Climate Change

Assignment 5

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Section 1: Plan

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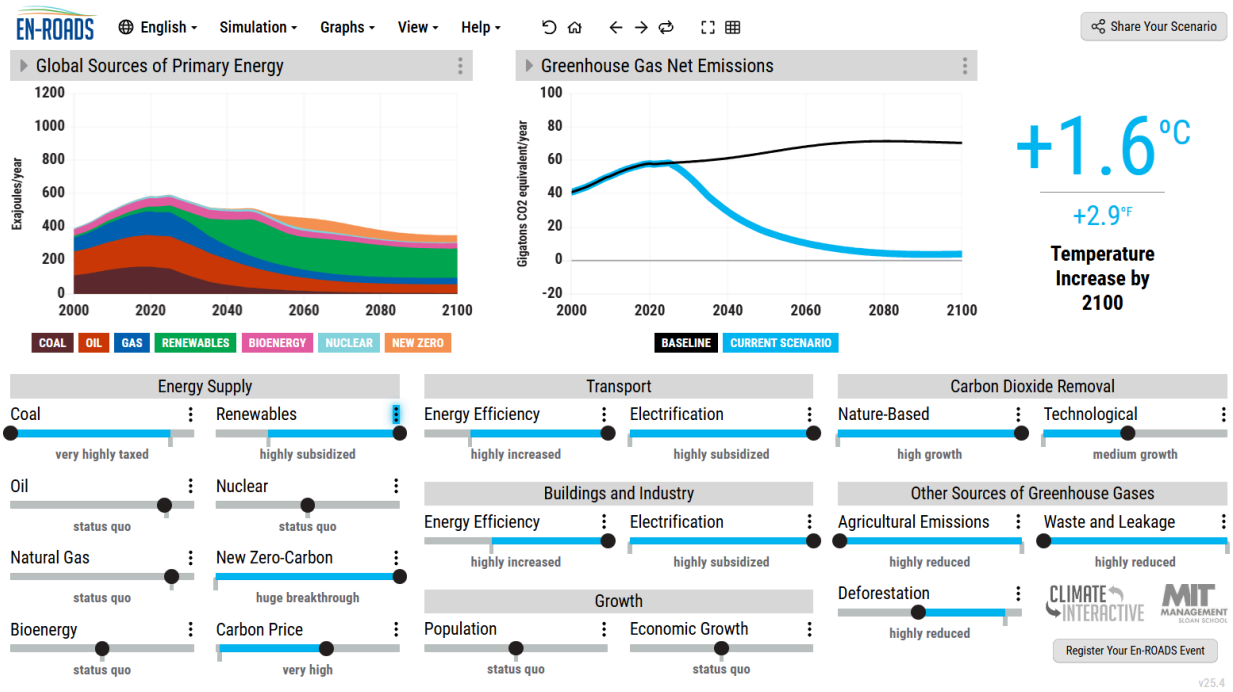
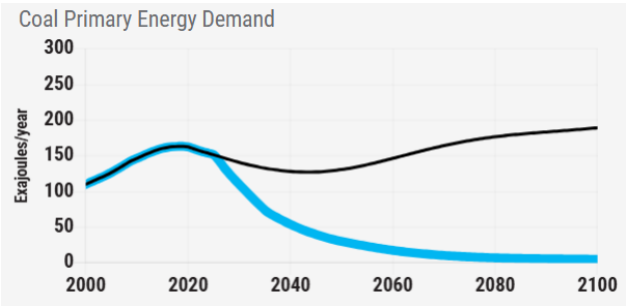


Key Policies & Outcomes

- Coal tax/subsidy = $100 / t
    - Eliminates almost all coal use by the middle of the century, reducing the most polluting fuel



