**Improve the efficiency of electric energy utilization**

On university campuses, lighting systems are one of the important energy consuming units. Therefore, installing energy efficient lighting is one of the effective measures to improve the efficiency of electricity consumption on university campuses. Traditional incandescent bulbs have been replaced by LED bulbs and energy saving bulbs because of their high energy consumption and short lifespan. According to research, LED bulbs and energy saving bulbs can save up to 80% of energy consumption compared to traditional incandescent bulbs and can also last longer. Therefore, university campuses can achieve a reduction in energy consumption and an improvement in environmental performance by replacing light fittings.

In addition to replacing luminaires, university campuses can also optimise the efficiency of their lighting systems through The Internet of Things (IoT). In details, we can design solution for a hierarchical model of power saving management system with the joint application of ZigBee technology and WiFi technology, based on the original network solution of the University of Glasgow, instead of adding a wired approach, a wireless approach is adopted. The wireless sensor network gram overcomes the shortcomings of the wired network, and its easy deployment of nodes, no wiring, simple network maintenance and greatly reduces the cost of the solution. The convergence point (gateway) on each layer transmits data to the server via wireless WiFi, so that mobile phones can also be connected to the server via WiFI, allowing for real-time control.According to this design, we can develop an app on a mobile phone, so that all the electrical appliances in the school can be switched on and off through the mobile phone app after the wiring modification. Further more, we can monitor the electricity consumption of all appliances in real time directly through this app. With these, we can remotely switch off useless appliances or set up timer switches to turn appliances on and off in batches to save unnecessary power.

Renewable energy sources, such as solar and wind power, can also be used to improve the efficiency of electric energy utilization. By harnessing natural sources of energy, we can reduce our reliance on fossil fuels and minimize our environmental impact. Additionally, some renewable energy sources, such as solar panels, can be installed on homes and businesses to generate electricity locally, reducing the need for energy to be transported over long distances.Depending on the local climate in Glasgow, wind power may be a more suitable option.Since The largest wind farm in Europe is near Glasgow,and renewables produced the equivalent of 97.4% of Scotland's electricity consumption in 2020, mostly from wind.

So, how can the University of Glasgow incorporate wind power into its energy mix? In order to effectively use the wind energy resources of the campus, combined with the innate conditions of the school's grid electricity, the wind power system adopts the wind grid intelligent switching off-grid power supply system, that is, under normal circumstances the wind power system as an off-grid system to supply power to the campus lights, if the battery is under-voltage due to insufficient wind power generation, the intelligent power switching system carried on the inverter will automatically switch to the city grid to supply power to the light loads, in addition, when the battery In addition, when the battery is seriously under-voltage, the mains power will supply the load and at the same time replenish the battery in time to avoid damage to the battery due to long time under-voltage. At the same time, the whole system must ensure the stable operation of the load, no matter how the wind conditions change, without affecting the daily work of the light load.

**Advantages**

In summary, the use of IoT for campus grid renovation has many advantages. IoT can achieve efficient use of energy and improve the efficiency and quality of power supply, thus providing a reliable energy guarantee for the development of the campus. At the same time, the use of the system can also reduce operating costs and improve the safety and stability of the grid.

By incorporating wind power into its energy mix, the university can reduce its dependence on the grid, save money on energy costs, and demonstrate its commitment to sustainability. The university has several options for implementing wind power, such as installing wind turbines on its campus or implementing a community wind power scheme. With careful planning and execution, the University of Glasgow can successfully harness the power of the wind and become a leader in sustainable energy.

**References**

Chen, X. (2015). Research on the Hybrid Energy Storage based Photovoltaic Piconets and the Isolated Net Running Comprehensive Control System in the Campus Environment. International Journal of Technology Management. Retrieved March 29, 2023, from https://iffybc15e942deeac4a7dh6cxqcwknqp606fkcfzzz.res.gxlib.org.cn/Qikan/Article/Detail?id=665449994

Dowdeswell, A. (2022). How much energy onshore wind generates in Glasgow as UK government ... Glasgow world. Retrieved March 29, 2023, from https://www.edinburghnews.scotsman.com/news/how-much-energy-onshore-wind-generates-in-glasgow-as-uk-government-backs-away-from-farms-increase-3651782

Tang, M., &amp; Zia, Q. (2015). IoT-based intelligent teaching building power saving management system design for universities. Journal of Chizhou University. Retrieved March 29, 2023, from https://iffybc15e942deeac4a7dh6cxqcwknqp606fkcfzzz.res.gxlib.org.cn/Qikan/Article/Detail?id=667718515

Zhao, F., &amp; Sun, Y. (2012). The Development and Application of Smart 5 kW Wind Power System in Campus. Gxlib.org.cn. Retrieved March 29, 2023, from https://iffybc15e942deeac4a7dh6cxqcwknqp606fkcfzzz.res.gxlib.org.cn/Qikan/Article/Detail?id=44058789

Zhao, F., Li, C., &amp; Da, H. (2020). Research on Energy Saving Transformation of Green Campus based on the Design of Phase-change Energy Storage Light Guide Plate. Jiangsu Construction. Retrieved March 29, 2023, from https://iffybc15e942deeac4a7dh6cxqcwknqp606fkcfzzz.res.gxlib.org.cn/Qikan/Article/Detail?id=7102461138