

Making Sense on Its Own Terms

India in the HFC and Aviation Negotiations

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This chapter covers India's engagement with two recent deals related to climate change that were not carried out under the auspices of the United Nations Framework Convention on Climate Change (UNFCCC). On 6 October 2016, 191 countries participating in the 39th general assembly of the International Civil Aviation Organization (ICAO) agreed to the first-ever industry-specific deal to reduce emissions. Also, after seven years of negotiations, on 15 October 2016, 197 countries reached a historic agreement in Kigali, Rwanda, to amend the Montreal Protocol on Substances that Deplete the Ozone Layer, and phase down hydrofluorocarbons (HFCs). Coming soon after the Paris Agreement on climate change, these deals were products of a season of climate negotiations. Earlier such attempts had failed. Why then did they succeed in 2016? What compromises were struck? How did India win or lose?

These deals truly matter. First, they deal with greenhouse gases (GHGs) or sectors that had, thus far, avoided strong regulatory

control. Second, both are concerned with projected emissions rather than current emissions or historical responsibility. Third, in these deals, historical distinctions between developed and developing countries have been blurred. Fourth, they offer the prospect of greater transparency, verifiability, and enforcement.

This chapter discusses points of contestation between negotiating parties. An important common factor was the threat of unilateral action, outside a multilateral framework, such as the European Union (EU) proposing to include aviation in its Emissions Trading Scheme (ETS), or refrigerant standards changing in the American or European markets. Although these measures would impact commercial interests, the chapter also considers how domestic conditions were changing in India and creating new constituencies in favour of a deal. The chapter's central focus is on the in-country analysis and consultations in recent years, which allowed for a more proactive—rather than merely defensive—approach to the HFC (and partly aviation) negotiations. The deals could not have been possible if India had not made sense of the science, the technological alternatives, the interests of varied groups, and the economic impact on its own terms.

Contestations

HFCs, primarily used for commercial, residential, and automotive refrigeration, are GHGs that are several hundred (and in some cases, several thousand) times more potent than carbon dioxide (CO₂) in contributing to climate change. Though meant to replace hydrochlorofluorocarbons (HCFCs) in order to protect the ozone layer, there was growing fear that runaway HFC emissions would undermine or negate efforts to mitigate CO₂ emissions (Sridhar and Chaturvedi 2017).

Globally, HFC consumption was projected to increase five to nine times during 2010–50, with the largest growth in developing country markets (Velders et al. 2009, 2015). Also, it was predicted that HFCs could contribute almost 20 per cent of total global warming by 2050 (Xu et al. 2013). While global studies warned of the impending risks, there was limited awareness or clarity in India about the challenge, the potential of natural refrigerants (Bhattacharyya 2010;

Padalkar 2012), the scale and growth rate of emissions, and costs of phasing down HFCs.

HFC Negotiations, and Pushback, at Many Forums

In July 2009, G8 countries said they would ‘work with ... partners to ensure ... HFC emissions reductions ... under the appropriate framework’ (G8 Declaration 2009: Para 66). The same month, Mauritius and the Federated States of Micronesia proposed that the Montreal Protocol be amended to regulate HFCs.

At the Montreal Protocol’s annual meeting in November, many developing countries opposed the proposal. India wanted existing implementation issues with HCFC phase out to be resolved first. Malaysia felt that, without alternatives, any discussion on HFCs was premature. China, India, and the Dominican Republic, among others, wanted HFCs to be handled under the UNFCCC. Another amendment proposal, by the US, Canada, and Mexico, was eventually withdrawn. The final decision omitted references to HFCs and replaced them with ‘environmentally sound alternatives’ (*Earth Negotiations Bulletin* 2009).

The pressure, nonetheless, kept mounting. In November 2011, the Bali Declaration called on parties to the Protocol to ‘pursue ... effective means of achieving the transition to low global warming potential alternatives to ozone depleting substances’ (Montreal Protocol 2011). In February 2012, the Climate and Clean Air Coalition was launched by the United Nations Environment Programme (UNEP) and six countries—Bangladesh, Canada, Ghana, Mexico, Sweden, and the US—to improve air quality and target short-lived climate pollutants. India refused to join this.

Tensions came to a head in 2013. In September, then Indian Prime Minister Manmohan Singh and then US President Barack Obama agreed (bilaterally and at the G20 Summit) to use the expertise and institutions of the Montreal Protocol to phase down HFCs and report emissions under the UNFCCC. The prime minister chose to keep both options open (UNFCCC and Montreal Protocol) and acted in concert with other G20 countries. Within a few weeks, however, India opposed discussing amendments in the Montreal Protocol.

India's negotiators scuttled a political deal for four reasons. They feared that developed countries would ignore action on CO₂, which was the much-larger and longer-lasting GHG. Second, there was concern that the UNFCCC would be bypassed, while not guaranteeing financial support for India to transition to alternatives. In fact, there was a higher chance of getting money through the Protocol's Multilateral Fund (MLF) than through the UNFCCC. Third, although historically China and India had opposed HFC discussions under the Montreal Protocol, recent developments made India unsure of China's strategy. China had agreed to work with the US on HFC phase-down negotiations in June 2013 (The White House 2013). In the October 2013 Montreal Protocol meetings, when India opposed discussion on HFCs, China remained silent. By not overtly supporting India's position, China signalled that its own position could shift. A side deal between China and the US would put undue pressure on India to yield. Fourth, critics argued that the prime minister had not gained prior support from negotiators at the Ministry of Environment and Forests. For the prime minister, it was a strategic decision at the G20 and for India-US bilateral relations. But line ministry officials, intent on keeping a hard line in HFC negotiations, undermined the prime minister's approach.

