Discuss the role of the government in the green transition. Suggest a policy agenda that can help accelerate the evolution to a sustainable, net-zero future. Your answer might include fiscal and monetary policies for green transition as well as macro and regulation policies.

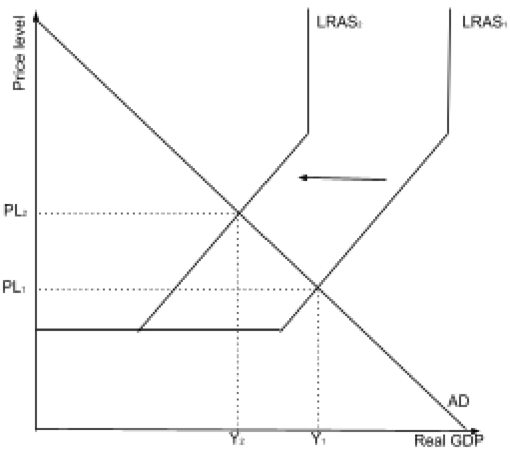
The earth is warming at unprecedented levels. In 2023, global temperatures reached 1.45°C above pre-industrial levels, approaching the 1.5°C limit set by the Paris Climate Agreement (United Nations, 2024). Considering that the majority of countries globally follow a free-market system, where the allocation of scarce factors of production is determined solely by price signals, firms fail to take negative externalities of production – e.g. through greenhouse gas emissions – into account. Thus, government intervention is required to introduce new regulations, and fiscal and monetary policies to encourage firms to reduce emissions, fuelling a sustainable, net-zero future.

However, critics of the green transition argue that countries may face growing unemployment, potentially hindering economic development. Hence, to truly understand the question, perhaps a relevant question to ask is what is at stake if a net-zero and sustainable future is not achieved.

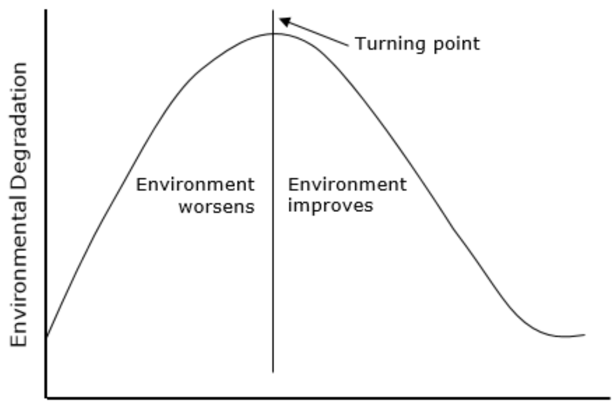
What is at stake?

The scientific explanation of global warming can be easily comprehended. Greenhouse gases, such as carbon dioxide, and other air pollutants are collected in the atmosphere and absorb sunlight and solar radiation that have been reflected off the earth's surface, trapping heat and causing temperatures to increase (MacMillan and Turrentine, 2021). This results in a ripple effect, contributing to melting ice caps and glaciers, desertification, and an increased occurrence of extreme weather events such as flash floods, heat waves, and forest fires. It is estimated that climate change, accelerated by global warming, will also result in an influx of 'climate refugees', which is expected to reach 1.2 billion people by 2050 (McAllister, 2022).

Climate change is also likely to have adverse effects on economic growth – which could cost the global economy up to $38 trillion a year within 25 years (Hart, 2024). Increasingly unpredictable weather patterns and increased occurrences of heat waves will likely cause crop failures to become more frequent, causing global crop yield losses of 6-21%, and an increasing proportion of land is predicted to become infertile (Abramoff et al., 2023). Human-induced climate change also serves as a threat to labour productivity, which has been attributed to 27% of heat-related deaths (World Health Organization, 2023), while increasing temperatures have contributed to a reduction in body load endurance and work efficiency while increasing operation errors and accident rates (Zhang et al., 2023). Thus, the aforementioned effects of climate change relate to the reduction in the quantity and quality of factors of production, in this case, land and labour, thereby reducing the productive capacity of the countries. Consequently, long-run aggregate supply decreases, culminating in increased cost-push inflation and negative long-run economic growth (shown below).



Despite this, it must be noted that some see environmental degradation as a necessary part of economic development – something which can be demonstrated by the Environmental Kuznets Curve (shown below).



Theoretically, the notion seems reasonable. Economic growth is an increase in output, meaning countries need to utilise more factors of production. For developing countries, the primary sector tends to take up the majority of the economy, which tends to use up more land. This is likely to result in environmental degradation, likely in the form of deforestation which contributes 12-20% of global greenhouse gas emissions (Watson and Schalatek, 2020). Such was the case in Costa Rica. In the 1940s, 75% of Costa Rica's territory was rainforest (Ugalde-Hernández, 2023). With the arrival of loggers in the 1950s and 1960s, the country shifted parts of its forest cover to grow crops and livestock, resulting in one of the highest deforestation rates in Latin America (Ugalde-Hernández, 2023).

