-RESEARCH ARTICLE-

SUSTAINABLE CITIES RESEARCH AND SUSTAINABLE MANAGEMENT MODELLING: INDONESIA AND WORLD TREND

Muhammad Ikhsan Setiawan

Department of Civil Engineering, Narotama
University, Indonesia
Email: ikhsan.setiawan@narotama.ac.id
https://orcid.org/0000-0002-4601-4315

Agus Sukoco

Department of Management, Narotama
University, Indonesia
Email: agus.sukoco@narotama.ac.id
https://orcid.org/0000-0002-5339-3536

Dani Harmanto

Associate Professor of Aeronautical Engineering,
De Montfort University, UK
Email: dani.harmanto@dmu.ac.uk
https://orcid.org/0000-0001-5115-1472

─**Abstract**─

Cities are hubs for ideas, commerce, culture, science, productivity, social, human, and economic development. Urban planning, transport systems, water, sanitation, waste management, disaster risk reduction, access to information, education and capacity-building are all relevant issues to sustainable urban development. Results from this movement can be seen in the inclusion of a stand-alone goal on cities and urban development in the 2030 Agenda, Sustainable Development Goal 11, "make cities and human settlements inclusive, safe, resilient and sustainable". Based on Scopus.com database, since 2010 to 2022, article with abstract content Computational Fluid Dynamics (CFD) Simulation and sustainable cities, limited to Journal type and Article document type, detected 34 best literatures. Documents by country or territory, compare

the document counts for up to 15 countries/territories. China is the highest number publication Scopus.com in CFD and Sustainable Cities, followed by UK, Hongkong and India. There's no Indonesia paper. Documents per year by source, compare the document counts for up to 10 sources. Energy and Buildings 4 documents is the highest number journal publication Scopus.com in CFD and Sustainable Cities. Documents by funding sponsor, compare the document counts for up to 15 sources. National Natural Science Foundation of China 9 documents and Ministry of Science and Technology of the People's Republic of China 2 documents are dominant and the highest institution funding sponsor. Documents by subject area, Engineering 22 documents and Environmental Science 15 documents are dominant also the highest subject area, publication Scopus.com in CFD and Sustainable Cities, followed by Energy 13 documents, Social Sciences 11 documents. Documents by affiliations, compare the document counts for up to 15 sources. Ministry of Education China, Ecole Nationale Superieure d'Architecture de Toulouse, Southeast University, Vellore Institute of Technology, University of Leeds, University of Nottingham, Chinese Academy of Sciences, Harbin Institute of Technology, INSA Toulouse, Universite Paul Sabatier Toulouse III, University of Chinese Academy of Sciences, Université Fédérale Toulouse Midi-Pyrénées, Institut Clément Ader, and Laboratoire Matériaux et Durabilité des Constructions LMDC, all of them are 2 documents. China dominant affiliations institution publication Scopus.com in CFD and Sustainable Cities. There's no Indonesia affiliations institution. Its challenge for Indonesia researcher to pushed research and publication especially in Computational Fluid Dynamics (CFD) Simulation and sustainable cities subject.

Keywords: Indonesia, Computational Fluid Dynamics (CFD) Simulation, Sustainable Cities, Sustainable Development Goal

1. INTRODUCTION

Based on BPS, 2022, after COVID19 pandemic decline in mid-2022, Indonesia economic become faster, it can view from investment activities, in second quarter of 2022 there were 30,141 Domestic Investment Projects (DIP) realizations with an investment value of Rp 139.02 trillion. This investment was dominated by Mining Sector (10.78 percent), then followed by Food Industry Sector (10.42 percent) and Transportation, Warehouse, and Telecommunication Sector (9.30 percent). International tourists arrived via entry ports in June 2022 were 340,459 people. This total increased from the total entering during the previous month, which was 209,391 people. The increase in international tourists who entered in that month compared with the previous month occurred at 15 main ports of entry. While, compared with the total entering international tourists in June 2022 compared to May 2022, there was a increase of around 62.69 percent. The Room Occupancy Rate (ROR) of star-classified hotels in all provinces in June 2022 increased in 21 provinces compared by the previous month. The ROR in that month ranged between 26.88-66.45 percent, the highest ROR was in DI Yogyakarta. In the same month, the average length of stay by foreign guests in star-

classified hotels ranged between 1.32-3.65 days with the longest length of stay in Jawa Barat. Since January 2020, the calculation of the Consumer Price Index (CPI) has been based on a consumption pattern obtained from the 2018 Cost of Living Survey (CLS) in 90 cities, covering 248-473 commodities. Before January 2020, the calculation of the CPI and inflation rate covered 225- 462 commodities, and was based on a consumption pattern obtained from the 2012 CLS in 82 provincial capital cities. The CPI of Indonesia is a weighted composite index of the calculated CPIs in 90 cities, using the total number of households in each city as the weighting factor. But this condition impact on environmental, especially on Urban water, sanitation, waste management and sustainable urban development.

Cities are hubs for ideas, commerce, culture, science, productivity, social, human, and economic development. Urban planning, transport systems, water, sanitation, waste management, disaster risk reduction, access to information, education and capacity-building are all relevant issues to sustainable urban development. In 2008, for the first time in history, the global urban population outnumbered the rural population. This milestone marked the advent of a new 'urban millennium' and, by 2050, it is expected that two-thirds of the world population will be living in urban areas. With more than half of humankind living in cities and the number of urban residents growing by nearly 73 million every year it is estimated that urban areas account for 70 per cent of the world's gross domestic product and has therefore generated economic growth and prosperity for many. Given the importance of this topic to global development efforts, recent movements pushing to address sustainable development from an urban perspective have taken place throughout the world. Results from this movement can be seen in the inclusion of a stand-alone goal on cities and urban development in the 2030 Agenda, Sustainable Development Goal 11, "make cities and human settlements inclusive, safe, resilient and sustainable". There is also recognition of the cross-cutting nature of urban issues, which have an impact on several other Sustainable Development Goals, UN-Habitat's complementary New Urban Agenda, adopted as the outcome document from the Habitat III Conference in 2016, seeks to offer national and local guidelines on the growth and development of cities through 2036.

