, which is the priority of developing energy resources in Siak Regency, level 2 economic and environmental factors, is a factor that supports the achievement of the main objectives, level 3 is criteria from a derivation of the factors that support the achievement of objectives, namely regional benefit criteria, potential resources, procurement costs, social culture, and physical environment, level 4 is subcriteria, namely multiplier effect, regional development, local revenue, availability of energy resources, continuity of energy resources, availability of human resources, energy processing technology, investment, payback period, processing costs, and profits, and level 5 are alternatives, which is a priority choice of energy resources to be developed in Siak Regency consisting of sunlight, oil palm (biomass), Petroleum, Peat Soil and Natural Gas. For more details about the hierarchy structure and results of the Weighting of Energy Resource Development Priorities for sustainable development in Siak Regency can be seen in the figure 3.

A. Economic Factor

Economic factors are the main factors in setting priorities for developing energy resources in Siak Regency for sustainable development. Economic factors and environmental factors based on AHP data processing have a priority value of 0.5 which places first in the ranking of the two main factors in the development of energy resources.

The elements contained in economic factors, namely regional benefits have a global priority value of 0.2, the potential of energy resources has a global priority weighting of 0.2 and the

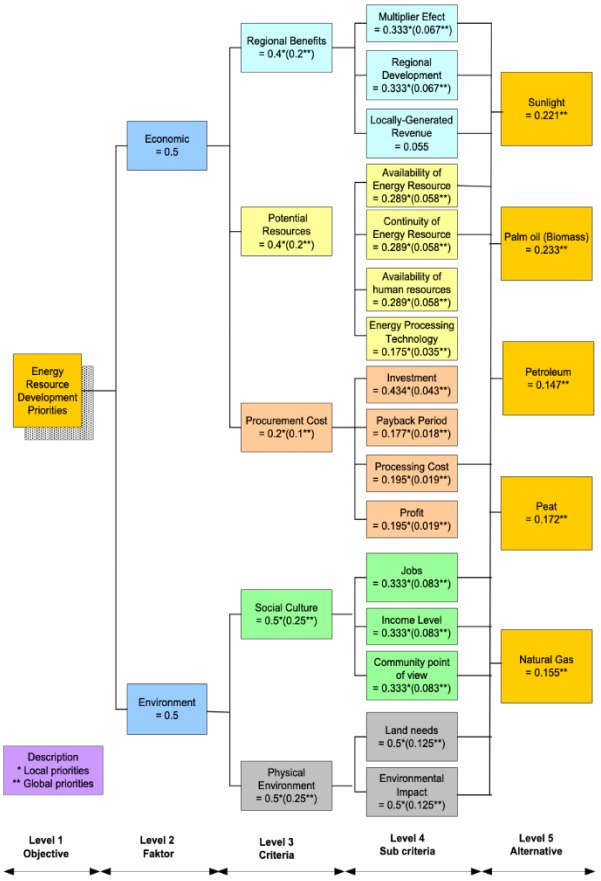

Fig.3. Energy Resource Development Priorities Based on Analytical Hierarchy Process Method

procurement cost element has a global priority value of 0.1 obtained from the multiplication operation of the local priority weights for each element with a global priority economic factor value.

a) Regional Benefits Criteria

Regional benefit criteria is an element of economic factors which has a global priority value of 0.2 illustrates that respondents provide an important assessment in filling out the questionnaire for the regional benefit criteria, because the development of energy resources in Siak Regency must have an impact that influences the progress of development and the fulfillment of energy needs sustainably for the area.

b) Resource Potential Criteria

Based on the results of the calculation, the weighting of the potential resource criteria has the highest global priority value of 0.2 which illustrates the respondents in filling out the questionnaire giving quite an important assessment on this criteria, because the existence of potential resources in an area is very important for the region or region itself, which is the basic capital for the region to develop and maintain the sustainability of these resources including energy resources that will be developed in Siak Regency, besides being beneficial for the region economically, it is necessary to maintain the sustainability of the existing potential in the Siak Regency area.

The criteria for resource potential have several sub-criteria, the availability of energy resources has a global priority value of 0.049, the sub-criteria for the availability of human resources has a value of 0.058, the continuity of energy resource sub-criteria has a value of 0.058 and the sub-criteria for energy resource processing technology has a priority value of 0.035.

c) Procurement Cost Criteria

The procurement cost criterion has the smallest global priority value of all the criteria of the economic factor. It illustrates that the procurement costs are a criterion that lacks contribution in terms of developing energy resources for sustainable development in Siak Regency.

Procurement costs have several sub-criteria, and the sub-criteria that has the highest value of 0.043 is the investment sub-criteria, this illustrates that respondents are more likely to assess investment sub-criteria, investment sub-criteria is important sub-criteria in terms of energy resource development in the Regency Siak for sustainable development. The second sub-criteria which has the highest weight is the cost that value 0.018, the profit sub-criteria has a value of 0.019 and the return period sub-criteria has a value of 0.019.

B. Environmental Factors

Environmental factors are a major component in the preparation of priorities for the development of energy resources on sustainable development in Siak Regency where is at second rank after economic factors with a global priority value of 0.5. Its represent that respondents assessed the environmental factors are quite contributory component for the development of energy resources, which factors that must be maintained for the sake of construction sustainable and natural stability in Siak Regency.

a) Socio Cultural Criteria

Based on the calculation results, the socio-cultural sub-criteria have the same value as the physical environment sub-criteria, which both are elements of environmental factors. The similarity value of global priority between these two represented that respondents assessed both sub-criteria are equally important in developing energy resources for construction sustainability in Siak Regency which also considers the ecological existence and prosperity of the people.

