Title

Investigating, Forecasting and Proposing Emissions-Mitigation Pathways for CO_2 Emissions from Fuel Combustion Only ($FFCO_2$) for the United States and Canada

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Context-Intro

❖Rapid increase carbon emissions from combustion (IEA 2016)

❖Such surges in emit harmful toxins into the environment, thereby affecting human and ecological safety

❖Such alterations in the ecosystem has led many economies into developing low-carbon consuming economy

❖By so doing, the year 2015 saw a milestone in climate action with the negotiation of the 21st Conference of Parties (COP) of the Paris Agreement

❖The ultimate aim of the agreement is to sustain the increase in global average to well below two-degrees-celsius above pre-industrial levels

Case-study Rationale

- The United States being the second largest emitter of carbon emissions has withdrawn from the Paris Agreement (Rutherford, 2017).

- Canada is also used as a case study because Canada is projected to miss its Intended Nationally Determined Contributions (INDCs) of mitigating industry-wide emissions by 30% below 2005 levels by 2030 (Canada's Climate Action Tracker, 2017)

Study Contribution

❖As most studies focus on investigating the seemingly plausible relationship between total CO_2 emissions and economic growth, studies in literature have failed to inform policymakers on the possible effect of CO_2 emissions from fossil fuel combustion ($FFCO_2$) and economic growth. Against this backdrop, we fill such a gap in literature by investigating the relationship between $FFCO_2$ and economic growth

❖Also, based on the case-study rationale, we forecast the amount of $FFCO_2$ and propose $FFCO_2$ emissions-mitigation pathways for the USA and Canada based on a piecewise artificial neural network (ANN) algorithm with the aim of achieving zero- $FFCO_2$ by the year 2030.

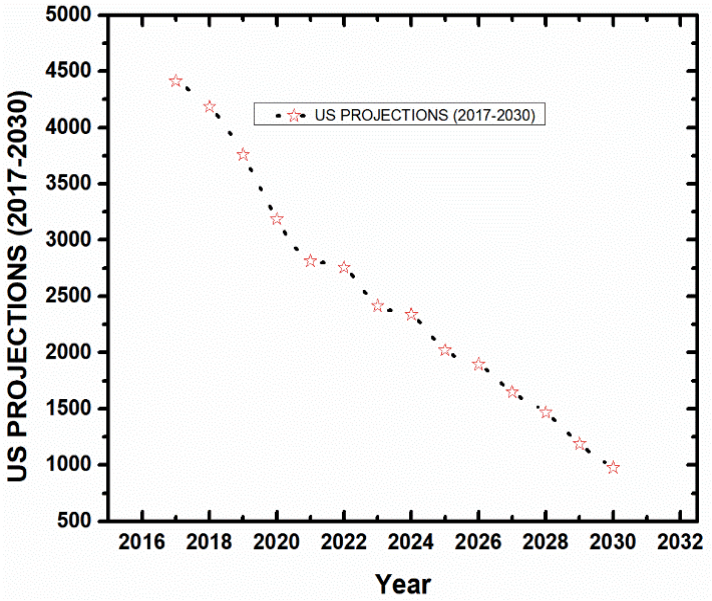
Main Findings

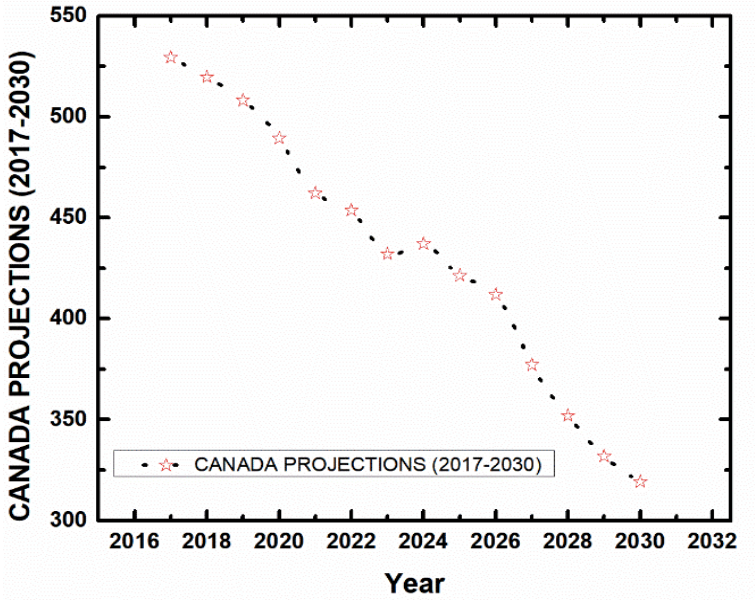
- In investigating the causal relationship between $FFCO_2$ and economic growth, we conclude that there exist a unidirectional causal relationship running from economic growth to $FFCO_2$

- Checking for the predictive accuracy of the ANN approach, we first test the performance of our algorithm's output against the observed values. ANN projections covering the period of 2011-2016 inclusive for the USA and Canada was used as our test datasets. For the USA and Canada, our algorithm output achieved a Mean Absolute Percentage Error (MAPE) of ~98.78% and ~98.21% respectively.