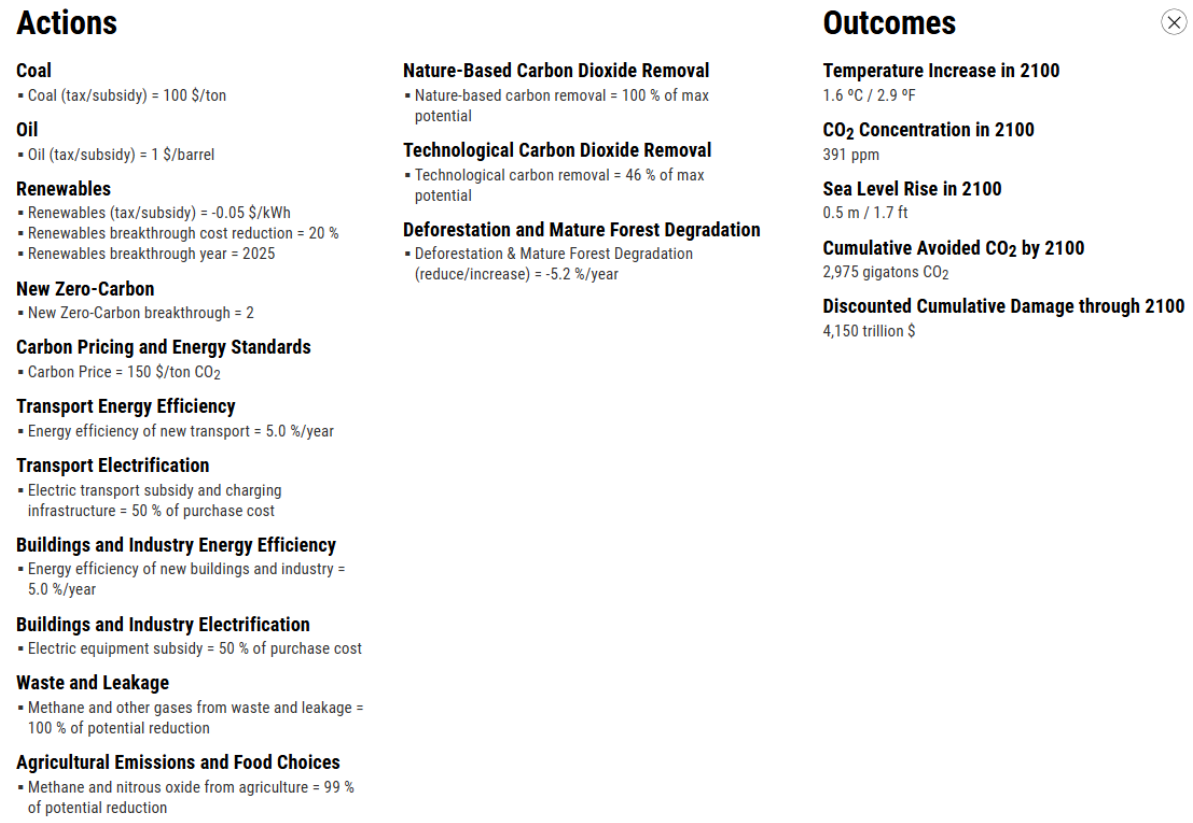
- Oil tax/subsidy = $1 / bbl
    - Used mainly to maintain a consistent policy mix, with little direct effect on the demand for liquid fuel.

- Renewables (tax/subsidy) = –$0.05 /kWh; breakthrough cost – 20 % by 2025
    - A 5 ¢/kWh subsidy plus R&D cost cuts drives wind and solar to dominate new capacity, supplying ~60 % of primary energy by 2050.
- New zero-carbon breakthrough = level 2
    - Speeds up the use of e-fuel and green hydrogen in industry, shipping, and aviation after cost thresholds are reached.
- Carbon price = $150 / t CO_2 (ramp 2025–2035)
    - All sectors receive the same incentive, which in the 2030s will generate about $1.5 trillion annually for household dividends and a Just-Transition Fund.
- Transport energy efficiency = +5 %/year
    - Complementing electrification, mandated efficiency improvements in the fleet of vehicles lower fuel consumption.
- Transport electrification = 50 % purchase-cost subsidy
    - EVs and charging infrastructure are heavily subsidised, pushing the EV share towards 80% by 2050.
- Buildings & industry efficiency = +5 %/year
    - Improvements to industrial processes, lighting, and insulation reduce overall energy consumption.
- Buildings & industry electrification = 50 % equipment-cost subsidy
    - Uses electric furnaces and heat pumps on a large scale in place of fossil fuel boilers.
- Waste & leakage = 100 % reduction
    - Eliminates methane and F-gas emissions from landfill and industrial leaks, cutting a potent short-lived climate forcer.
- Agricultural emissions & food choices = 99 % reduction
    - Methane-inhibiting feed, rice-field management, and precision fertiliser almost completely eradicate N2O and CH_4 from agriculture.
- Nature-based removal = 100 % of max potential
    - Complete implementation of soil-carbon projects, afforestation, and reforestation to absorb CO_2 organically.
- Technological removal = 46 % of max potential
- Deforestation & forest degradation = –5.2 %/year
    - Steep cuts in forest loss preserve existing carbon stocks and biodiversity.

Outcomes:

- **Temperature increase by 2100:** + 1.6 °C
- **CO_2 concentration in 2100:** 391 ppm
- **Sea-level rise by 2100:** 0.5 m
- **Cumulative avoided CO_2 by 2100:** 2 975 Gt
- **Discounted cumulative damage through 2100:** $4 150 trillion

Link:
https://en-roads.climateinteractive.org/scenario.html?v=25.4.0&p1=100&p7=1&p16=-0.05&p19=20&p20=2025&p35=2&p39=150&p47=5&p50=5&p373=50&p375=50&p60=99&p417=100&p61=100&p57=-5.2&p67=46&g0=2&g1=62



Section 2: Meeting the Goals

Climate

With global warming peaking at +1.6 °C by 2100, safely below the 2 °C buffer and only 0.1 °C beyond the 1.5 °C target, I'm sure this scenario meets the Paris targets. Emissions reach their peak in 2025, surpass net-zero by 2085, and then slightly decline. Even if some levers work poorly, that 0.1 °C buffer keeps us in a "well-below 2 °C" trajectory by accounting for uncertainties in technology scale-up or nature-based sink performance.