Computational fluid dynamics (CFD) technology is very good to analysis sustainable cities. According to Uchida et al. (2020) using CFD technology is to simulate the wind environment of building blocks, including point-type high rise buildings and row-type multi-story buildings. Zhang et al. (2022) using CFD study on the air ventilation assessment (AVA) in urban topology with twisted wind profiles (TWP). Shourangiz-Haghighi et al. (2020) analysis the effect of building shapes on turbine street level locations was elaborated using validated CFD literature results on pedestrian level wind conditions. Toja-Silva et al. (2018) explained that Liaoyang City in Northeast China as an example to develop green space planning using the CFD model, landscape ecological principles and GIS, indicated CFD model was effective for urban oxygen concentration simulation. The CFD model and research results in this paper could provide an effective

way and theory support for sustainable development of urban green space. Sumner et al. (2010) the summer natural ventilation of the mentioned apartment is investigated by determining the wind speed into the apartment through the CFD software. The research objective is to analyze Sustainable Cities problem with statistical analysis, also with Computational Fluid Dynamics (CFD) and Research Trend, based on Scopus.com database, since 2010 to 2022, article with abstract content CFD and sustainable cities, limited to Journal type and Article document type, and using data from BPS (Indonesia Statistic).

2. LITERATURE REVIEW

Based on Scopus.com database, since 2010 to 2022, article with abstract content CFD and sustainable cities, limited to Journal type and Article document type, detected 34 best literature review as followed: Arteaga-López et al. (2019) analyze the microclimate in a subtropical city by evaluating meteorological parameters with a three-dimensional model simulation software of CFD named ENVI-Met. Therefore, the results of this study can provide valuable guidance, both for keeping subtropical residents cooler and informing subtropical climate cities that would be sustainable in the future. Elsakka et al. (2019) points out that CFD technology is used to simulate the wind environment of building blocks, including point-type high rise buildings and row-type multi-story buildings, propose a new targeted wind environment measurement system developed using PHOENICS 2018 and a spatial combination model using urban information sensing for sustainable development. According to Rezaeiha et al. (2021), CFD simulation was verified using wind tunnel testing to improve the accuracy of the Phoenics simulation software. Wind speed, wind pressure, and the Universal Thermal Climate Index (UTCI) in residential areas distributed at different heights were analyzed and evaluated, research can inform the green and livable design of residential buildings and provide a new perspective for the construction of high-rise residential areas in cold cities. Dai, S.F., 2022, The effects of corner modifications (benchmark, recessed, chamfered, and rounded roofs) and wind angles ($\theta = 0°$, 22.5°, and 45°) over the flat rooftops of tall buildings were investigated through CFD simulations. The rounded roof was found to be ideal for the installation of wind turbines, due to the high velocity (more energy), low turbulence (small fatigue loads of wind turbines), and low installation height (low cost). Avotra et al. (2021), CFD study on the air ventilation assessment (AVA) in urban topology with twisted wind profiles (TWP), paper presents an LES-based CFD model based on the best practice guidelines (BPGs). CFD predicted wind speeds were validated against wind tunnel measurements in the literature, and good agreement was achieved. With the aid of the CFD model, wind conditions over heights were investigated, and the effects of twisted wind were evaluated, with the CFD results, it is possible to investigate the wind-structure interactions in specific urban areas and provide a better understanding of the effects of buildings on the local wind conditions, which could be useful to the urban plan for sustainable cities. Higgins et al. (2021)

asserted that the effect of building shapes on turbine street level locations was elaborated using validated CFD literature results on pedestrian level wind conditions.

AI programs with the decisional flow chart approach may be used for the identification and assessment of potential turbine locations to maximize the production of urban wind energy. Guo et al. (2021) pointed out that CFD-integrated method, and an illustrative example is presented. We think our method can be helpful in controlling infection risk and making the best use of the space and equipment in built environments, which is important for preventing the spread of COVID-19 and other infectious respiratory diseases, and promoting the development of sustainable cities and society. Zhang et al. (2022), CFD numerical simulation method was used to analyze the internal flow state of the prefabricated pump station, research results have certain guiding significance for improvement of the hydraulic performance and operation efficiency of prefabricated pump stations. They also provide a theoretical basis for parameter selection for prefabricated pumping stations. Aboulata et al. (2020) pointed out that the research is divided into two parts; the first part presents the impact of compact development and wind energy on sustainable urban communities in addition to the role of CFD in urban microclimate. The second part investigates the impact of wind behavior and speed on both straight and broken streets with different urban blocks heights using ANSYS Fluent software as an application of CFD programs. The paper came out with recommendations related to urban morphology using street form and buildings heights to enhance wind behavior and speed inside compact urban communities. Di Vito et al. (2020) asserted that the design drivers of a composite 5G smart pole are determined and the connecting design between finite element modelling (FEM), signal penetration and computational fluid dynamics (CFD) for thermal analysis are reported as an interdisciplinary process, sustainability regulations and realized business models will define the cost-structure and the response by customers. Akrami et al. (2020) demonstrated that the effect of vent configuration of a mono-span greenhouse with roof and side vents at low wind speeds was investigated using CFD, roof vent was found to affect the temperature and air velocity in the roof of the greenhouse but had very little effect on the distributions at the plant level. Mauro et al. (2019) revealed that effect of an upstream building on the "pumping" ventilation is investigated for various obstacle spacings, by CFD simulations. Simulation results show that vortex shedding frequencies could be affected by the non-dimensional obstacle spacing W/B (gap distance/building width), spacing W/B = 2 is the optimal spacing for largest ventilation rate and therefore lowest building energy consumption by Heating, Ventilation and Air Conditioning (HVAC) systems.

Our findings could benefit sustainable building design in dense cities. Ghosh et al. (2019) explores commonality from a modern perspective using CFD, reminding the stakeholders of the richness and the usefulness of their vernacular architecture in upholding the ideal of sustainability. Khanjari et al. (2020) demonstrated that CFD was used to simulate potential sedimentation phenomena. Sousa et al. (2019) stated that CFD can be used to provide detailed information on the urban flow field. However, the

complexity and natural variability of atmospheric boundary layer flows can limit the predictive performance of CFD. Yuan et al. (2019) asserted that CFD simulation was first validated against the wind tunnel experiment in the street canyon with tree planting. The vegetable was modelled as porous medium in CFD simulation. (Altaee et al., 2020) demonstrated that by using the numerical simulation method of GIS-CFD, simulating climate environment of the green land layout, research first comparative analyses the difference of thermal environment with or without green space layout, and further put forward the thermal environment optimization scheme based on urban ventilation path and urban green space ventilation corridor, feedback verification by CFD, find that the urban thermal environment continued to improve. It is beneficial to put forward a practical and operable green space optimization scheme to improve the urban thermal environment from the large scale of the city and the region CFD model, and related research in this paper provide new ideas for urban green space planning and sustainable development. According to Idriss et al. (2018), based on energy consumption, climate conditions in Djibouti and numerical analysis using CFD, it is apparent that the natural ventilation creates a thermally comfortable indoor environment in buildings. The study shows a design approach for selecting building architectural alternatives to improve natural ventilation behavior using CFD. Jain et al. (2018) pointed out that the present work aims to check the energy consumption of typical household buildings located in hot and humid environment using passive energy conservation techniques. The primary tenet of sustainable development is energy conservation. Simulations are carried out using CFD tools with fluent software.