Meanwhile, the socio-cultural criteria have three sub-criteria, where they have same value that important for sustainable development in Siak Regency. The availability of jobs, increasing income for the community and community support is very important and can improve the prosperity of the people along with the development of energy resources in Siak Regency.

The value of priority for sub-criteria of availability of jobs is 0.083, sub-criteria of income level is 0.083, and sub-criteria for community assessment is 0.083.

b) Physical Environmental Criteria

Based on the results of assessment with expertcoiche software of environmental factors, the sub-criteria of the physical environment get the same value as the socio-cultural sub-criteria which represented the importance of these two sub-criteria. Besides for the prosperty of the people by fulfill the energy needs that are evenly distributed and sustainability can stretching the economy of the community,there is also maintaining environmental sustainability that must be carried out to create a balance and sustainable development in Siak Regency.

The physical environment has sub-criteria of land requirements and environmental impact, each of them has value 0.125 and both of these sub-criteria get the same important value from respondents in maintaining the sustainability of energy and development resources development in Siak Regency.

C. Priority of Utilization of Natural Resources based on AHP method

Based on the results of the questionnaire and the processing of data using the AHP method, the energy resources development priorities in Siak Regency obtained percentage results as follow: (1) Oil Palm Waste as a biomass with a percentage of 0.305 (30.5%); (2) Solar light with a percentage of 0.221 (22.1%); (3) Peat with a percentage of 0.172 (17.2%); (4) Natural Gas with a percentage of 0.155 (15.5%); and (5) Petroleum with a percentage of 0.152. (15.2%). The final result of the AHP method is a description of the aspirations from respondents who are considered realistic towards conditions and characteristics of development in Siak Regency. To support all of this, a policy needs to be made so that the development of energy resources for sustainable development in Siak Regency can be directed.

3.3 Energy Resource Development Strategy in Siak Regency

1) Strength (S)

a) The potential of energy resources in Siak Regency which is renewable and non-renewable is very large, such as petroleum, coal, biomass, peat, and sunlight.
b) Had experience and infrastructure in the process of exploiting and processing petroleum energy resources
c) The extent of agricultural land and plantations in Siak Regency is a source of biomass development.
d) Peat soil is spread in Siak Regency with a large area
e) The strategic position of the Siak Regency
f) The land area of Siak Regency is adequate in developing energy resources.

2) Weakness (W)

a. Not all energy resources can be exploited because of the varying quality and quantity
b. Inadequate infrastructure to support energy resource development
c. Declining oil and gas production
d. No benchmark that supports the process of developing energy resources from the beginning of the process to the community
e. The transportation route still inadequate
f. Low quality of human resource
g. Some energy resources can produce pollution in the processing process.

3) Opportunity (O)

a. Support from the Minister of Energy and Mineral Resources through National Energy Policy (KEN) and National Energy Management (PEN)
b. Indonesia is a potential investment land
c. Renewable energy sources can reach remote areas
d. Subregional economic cooperation
e. Open coordination of energy management at the district/city, provincial, central and ASEAN levels
f. Reduction in fuel subsidies

4) Threat (T)

a. Degradation of environmental quality
b. Land conflict with the community
c. Higher energy consumption
d. The purchasing ability of energy consumers is still low
e. Investment legal certainty is not yet clear

Based on the results of the analysis that has been carried out and based on the priority objectives of developing energy resources in Siak Regency, efforts to develop energy resources are described as follows:

1. The development of energy resources in Siak Regency is environmentally insightful and sustainable.
2. Optimization and control in the development of existing and future energy resources.
3. Development of base infrastructure that supports the development of energy resources.
4. Research and training of human resources based on the development of energy resources.
5. Compilation of a clear legal framework for developing energy resources in the Siak Regency area.
6. Technology improvements used in the development and utilization of energy resources.
7. Improved efficiency of existing fossil energy resources.
8. Increased utilization of new renewable energy sources and alternative energy
9. Development of electricity generation by using the potential of energy resources in Siak Regency.
10. Increased access and equal distribution of population services to energy.
11. Community empowerment in developing energy resources
12. The partnership of the Siak Regency government with the business sphere in the development of energy resources

4. Conclusion

The energy resource that can be developed in Siak is palm oil, sunlight, soil, peat, petroleum, and natural gas.

The priority of developing energy resources in Siak Regency based on weighting using the AHP method is(1) Oil Palm Waste as a biomass with a percentage of 0.305 (30.5%); (2) Solar light with a percentage of 0.221 (22.1%); (3) Peat with a percentage of 0.172 (17.2%); (4) Natural Gas with a percentage of 0.155 (15.5%); and (5) Petroleum with a percentage of 0.152. (15.2%).

The activity of utilizing energy resources needs to be dealt with professionally while still prioritizing economic principles so that the government and local communities can enjoy their wealth of natural resources.

Coaching and participation in the activities of utilizing energy resources need to be carried out, by looking at the uniqueness and potential of each region combined with the overall business activities.

To be able to compete in the era of globalization, regions need to learn tactical and strategic actions to be ready later as partners in the industry for developing energy resources,

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