Perspective

GenAI4Sustainability: GPT and Its Potentials For Achieving UN's Sustainable Development Goals

By Rui Wang, *Student Member, IEEE*, Chaojie Li, *Member, IEEE*, Xiangyu Li, Rong Deng, and Zhaoyang Dong, *Fellow, IEEE*

SINCE 2015, 17 Sustainable Development Goals (SDGs) have been understood as more promising blueprints for a peaceful, prosperous, and sustainable future [1] which are formulated to seek a framework to address global challenging issues such as poverty, inequality, and pollution. Indeed, engineers and scientists have an obvious mandate for their growing role in solving these SDGs [2] where extensive research on various solutions to these challenges can be found from the perspective of engineering practice and social science [3]. Whilst there is existing research on AI-enabled techniques for tackling SDGs [4], [5], there has been less research on how generative AI can promote communities to live in a more sustainable way.

Recently, generative AI (GenAI) has shown its great potential for promoting the development of industries, economies, and societies [6]. The advent of new generation AI technique with its human-like ability has been recognized as a game-changer for sustainable development [7]. Specifically, this emerging technology can be leveraged to understand human requirements for delivering a desirable solution, adapt to different environmental conditions for comprehensive decision-making, and provide equal access for mitigating inequality [8]. The pioneering AI technology GPT has shown great promise in finance [9] and catalyst [10] with human-like text generated based on a large language model (LLM). The advent of generative pre-trained transformer 4 (GPT4) has exhibited powerful human-level performance in real-world scenarios with dramatic parameters, thereby extracting more features to overcome more challenges by understanding human requirements, adapting to different environment conditions, and providing equality access.

In the context of GenAI, it could bring significant impacts on many SDGs [11] if properly trained. A perspective of what the role GPT would play in SDGs is provided for economic, social, and environmental targets. Specifically, the illustration of UN's SDGs could connect with GPT is shown in Fig. 1.

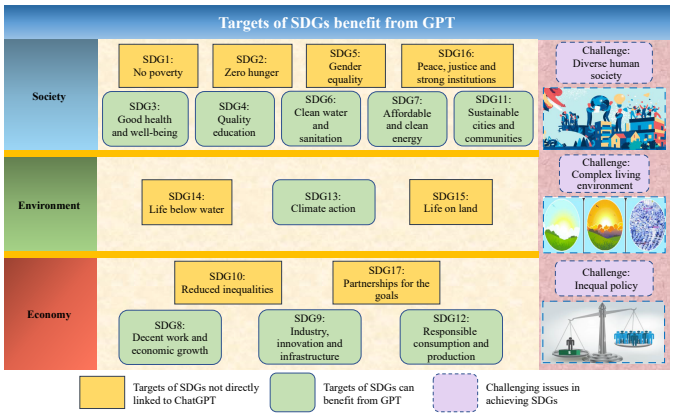

Fig. 1. UN's SDGs are connected with a perspective GPT.

1) SDG3: Good health and well-being: To maintain good health and promote well-being, a personalized diet and regular exercise are important.

Personalized Diet: A healthy diet is a basis against many chronic non-communicable diseases. Based on historical records of food consumption and health conditions by using smart wearables, GPT could enable intelligent recommendations for a daily healthy diet for people of all ages. With the powerful capacity to understand human languages, the daily nutritional requirement of a healthy lifestyle could be evaluated by GPT [7]. Moreover, the preference for food could also be identified for people. Thus, different preferable diet lists could be recommended for people who could guarantee a healthy lifestyle.

Customized Exercise Planning: Historical exercise records could be exploited by the strong learning ability of GPT to determine the time schedule for exercise or relaxation to prevent health issues from insufficient or excessive exercise. In daily life, a large amount of real-time data can be collected by wearable electronic devices, such as ketones and heartbeats. Recently, AI has been applied to obtain an accuracy of 99.4% for a specific recognition task and 42.91%–75% precision for the decision-making task while GPT could contribute to improving the performance of the interactive decision support in real-time [12]. Hence, GPT could help people with effective customized

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R. Wang, C. Li, and X. Li are with the School of Electrical Engineering and Telecommunications, UNSW, NSW 2052, AU (e-mail: rui.wang20@student.unsw.edu.au; chaojie.li@unsw.edu.au; xiangyu.li1@unsw.edu.au).