Bangga et al. (2020) stated that CFD parameter study was undertaken and validated by wind tunnel experiment before launch of the simulation. The results show that, under the flat canopy there is hardly any wind energy amplification effect. According to Cheshmehzangi et al. (2017), quantitative research method with the application of CFD and EcoTect tools for a sustainable urban design project, main method of this study is the application of CFD and EcoTect tools for environmental performance of a larger urban area than the common use for architectural interventions or immediate outdoor spaces of a project. This study suggests an integrated urban design model with the application of computational tools (i.e., CFD and EcoTect in here) and how these could inform, from a technical dimension, a more comprehensive approach to executing best practice in design and planning. The paper concludes by suggesting an integrated model of urban design to achieve urban sustainability. Masoumi et al. (2017) pointed out that the methodology adopted for this study is use of CFD analysis for modeling of selected urban space to obtain the amount of pressure and velocity of airflow in outdoor spaces, results could be used for designing future projects and improving existing urban forms that located in different places with similar climatic conditions. According to Jeanjean et al. (2017) CFD simulations are performed with Open FOAM using the k-ε model. CFD results are compared with UK AURN (Automatic Urban and Rural Network) station concentrations. CFD simulations show that trees trap air pollution by up to about

7% at the Marylebone monitoring station in the spring, autumn and summer seasons, suggesting that the aerodynamic effects are similar over the different leaf seasons. The analysis of concentration levels obtained from CFD simulations across the whole street confirms a beneficial aerodynamic dispersive effect of trees of 0.7% in summer time for all wind directions averaged at a wind speed of 5 m/s (yearly average wind speed observed in the area). Results highlight the need to account for both aerodynamic and dispersion effects of trees in CFD modelling to achieve a comprehensive evaluation and help city planners with a sustainable design of trees in urban environments. He et al. (2020) pointed out that the maturing CFD technology is making more wind flow simulation experiments available, which can be validated by in situ and wind tunnel measurements. Starting from research on wind accumulation by the Venturi effect in built environment, this paper tries to establish the relationship between wind energy potential and the configuration of two perpendicular buildings by performing parametric CFD wind tests. Su et al. (2014) concludes that coupling remote sensing data with a CFD model has widely been used to examine interactions between UHI and greenspace patterns, the paper aims to examine the impact of five theoretical models of greenspace patterns on land surface temperature based on the improvement of the accuracy of CFD modeling by the combination of LiDAR data with remote sensing images to build a 3D urban model. Nagawkar et al. (2006) CFD analysis to simulate air flow patterns around Tardeo in Mumbai, has been conducted using ANSYS CFX to obtain pressure and velocity profiles-these product modeling simulations are expected to inform green architects engaged in sustainable design enhancements.

The findings derived from CFD models indicate that tree planting elevates the CO levels inside canyons. Increasing the tree planting density can deteriorate the ventilation performance of canyons and to a greater extent for those with lower aspect ratios. The findings should be of great value to urban planners in planning a sustainable city. Balduzzi et al. (2012) concludes a numerical CFD analysis was carried out to characterize the flow field in the rooftop area of buildings with different shapes and geometrical proportions: the flow velocity modulus and direction were calculated for different oncoming wind profiles and the results were projected into a net available wind distribution in the rooftop of each building. According to Todorović (2012), reviewed are optimization of mixed, natural and mechanical ventilation via CFD integrated with architectural modeling; BPS and Co-simulation approach to the "total building performance optimization" encompassing multifunctional facades, day-lighting, IE&AQ and HVAC systems operation offering an enormous potential for energy saving by residential/municipal RES integrated renovation. Toja-Silva et al. (2018) concludes that Liaoyang City in Northeast China as an example to develop green space planning using the CFD model, landscape ecological principles and GIS, indicated CFD model was effective for urban oxygen concentration simulation. The CFD model and research results in this paper could provide an effective way and theory support for sustainable development of urban green space. According to Hosseini et al. (2019), the summer

natural ventilation of the mentioned apartment is investigated by determining the wind speed into the apartment through the CFD software.

3. METHODS

Research methodology Based on Scopus.com Analyze search results, 34 documents result, since 2010 to 2022, Abstract with Computational Fluid Dynamics (CFD) Simulation and sustainable cities, limited to Journal type and Article document type, also added with quantitative modelling statistical analysis, based on BPS (Indonesia Statistic). Research methodology, refer to some article, published in Scopus.com. In one article, research was conducted descriptively based on Scopus.com data, where researchers obtained 203 documents whose article titles were digital tourism for the last ten years. The research was conducted descriptively based on scopus.com data, where researchers obtained 62 documents entitled digital transportation for the last ten years (2012-2021). In second article, research was conducted descriptively based on Scopus.com data, which obtained 249 documents with the title digital rural for the last five years. In third article, research is conducted descriptively based on scopus.com data, where researchers obtained 586 documents over the last ten years (2012-2021). The analysis process uses (1) research country documents, (2) affiliation documents, (3) affiliation documents, and (4) funding sponsor documents. The researchers use an approach in quantitative dynamics modeling that is often used in time series analysis, which is the Autoregressive Exogenous modeling structure input (ARX). In general, AR is the Auto-Regressive nature of a model, while X is an exogenous input. Setiawan et al. (2020) research uses secondary data archives that contain past (historical) events to find out several factors that affect transportation and warehousing GDP. Other data provided in the study is panel data, which is data of several airport locations (cross-section).

