Economic Impacts of Low-Carbon Policies

Center for Study of Science, Technology and Policy (CSTEP) is a private, not-for-profit (Section 25) Research Corporation registered in 2005

Designed and Edited by CSTEP

Contributors: Krithika Ravishankar, Ramya Natarajan

Editor: Garima Singh

Designer: Alok Kumar Saha, Pooja Senthil

This policy brief should be cited as: CSTEP. (2022). Economic Impacts of Low-Carbon Policies. (CSTEP-PB-2022-07).

May 2022

Center for Study of Science, Technology and Policy

Bengaluru	Noida
#18 & 19, 10th Cross, Mayura Street, Papanna Layout, Nagashettyhalli RMV II Stage, Bengaluru - 560094 Karnataka (India)	1st Floor, Tower - A, Smartworks Corporate Park Sector 125, Noida - 201303 Uttar Pradesh (India)

Introduction

Meeting India's short- and long-term climate commitments made at COP26 entails a complete economic transformation, which can have considerable developmental tradeoffs. Many long-term energy and climate models that project low-carbon pathways for the country consider the gross domestic product (GDP) to be exogenously driving growth in various sectors. However, low-carbon policies or technologies will also impact GDP, as well as other economic variables like employment and income. To ensure an equitable transition to net zero, without compromising on the development objectives, it is important to understand the multiplier impacts (or spillover effects) of low-carbon interventions on the economy.

Social accounting matrix (SAM) — a tabulated representation of economic transactions between all agents such as industries, households, government, factors of production, etc. — can help with this. SAMs enable the estimation of macroeconomic indicators like GDP, gross value added (GVA), labour intensity, household income, etc., and also serve as the database for more complex analyses like multiplier modelling. While SAMs have been built for India, most of them do not have a disaggregated energy sector (crucial for studying the economy-wide impact of low-carbon policies).

The Center for Study of Science, Technology and Policy (CSTEP) conducted a SAM extension exercise under which the energy sector was disaggregated and then used to build multiplier models for analysing the macroeconomic and distributional impacts of low-carbon policies. The models help in identifying the economic sectors or agents that would be worst affected by energy transition and would, therefore, require policy support. Since the SAM-multiplier analysis[1] is based on a static single-year SAM and assumes demand to be exogenous, the analysis presented here pertains to supply-side interventions and fiscal measures only.

[1] The social accounting matrix (SAM) contains 5 household income accounts each for rural and urban areas. Every account represents a population quintile.

The output multiplier results (used for the 'Increased RE' scenario) show the changes in the total income of each class in INR.

The price multiplier results (used for the 'Increased Solar Subsidy' and the 'Increased Fossil-Fuel Tax' scenarios) show changes in price, cost of production, and household expenditure as percentages. These percentages are converted to absolute values by applying them to the original SAM values that are in INR.

Scenario Descriptions

Increased Renewable Energy (RE) Scenario

A higher share of solar and other non-conventional sources in electricity generation and a reduced share of coal-based thermal sources (~45%) was considered to understand the implications of India's power sector targets.

Increased Solar Subsidy Scenario

A 60% increase in the subsidy provided for solar power production was considered to understand how this affects the cost of production in key industries and the overall household consumption expenditure.

Increased Fossil-Fuel Tax Scenario

A higher implicit carbon tax was considered by increasing the sales and excise tax on raw and imported coal, crude oil, and natural gas by 50%, to understand the distributional impacts of a carbon tax.

Key Insights

‘Increased RE’ has an overall net positive impact on the economy even without any demand-side measures or technological changes:

Annual GDP increases by an additional 0.16% as most sectors, besides fossil-fuel industries, continue to grow.

Household income also increases by 0.16% on an average, with rural households benefitting more than urban ones. This translates to an increase of INR 2172 in the annual per capita income in rural areas (at 2017-18 prices) on an average.

Even if the power sector evolves to reduce coal consumption, there would be a compensating demand for it from key industries such as iron and cement, which grow due to increased construction of RE plants, particularly solar.

The net effect on employment (rural and urban) appears to be limited (<0.05% increase).

‘Increased solar subsidy’ has an overall positive impact on the various sectors and households:

Higher profit margins are observed across sectors, especially iron and steel, manufacturing, transport, and electricity generation. This could potentially free up resources for capital investment by these industries, thus promoting domestic manufacturing (the ‘Make in India’ initiative).

Rural households can save between INR 810 and 1910 per capita per year, while urban households can save up to INR 2310 per capita per year on an average.

‘Increased fossil-fuel tax’ results in increased cost of production and market price for all industries but market prices do not rise as much as production cost for most industries, suggesting that the tax burden is largely borne by the industries:

Profits for key industries like iron and steel, transport, electricity, and other manufacturing industries would reduce.

An additional INR 685 per capita consumption expenditure is incurred by rural households and an additional INR 960 per capita consumption expenditure is incurred by urban households per year.

Recommendations

Investing in RE and the related subsidies is recommended over increasing the fossil-fuel tax, as the former has higher benefits for the economy, especially in the short term.