$FFCO_2$ Forecasting

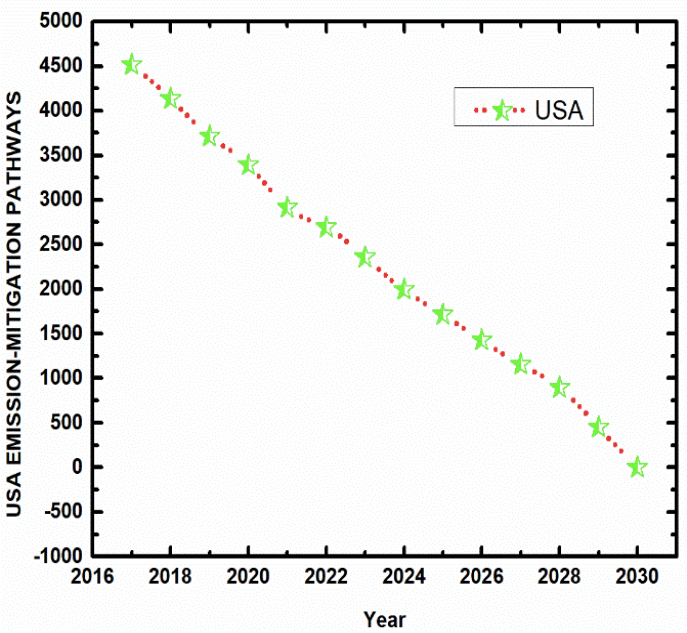
❖Based on the testing stage performance of our ANN approach, we forecast $FFCO_2$ from 2017-2030 inclusive for the countries employed herein. For USA, emissions will hit ~3187.43$MtCO_2$ in 2020, ~2021.89$MtCO_2$ in 2025, and ~977.46$MtCO_2$ in 2030. Canada's emissions will be ~489.23$MtCO_2$ in 2020, ~421.36$MtCO_2$ in 2025, and ~319.34$MtCO_2$ in 2030.

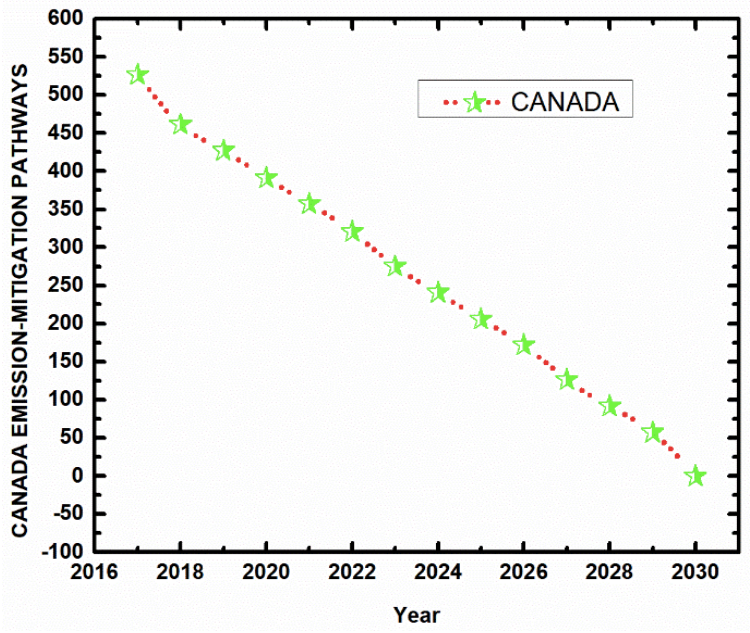




$FFCO_2$ Mitigation Pathways

To achieve zero $FFCO_2$ by 2030, the USA has to decrease $FFCO_2$ 2016 emissions level of (~4833.08$MtCO_2$) to ~3391.41$MtCO_2$ and ~1716.18MtCO2 by 2020 and 2025 respectively. Canada will have to decrease its 2016 emission level of (~540.77$MtCO_2$) to ~391.13$MtCO_2$ and ~205.63$MtCO_2$ by 2020 and 2025 respectively.





Study Implications

The findings of this study have important policy implications for the USA and Canada.

❖If investments in clean energy, cap-and-trade system intensification, greater openness to foreign direct investments, and technological innovation in meeting cleaner energy targets are not instituted, these countries stand a risk of not meeting their Intended Nationally Determined Contributions.

❖The $FFCO_2$ mitigation pathways cannot be realized if the USA and Canada fail to adopt mitigation measures like the cap-and-trade system. Also, if mitigation policies do not promote low carbon usage, institute a suitable and functional framework for climate change governance, and encourage investment into energy production from renewable sources, the proposed $FFCO_2$ pathways will not be achieved.