DEVELOPMENT AND CLIMATE POLICY SYNERGIES: INSIGHTS FROM GLOBAL MODELLING STUDIES

June 2015

Narasimha D. Rao
David McCollum
International Institute for Applied Systems Analysis

Navroz K. Dubash
Radhika Khosla
Centre for Policy Research

POLICY BRIEF

SUMMARY

India's approach to climate policy is based on amplifying synergies between sustainable development and climate outcomes, or co-benefits. However, the evidence base for the magnitude of these synergies remains limited. This brief summarizes the result of global models, which provide strong evidence of complementarities between climate mitigation outcomes, reduced air pollution and enhanced energy security. These results are robust across a wide range of models. They suggest there are considerable gains across multiple objectives of development policy from pursuing India's stated co-benefits approach to climate policy.

The pursuit of 'co-benefits' as a way of reconciling development and climate imperatives is well entrenched in Indian policy and academic circles. India's National Action Plan on Climate Change (NAPCC) states that India's approach to climate action is based on the pursuit of co-benefits -- measures that 'promote…development objectives while also yielding co-benefits for addressing climate change effectively' (Prime Minister's Council, 2009). The 12th Five Year Plan develops a co-benefits framework for low carbon strategies, making explicit the benefits of integrating sustainable development and climate change strategies (Government of India, 2012)[i]. As India develops its Intended Nationally Determined Contribution (INDC) for the 2015 Paris negotiations, exploring the linkage between sustainable development and climate policy, and the potential for achieving multiple objectives simultaneously, will continue to be significant.

While co-benefits remain the conceptual bedrock of Indian climate policy, the idea has not, as yet, received sufficient attention in analytical circles. A recent study reviewing national energy and climate modelling studies found that existing Indian models pay limited attention to the multiple objectives of policy such as distributional outcomes, air pollution and energy security (Dubash et al., 2015), and global models have only recently done so. In order to shed light on the scope for co-benefits in India, this brief reviews the findings of recent studies from global Integrated Assessment Models (IAMs) on India's projected carbon dioxide (CO_2) emissions, air pollution and energy security.[ii]

Two sets of results are discussed here. We first present detailed results from a single model (MESSAGE), to illustrate the time trends and synergies between multiple development objectives, including CO_2 emissions, air pollution, and energy security. Next, we present the results of nine additional global models, all of which are quite different, to illustrate the robustness of these synergies.[iii]