R. Deng is with the School of Photovoltaic and Renewable Energy Engineering, UNSW, NSW 2052, AU (e-mail: rong.deng@unsw.edu.au).

Z. Dong is with the School of Electrical and Electronic Engineering, Nanyang Technological University, 50 Nanyang Ave, Singapore (e-mail: zydong@ieee.org).

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exercise strategies to promote well-being.

2) SDG4: Quality education: AI-promoted education is expected to grow by 47.5 % from 2017–2021 in the US [13] where GPT could considerably improve the quality of education by providing an interactive learning environment.

Interactive Learning Assistant: Quality education exceptionally requires equal access to good education resources which highly relies on an interactive learning practice to monitor the progress of each student and present valuable feedback to students by using different strategies. GPT could significantly contribute to this interactive learning practice which enables teachers to provide extra educational resources and personalized tutoring for students.

Human-like Ability for Disability: Disabled learners such as dysphasia could benefit from the human-like ability of GPT which could help them more precisely express what they are thinking and what they want to say. Therefore, it is a promising solution for disabled learning practice.

Personalized Educational Planning: With powerful learning and human-like ability, GPT could potentially understand the progress of different learners. According to the historical data, learning methodologies such as just-in-time learning, self-regulated learning, and real-time reinforcement learning can be applied by GPT to refine personal educational planning so that better learning performance can be achieved by every student [14].

3) SDG6: Clean water and sanitation: From SDGs, an integrated water management strategy is expected to provide sufficient clean water by 2030 [1]. With the large language model, supervised learning, unsupervised learning, and reinforcement learning can be applied to increase the performance of the water cleaning system and the water sanitation equipment where the poisoner material in water can be closely tracked by a GPT-enabled monitor system to mitigate the hazard to all spices on the earth.

4) SDG7: Affordable and clean energy: The application of GPT in the energy sector is essential as a critical enabler of a clean, affordable, and reliable energy supply [3]. GPT-enabled decision-making systems can be leveraged to deliver the optimal solution for a huge amount of data mining tasks from multiple sources, i.e., weather information and load demand. With big data analysis, GPT can digitalize, automatize, informalize, and intelligentize the global energy operation to help provide real-time decision-making and insightful interpretations for integrating distributed energy resources and energy storage systems. Thus, GPT can be introduced to generate strategic decision-making, schedule efficient energy consumption for complex energy systems, and maintain the supply-demand balance at the distribution system level and the transmission system level.

5) SDG11: Sustainable cities and communities: GPT can definitely enable a sustainable city. Through big data analysis and the corresponding strategic decision-making, the energy sector, the transportation network, the healthcare system, the education system, and other important public sectors in a metropolitan city can be more efficient where smart sensors, IoT devices, and wearable electronics can record a large number of data from the city with green innovative solutions for sustainability [7], [8]. Based on the origin and destination of each vehicle, real-time monitored data can be provided by GPT for balancing scheduling and managing traffic flows for livable urban communities. With the human-like ability, GPT can be applied to coordinate smart home electronics with the understanding of human activities and adaptation to varied environmental conditions. With powerful self-learning ability, GPT can understand the healthcare system. Thus, the trend of health conditions can be identified which can be helpful to prevent serious diseases [15]. As an unprecedented assistance, GPT can comprehensively arrange and assess the smart city in multiple dimensions to assist in beneficial decision-making in dealing with equal policy for sustainable communities and cities.

The general illustration of GPT contributed to society targets is shown in Fig. 2.

6) Perspectives of GPT in environment target of SGD 13: Climate action: **Climate Change Tracking**: The 2015 Paris Agreement is made to mitigate the climate problem from the global perspective [16]. To take more efficiently and effectively synergistic action, climate change tracking is required to decide on coordinating strategies. Data collected by worldwide meteorological stations can be exploited by GPT to evaluate the global climate change states and give comprehensive and reliable predictions. Thus, climate change can be tracked with GPT to set the action priorities for the potential high risk.