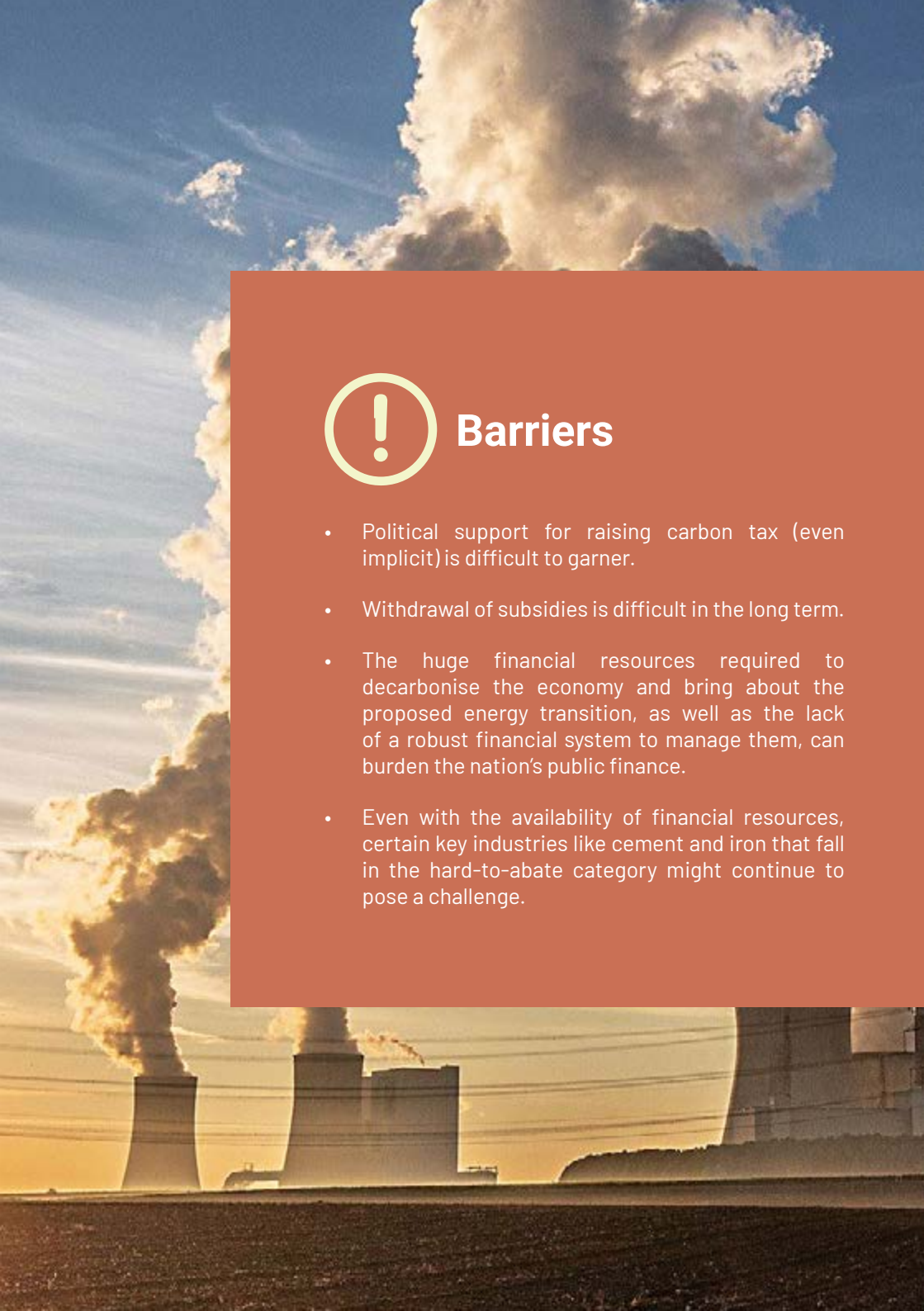
Reducing the share of coal-based electricity alone is not sufficient for reducing overall coal demand. Decarbonisation of key industries (iron, cement) is also needed to ensure significant emissions reduction and phase out of coal.

Shifting to RE and subsidising solar electricity (and possibly other RE sources) should be considered as it can lead to increased profits for key industries and subsequent capacity expansion (aligning with the 'Make in India' initiative).

Tax on unrefined fossil fuels can then be imposed to encourage industries to invest in low-carbon technologies to avoid the tax burden. This would discourage fossil-fuel use and also have lower negative impacts on households (than a tax on refined fossil fuels would).

Benefits

- Increasing the share of RE in electricity generation leads to higher GDP and household income. Rural households benefit more than urban households.
- Increasing solar subsidies results in higher profit margins across industries, promoting domestic manufacturing and the 'Make in India' initiative. Households also incur lower expenditure.



Barriers

- Political support for raising carbon tax (even implicit) is difficult to garner.
- Withdrawal of subsidies is difficult in the long term.
- The huge financial resources required to decarbonise the economy and bring about the proposed energy transition, as well as the lack of a robust financial system to manage them, can burden the nation's public finance.
- Even with the availability of financial resources, certain key industries like cement and iron that fall in the hard-to-abate category might continue to pose a challenge.

CENTER FOR STUDY OF SCIENCE, TECHNOLOGY & POLICY

Bengaluru
18 & 19, 10th Cross, Mayura Street,
Papanna Layout, Nagashettyhalli (RMV II Stage),
Bengaluru-560094, Karnataka, INDIA

Noida
1st Floor, Tower-A, Smartworks Corporate Park, Sector-125,
Noida-201303, Uttar Pradesh, India


www.cstep.in


+91-8066902500


cpe@cstep.in


@cstep_India