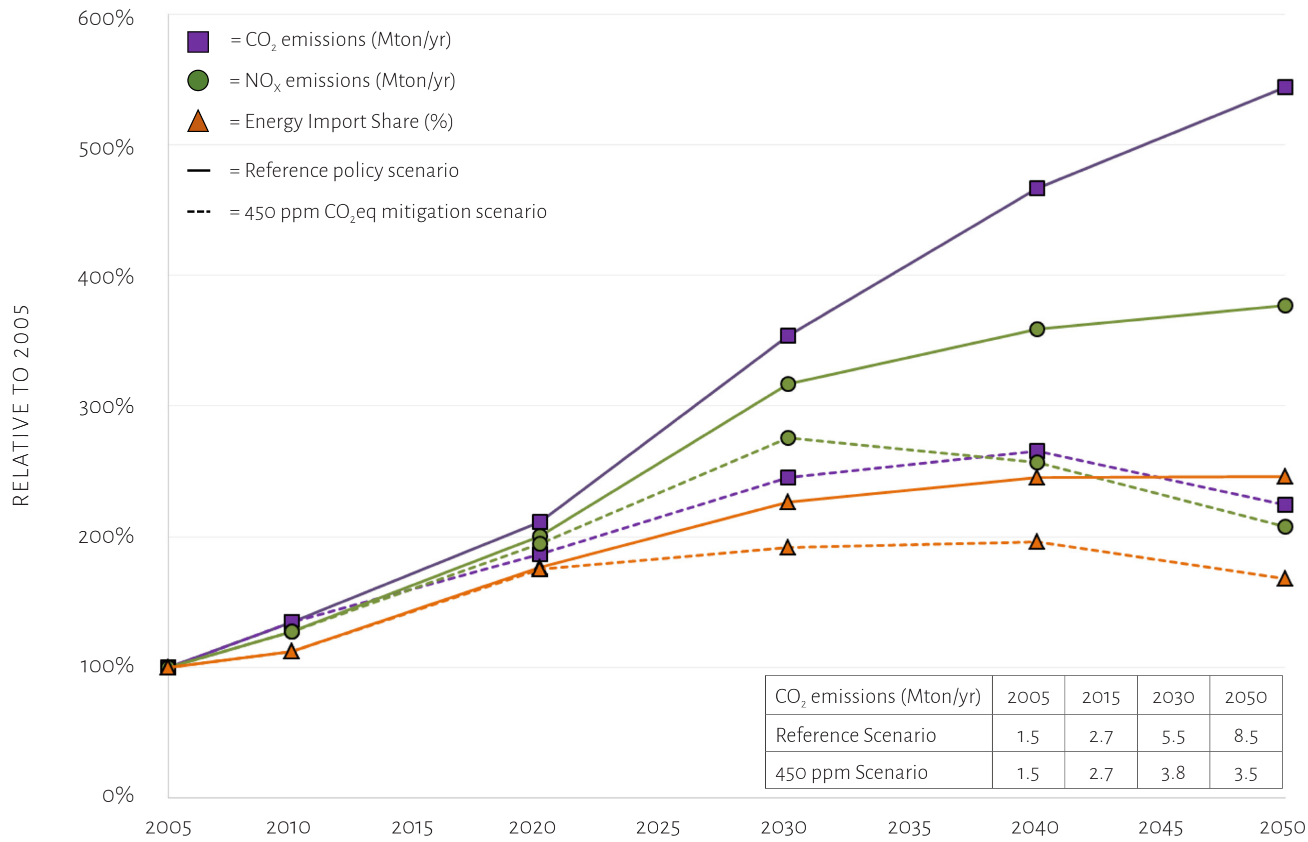
Analysis of Co-Benefits

The key result from the MESSAGE model is that there are strong complementarities across climate, air pollution and energy security outcomes. Figure 1 presents the results of this model for two scenarios: reference (full implementation of energy policies and targets at the time of India's Cancun pledge)[iv] and energy and climate policy consistent with a 450 ppm CO_2 eq target.[v] The figure shows that projections of all three indicators examined – CO_2 emissions, nitrogen oxides or NO_X emissions (which are generated by coal power plants, vehicle use, and diesel plants, and are a source of both particulates and ground-level ozone, which lead to serious health effects), and energy import share (a measure of energy security) – are considerably higher for the reference case (solid lines) than for the climate policy case (dotted lines).

CENTRE FOR POLICY RESEARCH

International Institute for Applied Systems Analysis
IIASA www.iiasa.ac.at

Figure 1: Projections of CO_2 emissions, NO_x emissions, and primary energy import share for India



CO_2 emissions (Mton/yr)	2005	2015	2030	2050
Reference Scenario	1.5	2.7	5.5	8.5
450 ppm Scenario	1.5	2.7	3.8	3.5

All numbers are indexed to their respective year-2005 starting points. Results come from the AMPERE WP3 scenarios run by the MESSAGE model. Note that MESSAGE models South Asia as a single region; we derive results for India by prorating according to population.

The results show that in the reference case, India's CO_2 emissions could double by 2030 relative to 2015 and triple by 2050.[vi] However, under policies consistent with a global 450 ppm scenario, CO_2 emissions increase by a more modest 1.5 times 2015 levels by 2030.

Similarly, in the reference scenario, NO_X emissions are projected to double by 2030, and the energy import share could be more than 50% higher than today. Under the more stringent 450 ppm scenario, NO_X increases at a slower rate and declines after 2030, while the energy import share remains relatively flat after 2020 and declines after 2040, demonstrating the simultaneous benefits of integrated climate, pollution and energy security policies.

Note that although global IAMs such as MESSAGE typically construct scenarios around climate mitigation policies, rather than sustainable development, these results remain relevant to Indian policy making. In both scenarios, the drivers of outcomes are the underlying shifts in the energy economy, such as greater efficiency of use, or a switch away from fossil fuels. The results presented here show that these underlying shifts, regardless of their motivation, are likely to achieve multiple development objectives.