Data analysis is then carried out by using quantitative methods. Meanwhile, sampling is done by purposive sampling that was based on individual or researcher' considerations, which often referred to as sampling considerations. The analysis begins with the coefficient of determination, a measure of the total variation in non- independent variables that could be explained by its relationship with the independent variable. Then, multiple linear regression analysis is used to determine the effect of airport performance variables on regional government revenues and expenditures (APBD) variables, using the multiple linear regression formula. Furthermore, data processing uses SPSS linear regression stepwise analysis, highlighting the independent variable's effect on the dependent variable partially and draws conclusions. Based on the multiple linear regression analysis results with the stepwise method processed using the SPSS version 24 data processing program, from 10 regression equations, the best equation is obtained. Type of research publication Tourism and digital tourism, internationally reputed Scopus, in Indonesia is still limited to Conference Paper, Article, Conference Review and Book Chapter, so it requires a strong effort to catch up with other countries. There are 171 documents related to titles, abstracts, and keywords in Scopus publications. Fish

and solar cell technology researches are available in 122 journals. 57 Affiliation, Scopus document title-abstract-keywords results, Sustainable Mobility and Transportation Research in Indonesia, 1989-2020. As the international publication affiliation of Scopus, Institut Teknologi Sepuluh Nopember Surabaya (ITS) ranks fourth in tourism and maritime research. Based on Scopus publication paper data, there are only five reputable international publications that are related to the research on sociology and sustainable management in Indonesia, in the last 30 years (1990-2020). Furthermore, based on Scopus Analyze search results and VOS Viewer analysis of supply chain and fisheries research, the development of the portable inflated solar power cold storage house technology is on the right track for the future research and publication in Indonesia.

4. DATA COLLECTION

First data collection from BPS (Indonesia Statistics), after COVID19 pandemic decline in mid-2022, Indonesia economic become faster, But this condition impact on environmental, especially on Urban water, sanitation, waste management and sustainable urban development.

Then data collection from databased on Scopus.com Analyze search results, 34 documents result, since 2010 to 2022, Abstract with Computational Fluid Dynamics (CFD) Simulation and sustainable cities, limited to Journal type and Article document type, devided: (1) documents by country or territory; (2) documents by affiliation; (3) documents by subject area; (4) documents by funding sponsor; and (5) documents per year by sources**.**

5. RESULTS AND DISCUSSION

Based on Price Index in 90 cities, Indonesia (June 2020-June 2022) statistical analysis with Adjusted R square dan F test, we can see all price index parameter are in good connection, and increase significantly after COVID19 pandemic, in June 2022, especially some indicator with environmentally problem, like Furnishings, Houshold Equipment, Food, Housing, Water, Electricity, gas and fuel. So, it will be impact on Sustainable cities problem. Then how we check and analysis sustainable cities problem, based on Scopus.com Analyze search results, 34 documents result, since 2010 to 2022, Abstract with Computational Fluid Dynamics (CFD) Simulation and sustainable cities, limited to Journal type and Article document type, devided: (1) documents by country or territory; (2) documents by affiliation; (3) documents by subject area; (4) documents by funding sponsor; and (5) documents per year by sources. Documents by country or territory, compare the document counts for up to 15 countries/territories. China is the highest number publication Scopus.com in CFD and Sustainable Cities, followed by UK, Hongkong and India. There's no Indonesia paper**.**

Table 1. Price Index in 90 Cities, Indonesia (June 2020-June 2022)

	Food, Beverages and Tobacco		Clothing and Footwear		Housing, Water, Electricity, gas and fuel		Furnishings, Houshold Equipment, and Routine Household Maintenance		Health		Transportation		Informaion, Communication and Financial Services	
2020 *June*	107,27	-2,51	104,95	-1,29	102,81	-0,67	105,33	-2,35	106,55	-2,24	103,03	-0,87	100,04	0,03
July	106,49	-3,29	105,04	-1,20	102,80	-0,68	105,44	-2,24	106,86	-1,93	102,85	-1,05	100,06	0,05
August	105,57	-4,21	105,11	-1,13	102,82	-0,66	105,52	-2,16	106,92	-1,87	102,71	-1,19	100,09	0,08
September	105,18	-4,60	105,10	-1,14	102,89	-0,59	105,68	-2,00	107,09	-1,70	102,37	-1,53	100,08	0,07
October	105,49	-4,29	105,19	-1,05	102,85	-0,63	105,65	-2,03	107,25	-1,54	102,23	-1,67	100,06	0,05
November	106,40	-3,38	105,34	-0,90	102,81	-0,67	105,73	-1,95	107,59	-1,20	102,54	-1,36	100,08	0,07
December	107,99	-1,79	105,37	-0,87	102,84	-0,64	105,81	-1,87	107,79	-1,00	103,01	-0,89	100,07	0,06
2021 *January*	108,87	-0,91	105,49	-0,75	102,87	-0,61	105,97	-1,71	107,99	-0,80	102,70	-1,20	100,11	0,10
February	108,95	-0,83	105,55	-0,69	102,91	-0,57	106,35	-1,33	108,20	-0,59	103,01	-0,89	100,08	0,07
March	109,39	-0,39	105,57	-0,67	102,95	-0,53	106,46	-1,22	108,29	-0,50	102,75	-1,15	100,05	0,04
April	109,61	-0,17	105,77	-0,47	103,02	-0,46	106,74	-0,94	108,49	-0,30	102,75	-1,15	100,05	0,04
May	110,03	0,25	106,32	0,08	103,05	-0,43	107,03	-0,65	108,57	-0,22	103,48	-0,42	100,06	0,05
June	109,25	-0,53	106,19	-0,05	103,12	-0,36	107,21	-0,47	108,60	-0,19	103,12	-0,78	100,05	0,04
July	109,41	-0,37	106,27	0,03	103,17	-0,31	107,33	-0,35	108,86	0,07	103,11	-0,79	100,08	0,07
August	109,06	-0,72	106,20	-0,04	103,22	-0,26	107,62	-0,06	109,21	0,42	103,06	-0,84	100,07	0,06
September	108,55	-1,23	106,49	0,25	103,30	-0,18	107,84	0,16	109,34	0,55	103,13	-0,77	100,06	0,05
October	108,66	-1,12	106,65	0,41	103,38	-0,10	107,98	0,30	109,41	0,62	103,47	-0,43	100,10	0,09
November	109,57	-0,21	106,75	0,51	103,52	0,04	108,36	0,68	109,42	0,63	104,00	0,10	100,10	0,09
December	111,33	1,55	106,98	0,74	103,62	0,14	108,62	0,94	109,60	0,81	104,64	0,74	100,00	-0,01
2022 *January*	112,63	2,85	107,44	1,20	104,15	0,67	109,48	1,80	109,86	1,07	104,66	0,76	99,87	-0,14
February	111,68	1,90	107,54	1,30	104,41	0,93	109,97	2,29	110,22	1,43	104,73	0,83	99,83	-0,18
March	113,32	3,54	107,72	1,48	104,84	1,36	110,52	2,84	110,53	1,74	105,17	1,27	99,83	-0,18
April	115,31	5,53	107,71	1,47	105,13	1,65	111,25	3,57	110,87	2,08	107,72	3,82	99,83	-0,18
May	116,21	6,43	107,49	1,25	105,23	1,75	111,73	4,05	111,08	2,29	108,42	4,52	99,86	-0,15
June	118,27	8,49	107,66	1,42	105,33	1,85	112,32	4,64	111,27	2,48	108,74	4,84	99,82	-0,19