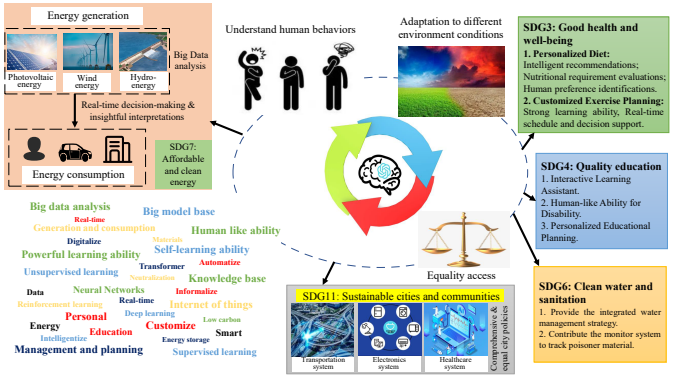

Fig. 2. The diagram of generative AI contributes to SDGs.

Natural Disaster Prewarning and Post-disaster Recovery: The global meteorological data integration is required for disaster prewarning and effective assessment of disaster characteristics is required for post-disaster recovery [13]. The global data can be processed by GPT with the large model base to give comprehensive disaster prewarning and plan the comprehensive post-disaster recovery.

Linkage for global climate action: Considering the extreme weather is continuously increasing, more people are required to take action for the global climate. With the powerful human-like and self-learning ability, GPT can be applied to give appropriate suggestions of action for people in different physical and social systems. Hence, everyone with internet access can take action for global climate with suggestions determined by GPT.

7) SDG8: Decent work and economic growth: From our perspective, GPT could bring more decent job opportunities and increase the economy.

Take Obsolete Job: The adoption of GPT would result in job losses in certain industries. Yet, the development of GPT-based automation can complete cumbersome tasks and boring obsolete jobs with high efficiency which increases productivity and promotes the economy [5]. Thus, obsolete jobs that people are unwilling to do would be replaced by the development of GPT.

Vocational Training: GPT can contribute to vocation training by educating the novice to absorb the latest knowledge since GPT can provide vocation training strategy from up-to-date news, current affairs, and even the research paper [9]. Hence, people who lost their jobs can be assisted by GPT to find decent and high-salary jobs for career upgrade.

GPT Human Interaction: In the future, the cooperative-coexisting GPT-human Interaction will be mature. Thus, the complex task could be completed by human-GPT cooperatives with human innovation and the constructed knowledge base from GPT which dramatically promotes efficiency and resilience and contributes to sustainable economic growth [17].

8) SDG9: Industry, innovation and infrastructure: Considering the highly nonlinear industrial system, difficulty in updating infrastructure, and complex innovation encouragement, the coexisting, cooperative, and cognitive GPT-based robot would be the solution for fostering innovation and entrepreneurship. The number of industrial robots is continuously increasing since 1993. Yet, current robots only complete low-skill and medium-skill tasks and increase by around 8 percent energy consumption [18]. With the powerful self-learning ability, GPT can imitate humans to complete more complex tasks. Besides, GPT-based robots could automatically switch modes when

the robot is workerless. Moreover, the automation level would be increased to increase productivity which increases salary and reduces working time. More flexible time and no budget stress would foster innovation. For the infrastructure, GPT-based robots can help to overcome future challenges. From 2003 to 2013, an estimated 35 Australian construction workers were seriously injured every day [19]. With GPT-based robots, the ability to adapt to different environmental conditions based on supervised learning and reinforcement learning contributes to identifying the safety risk for protecting workers. In addition, the shortage of skilled workers could also be solved by GPT-based robots. With the powerful self-learning ability, skilled workers could train mature GPT-based robots to complete complex infrastructure tasks.

9) SDG12: Responsible consumption and production: **Sustainability Promoter**: Digital technologies such as the Internet of Things (IoT) are applied to transfer information into bits and bytes of data [3]. Based on collected data, the sustainability promoter GPT can schedule high-efficiency tasks and monitor the materials consumption. Hence, energy efficiency could be improved which reduces the energy consumption from fossil fuels and materials such as material footprint could be traced that the low-material consumption power sector could be supported to reduce materials consumption.