Over the long run, increased economic growth has caused it to become a more service-oriented economy – making up over 67% of GDP in 2022 (O'Neill, 2024). Therefore, as the Costa Rican economy shifted to a more service-intensive consumption pattern, it required more research and development and the availability of professional services. Consequently, this contributed to a reduced need for industrial production, achieving further economic growth without environmental degradation and increased greenhouse gas emissions.

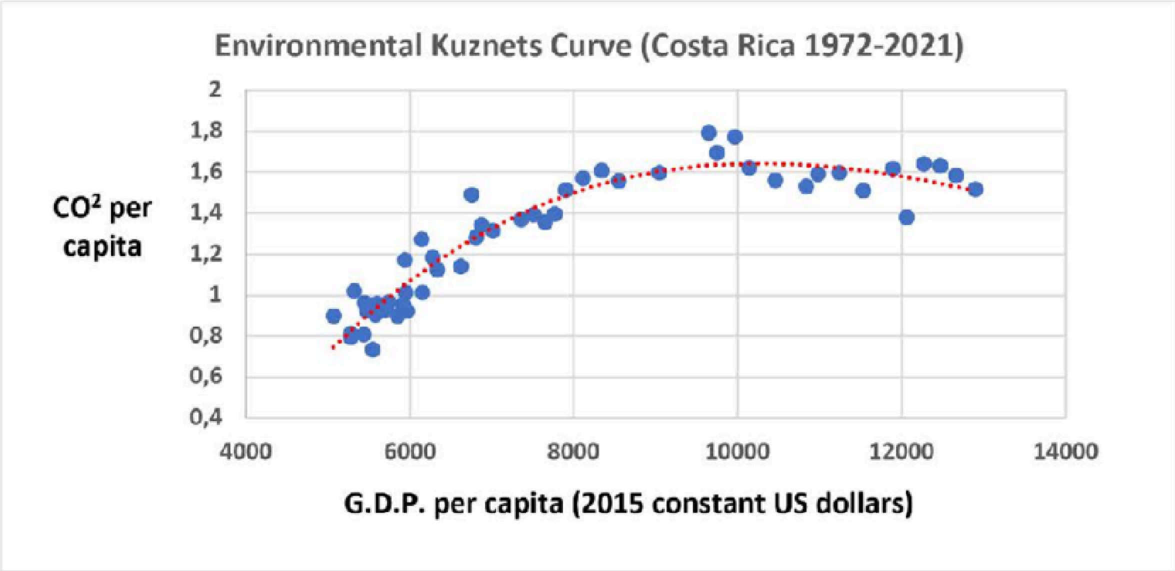


Figure 1: As GDP per capita increases, carbon emissions per capita decrease over the long run, showing an inverted U-shape between economic growth and pollution. (Source: Ugalde-Hernández, 2023)

Nevertheless, this does not negate the need for government intervention. Without it, global surface temperatures are forecasted to rise to a mean level of 3.28 °C above its pre-industrial level by 2100 (Song et al., 2023), only exacerbating the problems previously mentioned. Instead, to achieve a sustainable, net-zero future, policies should simultaneously increase economic growth whilst catalysing the green transition.

Potential policies

There are two ways net-zero can be achieved: through a reduction in greenhouse gas emissions or by increasing its removal from the atmosphere.

One effective policy measure to reduce greenhouse gas emissions is to encourage investment in renewable energy. Considering the energy sector accounts for 72% of global greenhouse gas emissions (Center for Climate and Energy Solutions, 2018), the adoption of renewable energy sources can significantly decrease overall emissions. This could be done through a feed-in tariff scheme. This will ensure that renewable energy providers are guaranteed a fixed above-retail fee for a period, which will decrease over time. Since, in a free market, firms' main objective is to maximise profits, they will be incentivised to invest more in green energy. Such policy measures have been introduced in Malaysia where, since 2001, under the Malaysian National RE Policy and Action Plan, the FIT rate was pegged at RM0.17/kW·h for biogas and biomass, a number which rose to RM0.21/kW·h in 2007 (Bakhtyar et al., 2014). The FIT rates for Solar photovoltaic (PV) are also shown below (Bakhtyar et al., 2014).