Table 2. Statistical Analysis with Adjusted R Square Dan F Test Price Index in 90 Cities (June 2020-June 2022)

|	Furnishings, Houshold Equipment, and Routine Household Maintenance	Food, Beverages and Tobacco	Food And Beverages Services/Restaurants	Housing, Water, Electricity, gas and fuel	Transportation	Health	Personal Care and Miscellaneous Goods and Services	Clothing and Footwear	Information, Communication and Financial Services	Education Services
R ADJUST	0,9703	0,9556	0,9451	0,9373	0,9042	0,9035	0,8564	0,8561	0,7369	0,6206
F ANALY	785,0899	517,7434	414,1445	359,9731	227,4863	225,6934	144,1278	143,8402	68,2316	40,2656
F TABLE	4,2800	4,2800	4,2800	4,2800	4,2800	4,2800	4,2800	4,2800	4,2800	4,2800
SIG. F	0,0500	0,0500	0,0500	0,0500	0,0500	0,0500	0,0500	0,0500	0,0500	0,0500
SIG F ANAL	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
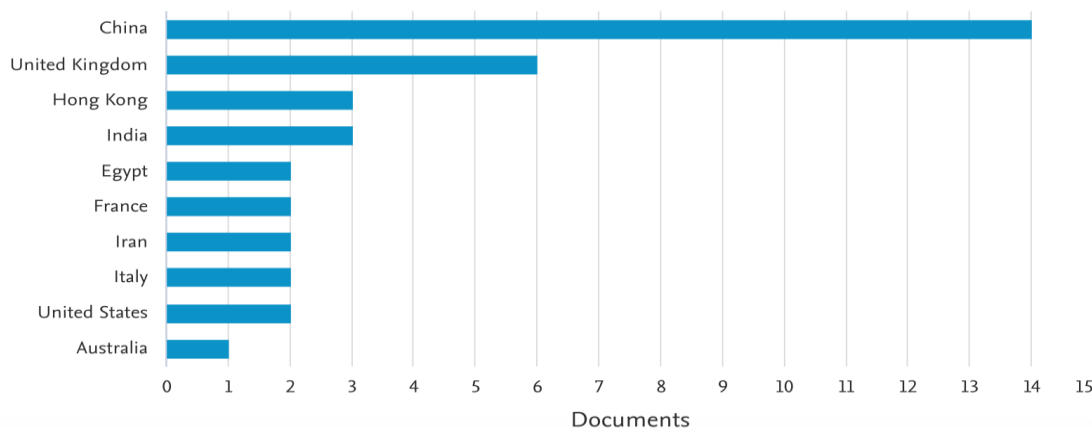
Figure 1. Documents by Country or Territory, Scopus.com Analyze Search Results

Documents per year by source, compare the document counts for up to 10 sources. Energy and Buildings 4 documents is the highest number journal publication Scopus.com in CFD and Sustainable Cities, followed by Sustainability Switzerland 3 documents, Sustainable Cities and Society 3 documents, Wit Transactions on Ecology, and the Environment 3 documents, Building and Environment 2 documents and Energy 2 documents. There's no Indonesia journal. Sources journal dominant from energy journal, sustainable journal, and environment journal.
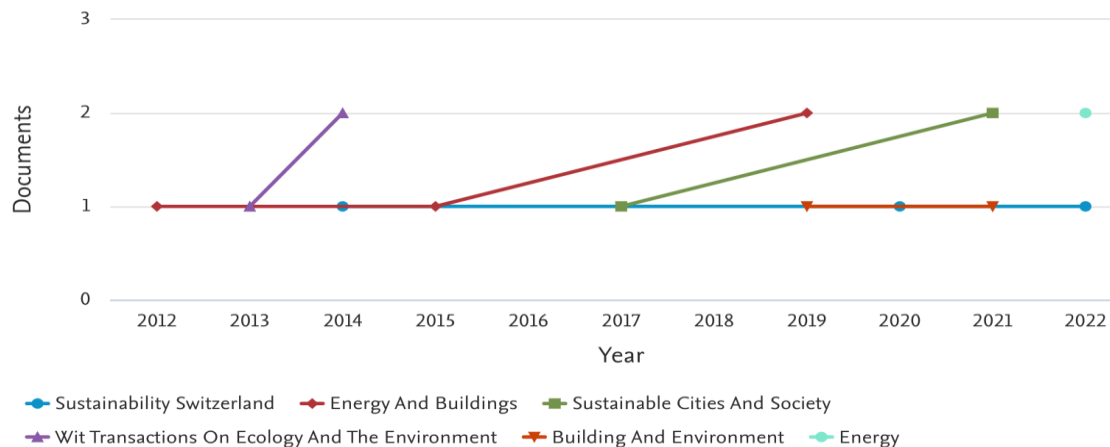
Figure 2. Documents Per Year by Source, Scopus.com Analyze Search Results

Documents by funding sponsor, compare the document counts for up to 15 sources. National Natural Science Foundation of China 9 documents and Ministry of Science and Technology of the People's Republic of China 2 documents are dominant and the highest institution funding sponsor publication Scopus.com in CFD and Sustainable Cities. There's no Indonesia institution funding sponsor.
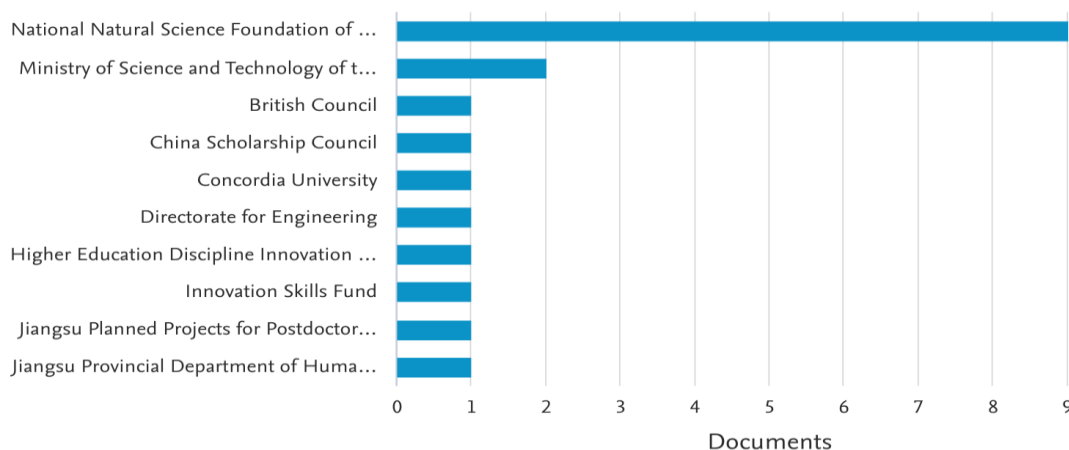
Figure 3. Documents by Funding Sponsor, Scopus.com Analyze Search Results