Efficiency Optimizer: The efficiency optimizer GPT could minimize the adverse impact of materials with sustainable management [6]. Based on the worldwide agreement on hazardous waste, the monitored waste data is applied to give real-time management since the large-model-based GPT can deal with the huge amount of data and finally gives the real-time management response. Besides, the management from GPT would be equal since no interference from inequality policies.

In conclusion, GPT-based approaches contributing to economic targets are illustrated in Fig. 3. Finally, we conclude this perspective. As an innovative AI technology, the GPT would play an important role in SDGs toward a sustainable future. Nevertheless, the ethical challenges involving data fraud and privacy disclosure are the obstacles to realizing SDGs goals with GPT. It is expected more research and commercial entities will join the discussion on how to apply GPT to different SDGs, and finally realize its potential.

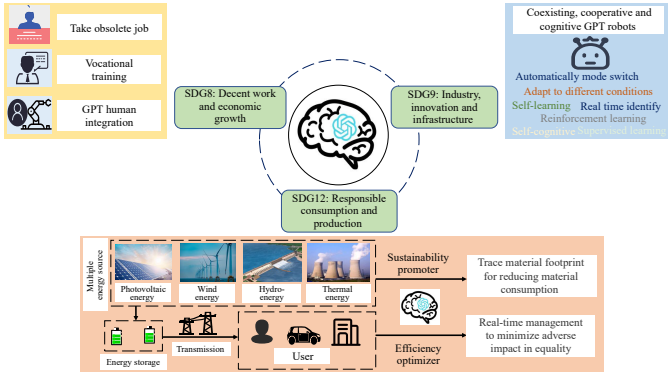

Fig. 3. GPT contributes to economic targets.

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ABOUT THE AUTHOR

Rui Wang (Student Member, IEEE) received the Ph.D. degree from the Zhejiang University in 2023. He is currently a Visiting Scholar at the School of Electrical Engineering and Telecommunications, UNSW. His research interests include battery SOH estimation, battery equalization, electric vehicles, applications of artificial neural networks, optimization theory, and computational intelligence in these areas.

Chaojie Li (Member, IEEE) received the B.Eng. degree in electronic science

and technology and the M.Eng. degree in computer science from Chongqing University, in 2007 and 2011, respectively, and received the Ph.D. degree from RMIT University, Australia in 2017, where he was a Research Fellow for one and a half years. He worked as a Senior Algorithm Engineer at Alibaba Group for one year. At present, He is an ARC DECRA Fellow/Lecturer at UNSW in Sydney. His current research interests include generative AI, graph representation learning, distributed optimization and game theory in smart grids, and cyber security.

Xiangyu Li received the B.Eng. degree in electrical engineering and its automation from Qinghai University, in 2016, the M.Eng. degree in electrical engineering from Tsinghua University, in 2018, and the Ph.D. degree in electrical engineering from the University of New South Wales (UNSW), Australia, in 2022. He is currently a Research Associate at the School of Electrical Engineering and Telecommunications, UNSW. His research interests include renewable energy trading, battery energy storage systems, electric vehicles, and applications of optimization theory, game theory, and computational intelligence in these areas.

Rong Deng received the B.Eng. degree in 2018 and the Ph.D. degree in 2021 in photovoltaic and solar energy engineering from the UNSW. She has been on Forbes 30 under 30 Asia List - Healthcare & Science, 2022. She is currently an Associate Lecturer at the School of Photovoltaic and Renewable Energy Engineering. Her research interests include PV sustainability, PV recycling, life cycle assessment, and circular economy.

Zhaoyang Dong (Fellow, IEEE) received the Ph.D. degree from the University of Sydney, Australia in 1999. He is currently with Nanyang Technological University, Singapore. His previous roles include SHARP professor and Director of UNSW Digital Grid Futures Institute, the University of New South Wales, Australia; and Ausgrid Chair and Director of the Ausgrid Centre for Intelligent Electricity Networks providing support for the Smart Grid, Smart City national demonstration project. His research interests include smart grids, smart cities, power system planning and stability, renewable energy systems, the electricity market, and computational methods for power engineering applications. He has served/is serving as an Editor for a number of IEEE Transactions and IET journals.