Capacity of RE installation	FIT rate (RM per kW·h)	Effective period	Degression rate
Installed capacity up to and including 4 kWp	1.23	21 years	8%
Installed capacity above 4 kWp up to and including 24 kWp	1.20	21 years	8%
Installed capacity above 24 kWp up to and including 72 kWp	1.18	21 years	8%
Installed capacity above 72 kWp up to and including one MWp	1.14	21 years	8%
Installed capacity above one MWp up to and including 10 MWp	0.95	21 years	8%
Installed capacity above 10 MWp up to and including 30 MWp	0.85	21 years	8%
Additional for installation in buildings or building structures	0.26	21 years	8%
Additional for use as building materials	0.25	21 years	8%
Additional for use of locally manufactured or assembled solar PV modules	0.03	21 years	8%
Additional for use of locally manufactured or assembled solar inverters	0.01	21 years	8%

Table 1: FIT rates for Solar PV in Malaysia

These policies have contributed to the increased adoption of renewable sources of energy in Malaysia, with solar power being forecasted to take up the largest proportion of energy production by 2035, as shown in Figure 2 (Bakhtyar et al., 2014).

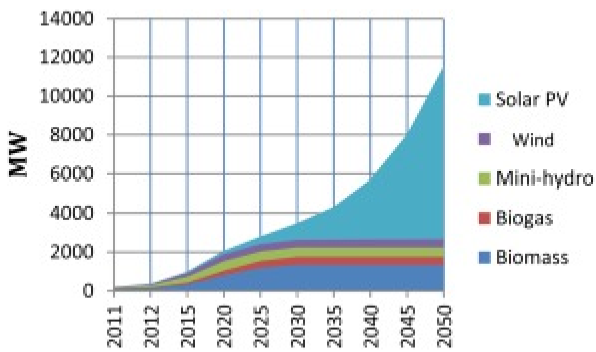


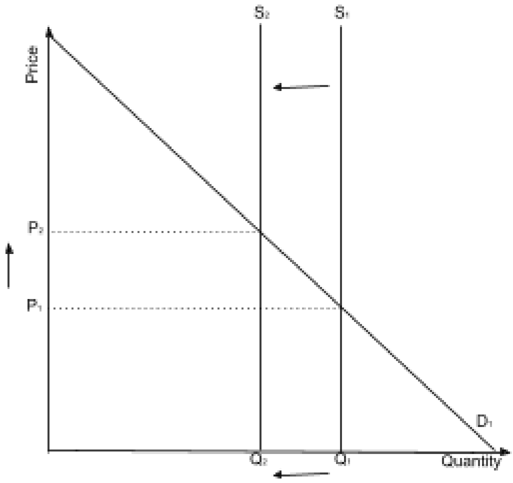
Figure 2: Trend in generating solar energy sources in 2011-2050.

However, this policy has its limitations. It could reduce demand for substitute goods and services, such as those provided by the fossil fuels industry. A substitute product serves the same needs and wants as a given product. Therefore, as demand for renewable energy increases, it would have the opposite effect on non-renewable energy, like fossil fuels, potentially resulting in increased structural unemployment for those working in such industries as fewer factors of production need to be utilised. In addition, since the tariff is usually set above market rates, there could be an initial increase in energy costs.

Nonetheless, it should be acknowledged that many fossil fuel workers have the skills to have clean energy jobs. It is estimated half of workers in fossil fuel sectors who face redundancy risks this decade have skills demanded by clean energy sectors (IEA, 2023). Others require slightly more training, which could be provided through increased spending on education and training programmes, enabling such workers to gain transferable skills. Renewable energy also usually creates more jobs and boasts greater job growth compared to fossil fuels, further reducing unemployment (IEA, 2023). Moreover, increases in energy costs should decrease as the feed-in tariff rate decreases over time and as the energy sector becomes more dominated by renewable energy – which is now cheaper than fossil fuels (Allen, 2023).

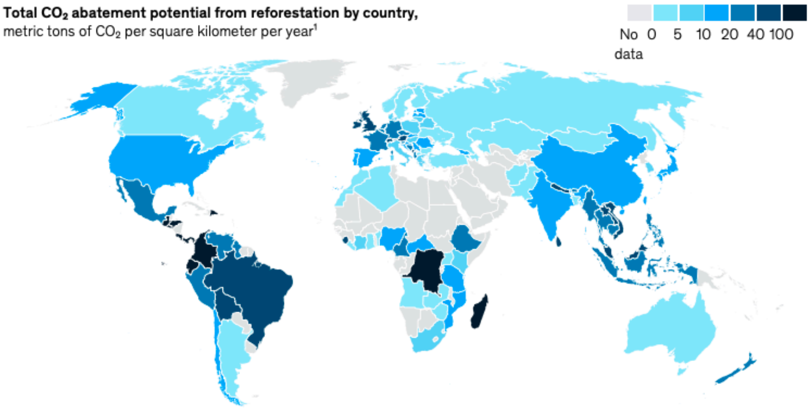
The changes in the energy sector could be accompanied by regulations that increase energy efficiency, which will reduce energy consumption and ease the replacement of existing fossil-fuel-based energy with renewable sources. For example, the government could introduce new building regulations, including thermal insulation standards in countries with a temperate climate. In Japan, the Design and Construction Guidelines on the Rationalization of Energy Use for Houses (DCGREUH), was introduced in 1980. It mandated that external roofs, ceilings, walls, and floors of residential buildings be insulated, improving thermal efficiency and reducing energy consumption (Evans, Shui and Takagi, 2009).