Documents by subject area, Engineering 22 documents and Environmental Science 15 documents are dominant also the highest subject area, publication Scopus.com in CFD and Sustainable Cities, followed by Energy 13 documents, Social Sciences 11 documents, Computer Science 4 documents, and Mathematics 3 documents, another subject area are Arts and Humanities 2 documents, Chemical Engineering 2 documents, Agricultural and Biological Sciences 1 document, Earth and Planetary Sciences 1 document, Materials Science 1 document, and Physics and Astronomy 1 document.
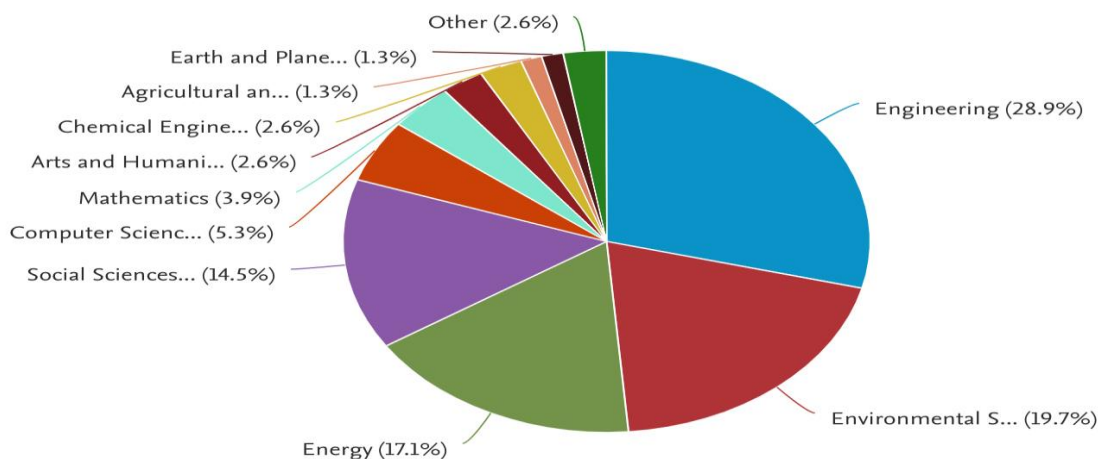

Figure 4. Documents by Subject Area, Scopus.com Analyze Search Results

Documents by affiliations, compare the document counts for up to 15 sources. Ministry of Education China, Ecole Nationale Superieure d'Architecture de Toulouse, Southeast University, Vellore Institute of Technology, University of Leeds, University of Nottingham, Chinese Academy of Sciences, Harbin Institute of Technology, INSA Toulouse, Universite Paul Sabatier Toulouse III, University of Chinese Academy of Sciences, Université Fédérale Toulouse Midi-Pyrénées, Institut Clément Ader, and

Laboratoire Matériaux et Durabilité des Constructions LMDC, all of them are 2 documents. China dominant affiliations institution publication Scopus.com in CFD and Sustainable Cities. There's no Indonesia affiliations institution.
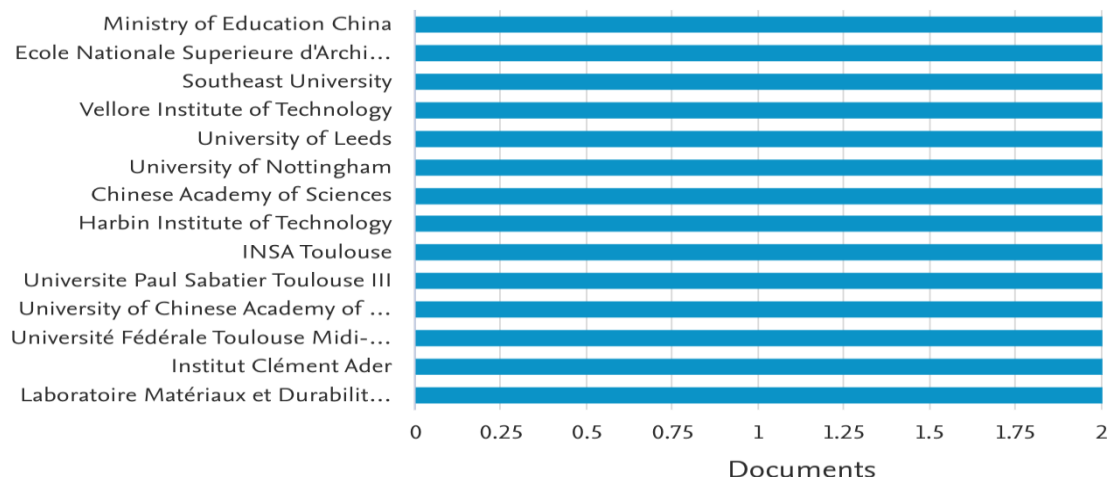

Figure 5. Documents by Affiliations, Scopus.com Analyze Search Results

6. CONCLUSION

Based on Scopus.com database, since 2010 to 2022, article with abstract content Computational Fluid Dynamics (CFD) Simulation and sustainable cities, limited to Journal type and Article document type, detected 34 best literatures. Documents by country or territory, compare the document counts for up to 15 countries/territories. China is the highest number publication Scopus.com in CFD and Sustainable Cities, followed by UK, Hongkong and India. There's no Indonesia paper. Documents per year by source, compare the document counts for up to 10 sources. Energy and Buildings 4 documents is the highest number journal publication Scopus.com in CFD and Sustainable Cities. Documents by funding sponsor, compare the document counts for up to 15 sources. National Natural Science Foundation of China 9 documents and Ministry of Science and Technology of the People's Republic of China 2 documents are dominant and the highest institution funding sponsor. Documents by subject area, Engineering 22 documents and Environmental Science 15 documents are dominant also the highest subject area, publication Scopus.com in CFD and Sustainable Cities, followed by Energy 13 documents, Social Sciences 11 documents. Documents by affiliations, compare the document counts for up to 15 sources. Ministry of Education China, Ecole Nationale Superieure d'Architecture de Toulouse, Southeast University, Vellore Institute of Technology, University of Leeds, University of Nottingham, Chinese Academy of Sciences, Harbin Institute of Technology, INSA Toulouse, Universite Paul Sabatier Toulouse III, University of Chinese Academy of Sciences, Université Fédérale Toulouse Midi-Pyrénées, Institut Clément Ader, and Laboratoire Matériaux et Durabilité des

Constructions LMDC, all of them are 2 documents. China dominant affiliations institution publication Scopus.com in CFD and Sustainable Cities. There's no Indonesia affiliations institution. Its challenge for Indonesia researcher to pushed research and publication especially in Computational Fluid Dynamics (CFD) Simulation and sustainable cities subject.