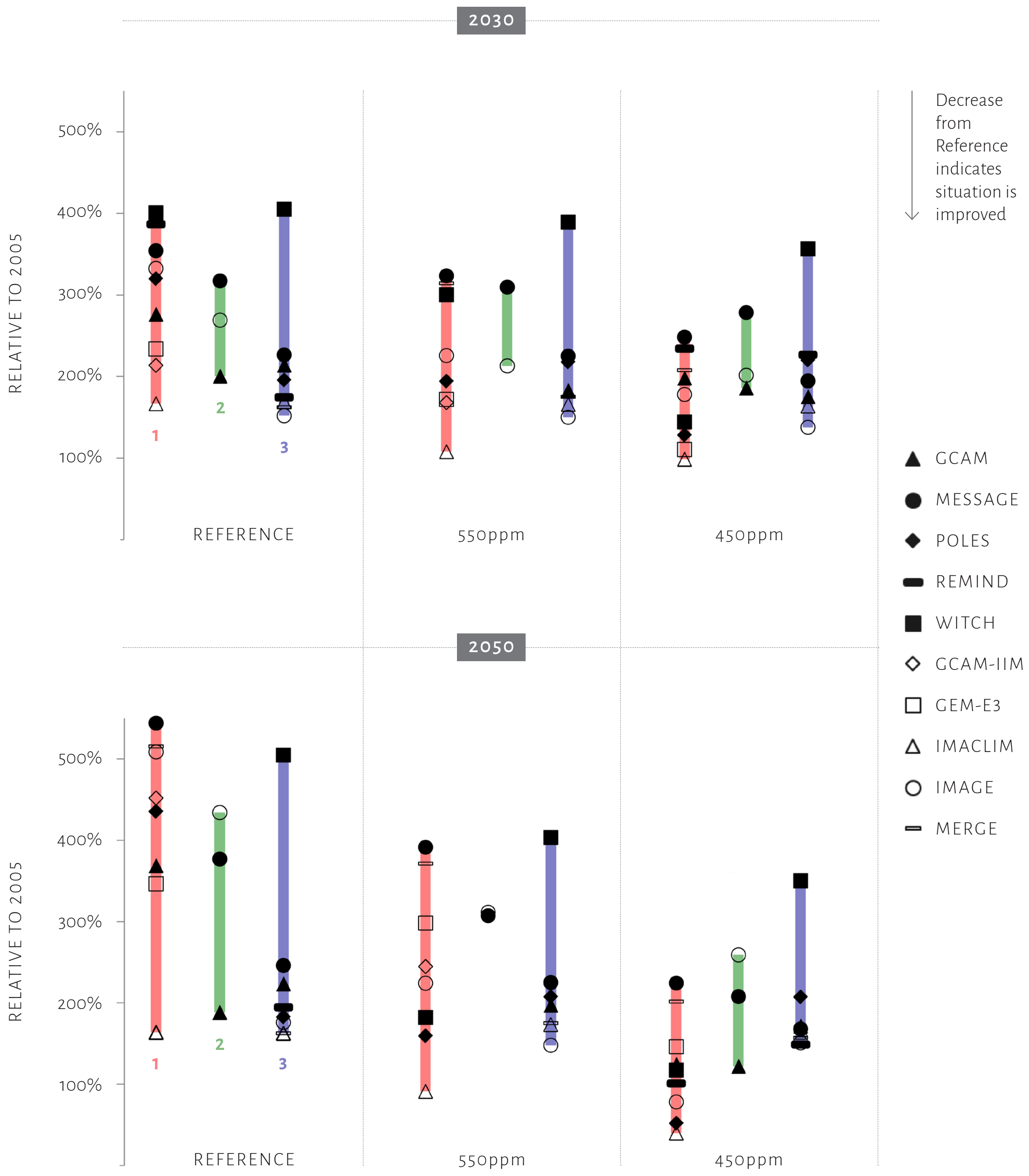
It is important to also note that IAMs assign mitigation to countries based on cost-effectiveness rather than equity. In the few scenarios where IAMs model burden sharing (e.g., equal per-capita emissions or equal economic effort), India's mitigation responsibility would be lower than that implied by the cost-based allocation (Tavoni et al., 2013). However, regardless of absolute levels of emissions or the type of allocation regime, it is notable that, as the next section shows, all models exhibit synergies rather than trade-offs across multiple objectives.

Multiple Model Results

Examining results for a larger sample of ten studies (Figure 2) illustrates the overarching point of this brief: the same underlying energy/climate policies bring about simultaneous reductions in CO_2, NO_X and energy import shares. Figure 2 presents these results for time snapshots in 2030 and 2050. In addition to the 450 ppm (2°C) scenario they also include a less stringent 550 ppm scenario.

The result of multiple models reveals a much larger spread of possible outcomes. For example, reference case CO_2 emissions in 2030 are projected anywhere from 1.7 to 4 times 2005 levels in 2030, and 1 to 2.5 times under the 450 ppm scenario. Despite the diverging nature of these results, however, certain trends remain robust across the scenarios and multiple objectives.

Figure 2: Multiple Model Results for Indian CO_2 emissions, NO_x emissions, and primary energy import share, relative to 2005 levels.



Multi-model results are sourced from different inter-comparison projects. Co-benefits are illustrated by comparing each metric across the three scenarios: reference, 550 ppm and 450 ppm.

1 = CO_2 (Mton/yr)

2 = NO_x (Mton/yr)

3 = Primary energy import share (%)

Figure 2 shows that for each of the given models both NO_X emissions and energy import shares are reduced in the climate stabilization scenarios, relative to the reference case. In addition, it shows that the gains for all objectives are higher in moving from moderate (550 ppm) to stringent (450 ppm) climate stabilization, than from reference case to moderate stabilization. In other words, the greatest gains in development objectives are achieved with more stringent 450 ppm scenario than in the less stringent 550 ppm scenario.

