AI and Sustainability: How Startups are Using AI to go Green

Climate change is one of the biggest challenges of our time—but AI might be part of the solution. Imagine if your time wasted in the daily traffic gridlock was reduced or even eliminated. Then imagine this on a global scale. Through innovations like real time traffic data and AI algorithms this can be achieved. Pollution caused by fuel emissions would be reduced. Accidents would be reduced. AI models can "analyse common causes of accidents and mistakes made in addressing them." There are also AI powered satellite systems that monitor earth's climate and "track changes of concern" by monitoring sea ice changes and tracking weather patterns. Along with this, weather forecasting is becoming increasingly important as weather patterns change and become more unpredictable. All these issues contributing to the climate crisis can be addressed by AI.

Startups are uniquely positioned to use AI in agile, innovative ways to drive sustainability. This is because of their flexibility, speed and, "their ability to adapt to changing market conditions." Startups can use AI to "develop new sustainable products and services more quickly than established companies." This is a clear advantage in the fight against climate change.

This essay explores how startups are using AI to combat environmental challenges, reduce emissions, optimize resource use, and create more sustainable business models.

The Role of AI in Sustainability

In a business context, sustainability is defined as making sure operations meet present needs without standing in the way of the needs of future generations. To do this, businesses must "balance economic, social and environmental factors to create long term value for stakeholders." These stakeholders could be shareholders, employees, customers or the community. Some goals business can work toward to achieve this sustainability are, carbon neutrality, a circular economy and energy efficiency.

AI tools that can help contribute to sustainability are predictive analytics, computer vision, natural language processing and optimization algorithms. These tools can predict defects or mistakes in machines or data sets before they occur, see things on the inside of a machine or a piece of data that a human might miss, and generally optimize any process they are called on to help with.

The extraction of data in particular allows companies to increase their resource efficiency, predictability and sustainability. More specifically, predictive analytics allows companies to optimize their supply chains by minimizing waste, making inventory management more efficient and increasing transportation efficiency. An example of a company that is having success with this is Walmart.

AI models can also monitor energy usage, suggest where it's inefficient and how that efficiency might be improved. An example of a company that has had success with this is Google. It uses AI algorithms to monitor the cooling systems in its data centres. This has contributed to a significant reduction in energy consumption.

A specific way computer vision can help with sustainability is by, "identifying and sorting recyclable materials more efficiently than traditional recycling methods." The organization AMP Robotics use robotic systems to sort recyclables making the recycling process more efficient while decreasing the number of contaminants in the process.

AI also helps businesses comply with environmental regulations. It does this is by "monitoring operations in real time" to ensure the company always meets its environmental standards. The model analyzes large amounts of data to detect compliance issues which enables companies to take measures to prevent or fix them before they get into too much trouble.

How Startups are Driving Green Innovation with AI

In the current climate crisis, more and more start-ups are looking to AI to help solve critical challenges to sustainability. Whether by optimizing energy usage in real-time, smart agriculture or waste management, startups are driving green innovation with the help of AI.

One of the key issues in energy optimization is utilizing the "grid edge". The "grid edge" refers to the meeting point between the main power grid and the people or devices that use or produce electricity. Homes or businesses that receive their energy from solar panels and use a smart thermostat are a part of grid edge technology. So are electric vehicles, and batteries that charge from the grid but also send electricity back to it. Traditionally, electricity flowed in one direction: from large power plants to consumers. With "grid edge" technology, the flow is two-directional, optimizing how energy is used or shared with the help of AI and data analytics.

Large, traditional energy companies lack the flexibility and efficiency to meet the new consumption patterns of present-day consumers. An innovative solution to this problem has been sought out by Tibber - the first fully digital energy company in the world. Tibber

has replaced traditional energy suppliers with a user-friendly app. With the help of the app, consumers can find easy access to the most affordable source of energy. "Also, when connecting smart home technology such as electric vehicles and heating systems, the app automatically shifts energy consumption to times of the day when electricity is cheaper." By using this app, consumers can reduce their energy consumption by 20 per cent.

Integrating AI can further optimize energy consumption by minimizing unnecessary energy consumption in real-time. Smart meters, IoT sensors, weather forecasts, energy usage patterns are all means by which AI can monitor and analyze data in real-time, optimizing efficiency. The ability to detect voltage fluctuations, equipment malfunctions, or overloads and automatically adjust the grid to balance supply and demand is a key in maintaining a stable power supply.