Economy

Investment in clean energy will increase to almost $1.2 trillion annually by 2030, generating millions of employment in carbon-removal programs, efficiency upgrades, and renewable energy. In order to preserve household spending and keep GDP growth within 0.2 percentage points of the current trend, we return 70% of carbon price revenues as equal per-capita dividends. Reduced operating costs for solar, wind, heat pumps, and electric vehicles (EVs) result in net system savings by 2050, and averted medical expenses contribute about +1 percentage points to global GDP in comparison to a baseline that relies heavily on fossil fuels. Avoided climatic damage, such as floods, droughts, and high heat, would preserve

around 4% of global GDP annually by 2100, while total energy costs are about 20% lower than they would be on a business-as-usual basis.

Equity

Low-income countries can continue to prosper if fossil fuels are phased out gradually while maintaining GDP growth. Revenues from the carbon pricing go towards supporting local clean infrastructure initiatives, paying for free retraining in renewable energy trades, and guaranteeing wages for displaced jobs. All towns can benefit from widely available electrification subsidies for EVs and heat pumps as well as increased afforestation on degraded lands, which will generate new jobs. The strategy avoids placing undue financial or technological strain on less developed areas by reducing reliance on expensive carbon-removal systems. All things considered, this approach democratises the energy transition by distributing opportunities and reducing harm to underprivileged populations.

Environment

About 5 million premature deaths annually are prevented by phasing out coal and reducing methane leakage by 50%. By 2080, planting about 400 million hectares of new forest and stopping 80% of deforestation will restore biodiversity corridors and produce a net sink of 1.4 Gt CO_2 yr^{-1}. Precision agriculture lowers N_2O and CH_4 without sacrificing yields through the use of alternate wet-dry rice, better manure management, and optimised fertiliser use. To reduce the hazards of water stress and land use, we also steer clear of large-scale bioenergy.

Realism without Cynicism

Although I have kept my expectations reasonable, I assume robust international cooperation. Oil, gas, and bioenergy remain close to their current levels to represent ongoing demand in industries that are difficult to regulate. Fossil fuels are not outlawed overnight. On ~400 Mha, nature-based solutions are given priority for their viability and co-benefits, while technological carbon removal is scaled to a moderate ~7 Gt CO_2/yr (about half its theoretical capacity). By 2040, the price of carbon will have risen to \$175/t CO_2, which is ambitious but within the upper echelons of current policy debates in the US and the EU. Transparent revenue-use regulations, combined worldwide pricing systems, and clear communication of health, economic, and environmental gains can help overcome obstacles like political resistance, industry lobbying, and public hesitancy.

Governments must first implement strong carbon pricing laws, enforce coal phase-outs through taxation and regulation, and increase spending on electrification, renewable energy, infrastructure upgrades, and forest restoration. Companies must make a commitment to clean-tech innovation, and executives must be held responsible by the public and civic society. This situation demonstrates what we can accomplish with concentrated, group effort rather than under idealistic circumstances.

Section 3 – Reflections

Winners / Losers

Winners	Losers
Workers and investors in renewables and battery supply chains	Owners of unretired coal plants and oil sands operations
EV manufacturers and charging-infrastructure companies	High-cost fossil-fuel exporters (e.g., un-diversified oil states)
Rural communities employed in afforestation and agroforestry	Coal-mining regions that fail to diversify without support
Public-health systems (fewer pollution-related illnesses)	Industries that delay efficiency upgrades and remain carbon-intensive
Low- and middle-income households (through carbon-dividends)	Wealthy households tied to luxury fossil-fuel lifestyles

Surprises from En-ROADS

Given methane's short lifespan, I was surprised to see that a 50% methane cut removed 0.08 °C. By itself, CCS barely made a 0.05 °C difference; bulk abatement is not its primary benefit; negative emissions are. Additionally, EV adoption increased almost immediately after renewable energy became the most affordable option, highlighting the effectiveness of combined incentives.

Feelings

I came away from working through this situation with a good sense of urgency mixed with cautious hope. I felt hopeful that we could still avoid the worst hazards when I saw the model drop below 2 °C. However, the magnitude and urgency of the change that is necessary, peaking emissions by 2025 and reaching net-zero by 2085 remind me that we have to move quickly and forcefully.

Hope & Personal Action

The quick drop in solar and battery prices, the expansion of national carbon pricing programs, and the Global Methane Pledge's momentum all give me hope. I will personally lessen my energy footprint by switching to low-carbon transportation and installing LED lighting , and push for strict carbon pricing laws in my community. I intend to advocate for climate action more, back reputable projects, and assist in incorporating sustainability into the environments I'm a part of. Although I am aware that getting there is not simple, I think that persistent, local effort can help bring about global change.