7. THEORETICAL AND PRACTICAL IMPLICATIONS

This research has significant theoretical and practical implications that are related to the city's development with sustainability. To start with, this study added in the literature that for sustainable development of the cities, the government should work on the innovative ideas because government factor is significant for cities enhancement and sustainability. Secondly, this research introduced that the local government also has significant impact on the development of cities. Thirdly, this research enhanced the body of knowledge with significant implication regarding the management of cities, because the earlier research neglected the role of innovation adoption and collaboration between government department for sustainable development of cities. This research further added that the basic purpose of cities development is dependent on the sustainable development goals, therefore for the implications of these goals, the effective state machinery should participate the provide better relief to the community. These implications are based on the findings of this research that are remarkable for literature as the body of knowledge is enhanced with these implications. Furthermore, this research is advanced with literature and based on discussion the implications are significant for further studies on sustainability of cities.

On the other hand, this research has introduced remarkable practical implications for sustainable development of the cities. This study highlighted that the sustainable development goals are appropriate for working, and the modern cities should be enriched with infrastructure and units of basic needs of the people. The people of any society are attracted towards the sustainable development process, therefore the less attention paid of the development of cities can reduce the sustainability in the country. Therefore, the government and other stakeholders of civil society are required to focus on the sustainable development cities to make the working appropriate. On the other hand, this research has discussed that the sustainability in the city can be achieved when there would be resources for education and basic health facilities. Indeed, the public living in any society is more attracted to the health facilities and these facilities are appropriate for getting the better results. The government of Indonesia and other advanced countries need to focus on the sustainable development and improve the living standard of public. By enhancing the public involvement in sustainability of cities, the government can achieve better results. Moreover, these practical implications are remarkable to enhance the government practices for improving the sustainability of cities.

8. FUTURE DIRECTIONS

This research has discussed the concept of cities' sustainable development in Indonesia and other modern trends in the interesting way. No doubt, the research purpose was to determine sustainable cities problem with statistical analysis, also with Computational Fluid Dynamics (CFD) and Research Trend, based on Scopus.com database, since 2010 to 2022, article with abstract content CFD and sustainable cities, limited to Journal type and Article document type, and also using data from BPS (Indonesia Statistic). In this regard, this study has some future directions that are analysed and during the literature review. Firstly, this research is based on the secondary data, therefore to validate the findings of this research the future studies should be conducted on the primary data collected on Likert scale. Secondly, the future research needs to develop a conceptual framework for sustainability of modern cities and contribute that framework in the body of knowledge. Lastly, the future research needs to address the role of government modern policies of sustainability in the development of sustainable cities. In this way, by working on these recommendations the future research would fill the gap in literature.

REFERENCES

Aboulata, T., Zayed, M., & Elmassah, O. (2020). Impact of Compact Urban Morphology on Wind Behavior Using CFD for Sustainable Development. *Journal of Engineering and Applied Science, 67*(8), 2187-2204. Retrieved from https://www.researchgate.net/profile/Mohamed-Zayed-6/publication/349163288

Akrami, M., Javadi, A. A., Hassanein, M. J., et al. (2020). Study of the effects of vent configuration on mono-span greenhouse ventilation using computational fluid dynamics. *Sustainability, 12*(3), 986. doi: https://doi.org/10.3390/su12030986

Altaee, A., Khlaifat, N., Zhou, J., & Huang, Y. (2020). A review of the key sensitive parameters on the aerodynamic performance of a horizontal wind turbine using Computational Fluid Dynamics modelling. *AIMS Energy, 8*(3), 493-524. Retrieved from http://hdl.handle.net/10453/141486

Arteaga-López, E., Ángeles-Camacho, C., & Bañuelos-Ruedas, F. (2019). Advanced methodology for feasibility studies on building-mounted wind turbines installation in urban environment: Applying CFD analysis. *Energy, 167*, 181-188. doi: https://doi.org/10.1016/j.energy.2018.10.191

Avotra, A. A. R. N., Chenyun, Y., Yongmin, W., Lijuan, Z., & Nawaz, A. (2021). Conceptualizing the state of the art of corporate social responsibility (CSR) in green construction and its nexus to sustainable development. *Frontiers in Environmental Science, 9*, 541. doi: https://doi.org/10.3389/fenvs.2021.774822

Balduzzi, F., Bianchini, A., Carnevale, E. A., Ferrari, L., & Magnani, S. (2012). Feasibility analysis of a Darrieus vertical-axis wind turbine installation in the rooftop of a building. *Applied Energy, 97*, 921-929. doi: https://doi.org/10.1016/j.apenergy.2011.12.008

Bangga, G., Dessoky, A., Wu, Z., Rogowski, K., & Hansen, M. O. (2020). Accuracy and consistency of CFD and engineering models for simulating vertical axis wind turbine loads. *Energy, 206*, 118087. doi: https://doi.org/10.1016/j.energy.2020.118087

Cheshmehzangi, A., Zhu, Y., & Li, B. (2017). Application of environmental performance analysis for urban design with Computational Fluid Dynamics (CFD) and EcoTect tools: The case of Cao Fei Dian eco-city, China. *International Journal of Sustainable Built Environment, 6*(1), 102-112. doi: https://doi.org/10.1016/j.ijsbe.2017.01.004

Di Vito, D., Kanerva, M., Järveläinen, J., et al. (2020). Safe and sustainable design of composite smart poles for wireless technologies. *Applied Sciences, 10*(21), 7594. doi: https://doi.org/10.3390/app10217594

Elsakka, M. M., Ingham, D. B., Ma, L., & Pourkashanian, M. (2019). CFD analysis of the angle of attack for a vertical axis wind turbine blade. *Energy Conversion and Management, 182*, 154-165. doi: https://doi.org/10.1016/j.enconman.2018.12.054