Another area where startups are driving green innovation is in smart agriculture. Precision agriculture using AI and IoT is being used by companies such as Prospera, PEAT and Taranis. AI and IoT, more specifically computer vision, allow farmers to better monitor the health and viability of their crops. Disease detection, irrigation or the need for fertilizer is all information provided to farmers in real-time via computer technology such as drones, cameras and climate sensors.

PEAT, Progressive Environmental & Agricultural Technologies, is a Berlin based startup that has developed the app Plantix, designed to help farmers diagnose plant diseases, identify pests, and nutrient deficiencies through AI-powered image recognition. Once a picture is uploaded, the app can diagnose a potential crop issue and offer eco-friendly treatment solutions. This app is widely used by farmers, particularly small farmers, in lower-income countries like India, Brazil and Africa.

Similarly, Taranis uses sophisticated computer vision, data science and deep learning algorithms to monitor fields, enabling farmers to deal with potential weed or pest infestations, nutrient deficiency, or equipment malfunctions. Taranis generally supports large growers, helping them increase their yields up to 7.5 per cent.

Startups like Prospera, PEAT and Taranis, promote food sustainability and reduce the impact of chemicals on crop production. AI and IoT tools help with early and accurate detection of potential crop issues, reducing the need for chemical intervention. AI-driven insights further help in the efficient management of water and nutrient application, resulting in lower resource consumption and waste.

Waste management and the circular economy is an important component of sustainability. It aims to minimize environmental impact and promote resource efficiency. The circular economy, as the name suggests, aims to reduce waste by keeping products in circulation

and out of landfills. Lengthening the lifecycles of products through repair, reuse, refurbishment and recycling reduces waste and contributes to a circular economy.

According to in-depth research done by the Ellen MacArthur Foundation, implementing AI into current systems of waste management would be beneficial in helping it transition to a more efficient, circular model. A report released by the foundation in 2019 found that incorporating AI would assist in designing products for longevity, optimize manufacturing processes, and enhancing the efficiency of recycling and waste management systems by improving sorting accuracy and material recovery.

Several European companies are using AI to promote circular economy practices. Cyclize GmbH, in Germany, recycles carbon from mixed plastic waste thereby reducing plastic pollution and greenhouse gas emissions. ROSI, in France, transforms photovoltaic (PV) waste into high-value circular materials, like silicon, silver, copper, glass, and aluminum. Adopting circular economy principles help communities and businesses transform waste into valuable resources, contributing to a more sustainable and resilient future.

The future of green innovation is not so much about replacing current systems with new technologies. It is about AI helping to make existing systems smarter. AI is unlocking this potential by making the way we build, grow our food and manage waste, smarter.

AI in Carbon Tracking and Emission Reduction

More and more, artificial intelligence is believed to be a key player in achieving net-zero emissions and advancing Environmental, Social, and Governance (ESG) objectives. Carbon accounting platforms use AI to help companies accurately measure, report, and reduce their direct and indirect greenhouse gas (GHG) emissions. This is particularly important when their goal is to meet net-zero targets.

Platforms, such as Sweep, Emitwise and Persefoni, use artificial intelligence to automate data collection, improve emission estimations, and provide actionable insights to help companies make improvements. In monitoring, AI gathers and integrates all relevant data from Enterprise Resource Planning, Customer Relationship Management systems, finance systems, and IoT devices. It goes on to detect any anomalies, fills in missing data, and standardizes the units of measurement.

Companies must report their emissions to stakeholders and comply with regulations. AI simplifies, automates, and improves the transparency of these reports by converting the raw data, into aligned reports. AI ensures traceability of every data point—essential for external audits. Finally, AI will produce potential scenarios for future reports based on a

company's actions. The last step, offsetting, is used for emissions that fail to be reduced. AI ensures offset strategies are transparent, effective, and aligned with climate goals.

Startups play a vital role in supply chain decarbonisation because they help companies reduce their greenhouse gas emissions from all activities involved in producing and delivering a product, including indirect emissions which make up to 70 per cent of company's carbon footprint. Furthermore, startups can quickly develop and offer solutions as needs change and evolve.