Conclusion

Global models provide strong evidence that there are substantial complementarities between climate mitigation, reduced air pollution and energy security outcomes. These results are robust across a wide range of IAMs, despite model-to-model differences in the projected absolute levels of CO_2 and NO_X emissions and import shares. The results suggest there are considerable gains across multiple objectives of development policy from pursuing India's stated co-benefits approach to climate policy.

ENDNOTES

i The Intergovernmental Panel on Climate Change states sustainable development is the basis for addressing climate policies, and documents the interaction between the two (IPCC, 2014).

ii IAMs combine representations of human, energy and climate systems and interactions among these to evaluate environmental change and the implications of alternative policy responses. The scenario databases examined are the following: Global Energy Assessment (Riahi et al., 2012), Asian Modeling Exercise (Calvin et al., 2012), LIMITS (Kriegler et al., 2013; Tavoni et al., 2013), and AMPERE (Kriegler et al., 2015).

iii The databases can be accessed via the respective links: GEA (http://www.iiasa.ac.at/web-apps/ene/geadb/), AME (https://secure.iiasa.ac.at/web-apps/ene/AMEDB/), LIMITS (https://tntcat.iiasa.ac.at/LIMITSDB/), and AMPERE (https://tntcat.iiasa.ac.at/AMPEREDB/). The modelling protocols describing the scenario designs of the studies can also be found at these links and/or in the cited overview papers.

iv The reference scenario is based on India's Cancun pledge and other targets as of 2011. Specifically, this includes a 20% reduction in GHG intensity between 2005 and 2020, achieved by at least 50 GW of fossil-free electric capacity by 2020. See Kriegler et al. (2015) for further details. Recent, more aggressive targets could result in lower reference emissions than shown here.

v IAMs assign mitigation burdens by country based on global cost-effectiveness calculations. Here the global target is 450 ppm CO_2 eq by 2100, which corresponds to achieving (with >50% likelihood) a 2°C global average temperature increase above pre-industrial levels.

vi Notably, these projections fall at the lower end of the range of projections from low-carbon policy scenarios in national modelling studies (see Dubash et al., 2015), which assume much higher GDP growth rates and a wider range of assumptions on current policy implementation.

REFERENCES

Calvin, K., et al. (2012). The role of Asia in mitigating climate change: Results from the Asia Modeling Exercise. Energy Economics 34(S3): S251-S260.

Dubash N.K., R. Khosla, N.D. Rao, K.R. Sharma (2015). Informing India's Energy and Climate Debate: Policy Lessons from Modelling Studies, Research Report, Climate Initiative, Center for Policy Research, New Delhi.

Government of India (2012). Twelfth Five Year Plan (2012-17): Faster, More Inclusive and Sustainable Growth. Planning Commission, Government of India.

IPCC (2014). Summary for Policymakers. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., et al. (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Kriegler, E., et al. (2013). What does the 2°C target imply for a global climate agreement in 2020? The LIMITS study on Durban Platform scenarios. Climate Change Economics 4(4).

Kriegler, E., et al. (2015). Making or breaking climate targets: The AMPERE study on staged accession scenarios for climate policy. Technological Forecasting and Social Change 90(Part A): 24-44.

Prime Minister's Council on Climate Change, Government of India (2009). National Action Plan on Climate Change. Government of India.

Riahi, K., et al. (2012). Energy Pathways for Sustainable Development. In: Global Energy Assessment: Toward a Sustainable Future. IIASA, Laxenburg, and Cambridge University Press, Cambridge, United Kingdom and USA.

Tavoni, M., et al. (2013). The distribution of the major economies' effort in the Durban platform scenarios. Climate Change Economics 4(4).

ACKNOWLEDGEMENTS

This Policy Brief is produced by the Centre for Policy Research (CPR) in partnership with the International Institute for Applied Systems Analysis (IIASA) as part of a larger project: 'Toward a Robust Development Focused INDC for India.'

The authors thank K. Rahul Sharma and Shibani Ghosh for research assistance. This document is an output from a project funded by the Climate and Development Knowledge Network (CDKN). CDKN is a programme funded by the UK Department for International Development (DFID) and the Netherlands Directorate-General for International Cooperation (DGIS) for the benefit of developing countries. The views expressed and information contained in it are not necessarily those of or endorsed by DFID, DGIS or the entities managing the delivery of CDKN, which can accept no responsibility or liability for such views, completeness or accuracy of the information or for any reliance placed on them. We are also grateful for additional financial support from the Oak Foundation. All responsibility for analysis and views expressed in this report rests with the authors.