Ghosh, S., Goenka, A., Deo, M., & Mandal, D. (2019). Vernacular architecture as an idiom for promoting cultural continuity in South Asia with a special reference to Buddhist monasteries. *AI & society, 34*(3), 573-588. doi: https://doi.org/10.1007/s00146-017-0754-z

Guo, Y., Qian, H., Sun, Z., et al. (2021). Assessing and controlling infection risk with Wells-Riley model and spatial flow impact factor (SFIF). *Sustainable Cities and Society, 67*, 102719. doi: https://doi.org/10.1016/j.scs.2021.102719

He, J., Jin, X., Xie, S., et al. (2020). CFD modeling of varying complexity for aerodynamic analysis of H-vertical axis wind turbines. *Renewable Energy, 145*, 2658-2670. doi: https://doi.org/10.1016/j.renene.2019.07.132

Higgins, S., & Stathopoulos, T. (2021). Application of artificial intelligence to urban wind energy. *Building and Environment, 197*, 107848. doi: https://doi.org/10.1016/j.buildenv.2021.107848

Hosseini, A., & Goudarzi, N. (2019). Design and CFD study of a hybrid vertical-axis wind turbine by employing a combined Bach-type and H-Darrieus rotor systems. *Energy conversion and management, 189*, 49-59. doi: https://doi.org/10.1016/j.enconman.2019.03.068

Idriss, A., Idris, A., Dabar, O., & Mohamed, M. A. (2018). Computational Fluid Dynamics Modeling of a Natural Ventilated Building. *Journal of Electrical Systems, 14*(3), 51-62. Retrieved from http://journal.esrgroups.org/jes/papers/14_3_5.pdf

Jain, M., & Pathak, K. (2018). Thermal modelling of insulator for energy saving in existing residential building. *Journal of Building Engineering, 19*, 62-68. doi: https://doi.org/10.1016/j.jobe.2018.04.012

Jeanjean, A. P., Buccolieri, R., Eddy, J., Monks, P. S., & Leigh, R. J. (2017). Air quality affected by trees in real street canyons: The case of Marylebone neighbourhood

in central London. *Urban Forestry & Urban Greening, 22*, 41-53. doi: https://doi.org/10.1016/j.ufug.2017.01.009

Khanjari, A., Mahmoodi, E., & Ahmadi, M. H. (2020). Energy and exergy analyzing of a wind turbine in free stream and wind tunnel in CFD domain based on actuator disc technique. *Renewable Energy, 160*, 231-249. doi: https://doi.org/10.1016/j.renene.2020.05.183

Masoumi, H. R., Nejati, N., & Ahadi, A. a. (2017). Learning from the heritage architecture: Developing natural ventilation in compact urban form in hot-humid climate: Case study of Bushehr, Iran. *International Journal of Architectural Heritage, 11*(3), 415-432. doi: https://doi.org/10.1080/15583058.2016.1238971

Mauro, S., Brusca, S., Lanzafame, R., & Messina, M. (2019). CFD modeling of a ducted Savonius wind turbine for the evaluation of the blockage effects on rotor performance. *Renewable Energy, 141*, 28-39. doi: https://doi.org/10.1016/j.renene.2019.03.125

Nagawkar, J., Ghosh, S., Kataria, R., Nashit, A., & Deora, A. (2006). Effect of Sky Scrapers on Natural Ventilation Patterns and Human Comfort Index in Low-Risebuildings-A CFD Analysis over Central Mumbai. *9*(3), 293-295. Retrieved from https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1061.2403&rep=rep1&type=pdf

Rezaeiha, A., & Micallef, D. (2021). Wake interactions of two tandem floating offshore wind turbines: CFD analysis using actuator disc model. *Renewable Energy, 179*, 859-876. doi: https://doi.org/10.1016/j.renene.2021.07.087

Setiawan, M. I., Sukoco, A., Harmanto, D., Halim, P., Mursidi, A., & Ting, I.-H. (2020). *Sustainable Cities, Transportation and Warehousing GDP.* Paper presented at the IOP Conference Series: Earth and Environmental Science: IOP Publishing *498*(1), 012112. doi: https://doi.org/10.1088/1755-1315/498/1/012112

Shourangiz-Haghighi, A., Haghnegahdar, M. A., Wang, L., Mussetta, M., Kolios, A., & Lander, M. (2020). State of the art in the optimisation of wind turbine performance using CFD. *Archives of Computational Methods in Engineering, 27*(2), 413-431. doi: https://doi.org/10.1007/s11831-019-09316-0

Sousa, J., & Gorlé, C. (2019). Computational urban flow predictions with Bayesian inference: Validation with field data. *Building and Environment, 154*, 13-22. doi: https://doi.org/10.1016/j.buildenv.2019.02.028

Su, W., Zhang, Y., Yang, Y., & Ye, G. (2014). Examining the impact of greenspace patterns on land surface temperature by coupling LiDAR data with a CFD model. *Sustainability, 6*(10), 6799-6814. doi: https://doi.org/10.3390/su6106799

Sumner, J., Watters, C. S., & Masson, C. (2010). CFD in wind energy: the virtual, multiscale wind tunnel. *Energies, 3*(5), 989-1013. doi: https://doi.org/10.3390/en3050989

Todorović, M. S. (2012). BPS, energy efficiency and renewable energy sources for buildings greening and zero energy cities planning: Harmony and ethics of

sustainability. *Energy and Buildings, 48*, 180-189. doi: https://doi.org/10.1016/j.enbuild.2012.01.027

Toja-Silva, F., Kono, T., Peralta, C., Lopez-Garcia, O., & Chen, J. (2018). A review of computational fluid dynamics (CFD) simulations of the wind flow around buildings for urban wind energy exploitation. *Journal of Wind Engineering and Industrial Aerodynamics, 180*, 66-87. doi: https://doi.org/10.1016/j.jweia.2018.07.010

Uchida, T., Taniyama, Y., Fukatani, Y., et al. (2020). A new wind turbine CFD modeling method based on a porous disk approach for practical wind farm design. *Energies, 13*(12), 3197. doi: https://doi.org/10.3390/en13123197

Yuan, C., Shan, R., Adelia, A. S., Tablada, A., Lau, S. K., & Lau, S. S.-Y. (2019). Effects of vertical farming on natural ventilation of residential buildings. *Energy and Buildings, 185*, 316-325. doi: https://doi.org/10.1016/j.enbuild.2018.12.028

Zhang, S., & Chen, W. (2022). China's energy transition pathway in a carbon neutral vision. *Engineering, 14*, 64-76. doi: https://doi.org/10.1016/j.eng.2021.09.004

Acknowledgment