Another policy that would drive a green transition is the introduction of tradable pollution permits, whose supply could be reduced steadily over time. This will give firms a legal right to emit a certain amount of greenhouse gases, which can be sold and bought in a market, increasing potential profits for firms with lower emissions compared to those with higher emissions.



Since the price of permits increases over time (from P1 to P2) as the supply of permits decreases (from S1 to S2), the cost of production of firms that emit greater emissions and the potential profits of firms that emit fewer emissions increase. Being motivated by profit maximisation, firms will invest in ‘greener’ means of production. For example, the EU launched a European Union Emissions Trading System (EU ETS) in 2005. Currently, it covers 10,000 power stations and industrial facilities in 30 countries, representing 40% of the EU’s total greenhouse gas emissions (Dechezleprêtre, Nachtigall and Venmans, 2022). As a result, EU-wide emissions have fallen between 2.5% and 5%. It is estimated that sectors subject to EU ETS emitted 11.5% less than what they usually would have, while, in France, ETS-regulated manufacturing firms reduced emissions by 8-12% compared to a group of similar, unregulated firms (Dechezleprêtre, Nachtigall and Venmans, 2022). The benefits of such regulations have not just been limited to the reduction of emissions, resulting in an increased level of investment and productivity (Dechezleprêtre, Nachtigall and Venmans, 2022).

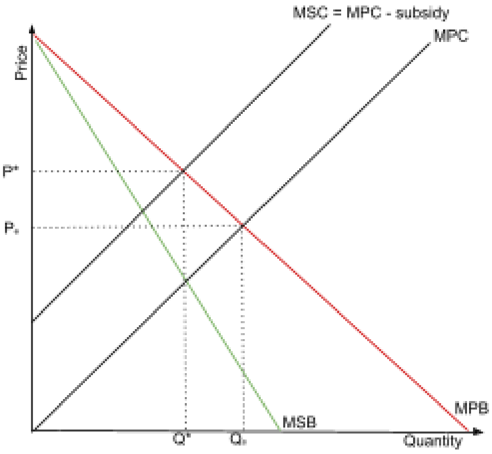
With regards to the removal of emissions from the atmosphere, one of the most common and affordable approaches is reforestation, whose benefits could apply to many countries, as shown.



(Source: Krishnan et al., 2022)

One policy measure that could help achieve this is the introduction of payments for ecosystem services, where landowners or farmers are given direct payments to encourage the adoption of a more sustainable means of production or environmental service. The Costa Rican Payments for Environmental Services Programme (PES), introduced in 1997, is an example of this – providing direct payments for ecological services which are provided as a result of more sustainable land use and management techniques. Whilst not the only cause, the programme could have contributed to an increase in forest cover, from 42% in 1997 to 51% by 2005 (Cameron, 2015). Hence, it is estimated that it prevented 11 million tons of carbon emissions from 1999 to 2005 (Karousakis, 2007). Over the same period, approximately $110 million was spent on PES contracts protecting over 400,000 hectares of land, 8% of the country's total land area (Cameron, 2015).

Whilst seemingly successful when reducing emissions, the programme will be costly and governments could bear a significant opportunity cost. Therefore, to fund this, governments should reduce spending on fossil fuel subsidies. Not only are fossil fuel subsidies becoming more expensive, costing a record $7 trillion in 2022 (Black, Parry and Vernon, 2023), but fossil fuels cause negative externalities of consumption in the form of pollution and greenhouse gas emissions. The reduction in the subsidy will increase prices for the good, discouraging consumption and offsetting the negative externalities of consumption.



Hence, the new equilibrium achieved following the reduction of the subsidy is the intersection of the MSC (Marginal Social Costs) curve and the demand/MPB (Marginal Private Benefits) curve. At the new price/**P***, the quantity supplied and demanded for fossil fuels will reach its allocative efficient point **(Q*)**, internalising the negative externalities.

<u>Conclusion</u>
Overall, whilst such policies could ensure a net-zero future on a national scale, for the negative impacts of greenhouse gas emissions to be completely mitigated, international cooperation is required. The issue of global warming and environmental degradation transcends borders, thus, all countries need to be willing to commit themselves to such policies and be willing to collaborate with other countries to achieve such goals.

There is reason to be optimistic. In 2023, at COP28, countries agreed to compensate nations for loss and damage caused by climate change through establishing a fund, whilst reinforcing the aim of transitioning away from fossil fuels (UNFCCC, 2024).

However, this must continue. Without such cooperation, the policies' impact on fuelling global sustainable development will be undermined and, ultimately, unsuccessful.

(1995 words)

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