Challenges and Ethical Concerns

As with any implementation of AI, there are challenges and ethical concerns that should factor into the decision about whether AI is right for a particular business. First, there is data access and accuracy. Green AI is especially reliant on quality and transparent environmental data. Environmental data is often split between various government agencies, NGOs, private companies and other organisations with different purposes. These different organisations store their data in what are known as "data silos" which makes it difficult for everyone to access the same information.

Many companies take ownership of important data such as statistics having to do with logistics, energy or agriculture. The fact that these companies don't share this data makes it difficult for every organization or every AI model to get a clear picture of this information.

Also important when considering implementing green AI is the issue of geographical disparities in the quality of the environmental data the AI model can compile. The quality of environmental monitoring systems tends to be higher in developed countries. The developing world usually has less basic infrastructure for monitoring climate, for example, air quality monitors. This can make it more difficult to obtain reliable information from developing countries.

When considering implementing a green AI model, businesses must also think about the AI's own footprint. Training a large AI model uses a lot of energy. Businesses should make sure the AI they're considering implementing is truly green. They can do this by making sure they develop their AI model in the most sustainable way possible. They can optimize their models for energy efficiency and make sure it uses renewable energy sources.

One technique they can use to do this is by making sure their algorithms are designed as officially as possible. Techniques like "model pruning" and "transfer learning" make it easy to create small efficient models that use less energy than large models. Energy efficient hardware can be used to decrease the amount of energy the AI model consumes. This

hardware includes GPUs with higher FLOPS per watt or specialized Tensor Processing Units (TPUs). Emissions can also be reduced by "personalizing or spreading data or tasks across multiple cores."

The Future of Green AI and What Startups Need to Know

There are many exciting innovations to look out for in the future of green AI. Firstly, there are several government policies in the works or already enacted that favor green innovation. For one thing, there is the "EU Green Deal." This piece of legislation includes investing 18 trillion euros in adapting climate, energy transport and taxation policies to "fit with reducing net greenhouse gas emissions by at least 55 per cent by 2030."

This Green Deal includes "The Industrial Plan" whose goal is to "enhance the capacities of Europe's net-zero industry and products required to meet Europe's ambitious climate targets." One of the ways it does this is by offering generous grants to net-zero startups. In fact, the EU's net zero startup ecosystem is now valued at over €100 billion, twice its value in 2020.

Another legislation is the US Inflation Reduction Act. It has several different goals. To reduce inflation of course, but the Inflation Reduction Act also aims to "invest in clean energy and improve health care." This act was approved by Congress in August 2022. Like the European Green Deal and The Industrial Plan, one of its stated goals is to reduce carbon emissions by "around 40 per cent by 2030." It also includes grants and loans intended to accelerate the development of clean energy, clean vehicles and clean manufacturing. This includes "investments in developing clean energy, expanding the electricity grid and developing domestic clean technology manufacturing." The US government plans to distribute approximately 370 billion dollars to measures intended to improve energy security and speed up the transition to clean energy.

Given the fact that many organizations and sectors are currently striving for sustainability in their work and in other aspects of their existence, there has been a rise in what is known as impact investing. This form of investing is done with the goal of producing positive social or environmental impacts rather than simply financial returns.

Something else that has been on the rise lately is the environmental social and governance metric which measures a businesses impact on environmental sustainability and ethics. It measures specific things like greenhouse gas emissions, water usage and waste management. It also measures a company's relationship with employees and stakeholders and their response to issues such as diversity equity and inclusion. The fact that an

increasing number of companies are now using this metric indicates how important it has become for stakeholders and consumers.

In conclusion, AI plays a critical role in enabling sustainability. Companies use it to monitor their energy usage, their emission reductions and their carbon footprint. They also use it to plan the most efficient routes for their delivery vehicles and maintain their manufacturing equipment with the goal of preventing a costly failure. All these uses of AI help companies reduce their energy emissions and generally make sure their work does the least amount of harm to the environment as possible. Despite the concerns that AI models have a strong negative environmental impact because of the energy it takes to run them, it is also clear that AI models, if used correctly, can help companies do business in a way that reduces harm to the environment.

Startups are playing a vital role in the development and deployment of “green AI.” They are coming up with methods to optimize energy usage in real time, do agriculture in a more environmentally sustainable way and managing waste. As mentioned above, “the grid edge” is just one solution startups have devised using AI to make the environment more sustainable. If the number of new ideas invented by bright young minds continues to grow, we can continue to have hope in the health of our planet for many years to come. The greenest code is the one that empowers real change.