The negotiators worried that they were being forced into a corner. The G8 and G20 declarations, the amendment proposals, plurilateral coalitions, and bilateral announcements were negotiating tactics. However, the rules were uncertain and India's understanding of the issues was inchoate. Although bilateral and plurilateral deals might have allowed India to carve out flexibility, it reflexively preferred the relative certainty of the UNFCCC process.

Logjam on the Aviation Runway

The aviation sector, at the beginning of the twenty-first century, accounted for only 2 per cent in global emissions, but 4–9 per cent of anthropogenic global warming (Lee et al. 2009). International aviation emissions had grown 76 per cent during 1990–2012, double the average growth in emissions from the rest of the global economy (UNFCCC 2014).

The UNFCCC did not have any direct mandate to regulate aviation emissions. The responsibility lay with ICAO. The Convention on International Civil Aviation (Chicago Convention), which established ICAO in 1947, had two core principles: special circumstances and respective capabilities of states; and non-discrimination between aircraft operators.

From 1 January 2012, the EU included aviation emissions in its ETS. Airlines were told to buy permits for 15 per cent of their carbon emissions, with the remainder provided to them as free allowances. It exempted airlines from countries with 'equivalent measures' to combat climate change. This violated the UNFCCC principle of common but differentiated responsibilities (CBDR), while not offering objective criteria to determine equivalence (Rajamani 2011).

There was strong pushback from developed and developing countries. In October 2011, India submitted several proposals to the UNFCCC, arguing that unilateral trade measures would violate the principle of CBDR and that poor countries would be paying rich ones, rather than the other way round (Government of India 2011). This was itself a point of contention. In one interpretation, exemptions for developing countries would not necessarily extend to exemptions for sub-national entities (airlines or passengers in this case) (Müller 2012). Other scholars, however, argued that while the EU had valid competitiveness concerns, it was still possible to introduce differentiation while avoiding 'crude differentiation' between developed and developing countries as blocs (Scott and Rajamani 2012: 481).

In February 2012, more than 20 countries, including China, India, Russia, and the US, debated a basket of countermeasures against the EU. Aviation officials urged the EU to let ICAO develop a global scheme. By March, China and India told their airlines not to comply with the directive; China halted orders worth US\$14 billion of Airbus aircraft; and the US threatened legal action. The EU agreed to temporarily suspend these requirements for international flights, but insisted that an ICAO deal 'cannot take 100 years ...' (International Centre for Trade and Sustainable Development [ICTSD] 2012).

In September 2013, the ICAO Assembly decided to develop a global market-based measures (GMBM) scheme to offset aviation

emissions. The plan was to adopt it in 2016 and bring it into force by 2020 (ICAO 2016b). In December 2015, ICAO's president tabled a draft policy on GMBM. In February 2016, ICAO's Committee on Aviation Environmental Protection achieved consensus on global aircraft standards for CO₂ emissions (ICAO 2016a).

The EU was again threatening to introduce unilateral measures. Its posture, described as 'contingent unilateralism', sought to create incentives for a global deal, in reaction to slow progress at multilateral forums (Scott and Rajamani 2013). However, a legal analysis of the EU's proposed scheme concluded that it could be challenged as a prohibited quantitative trade restriction (Bartels 2012).

Changes on the Ground

Opposition in the negotiations in both arenas notwithstanding, economic interests were beginning to shift within India. Uncertainties remained on the costs of transition, access to technology, and proportionate burden sharing, but market conditions within and outside the country were also changing.

Market Shifts and Technological Alternatives in the HFC Market

Segments of the Chinese and Indian chemical industry had opposed the HFC phase down. As major producers of the HCFC-22 refrigerant, 5 Indian companies, along with 19 other (mostly Chinese) firms, could destroy the by-product HFC-23 and earn credits under the Kyoto Protocol's Clean Development Mechanism (CDM). In 2010, two European non-governmental organizations (NGOs)—CDM Watch and the Environmental Investigation Agency—charged these firms with making supernormal profits, thanks to a perverse incentive to produce and incinerate even more HFC-23 (Schapiro 2010). The EU eventually banned HFC-23 carbon credits in the ETS as of May 2013.

Meanwhile, business opportunities emerged in other segments as Indian firms started undertaking research and development (R&D) for alternatives. By 2012, three companies in India were developing room air conditioners with refrigerants other than HFC-410a (which, with a global warming potential [GWP] of 2088, is a potent

GHG). These included: Godrej and Boyce, which was selling split air-conditioning systems with low-GWP HC-290 (propane; GWP < 5) with the highest five-star energy-efficiency rating; and Daikin and Panasonic with medium-GWP HFC-32 (GWP = 675). Daikin was willing to let developing country firms use basic HFC-32 patents at no charge through ‘non-assertion contracts’ (Council on Energy, Environment and Water [CEEW] et al. 2013).

Alternatives for automobile air conditioning were fewer and expensive. At the time, almost all mobile air conditioners produced or marketed in India used HFC-134a (GWP = 1430). Indian manufacturers could consider three options: HFO-1234yf (GWP = 4), which was significantly more expensive; HFC-152a (GWP = 124), which was less expensive but vehicles needed a secondary cooling loop to isolate the flammable refrigerant; and CO₂, which was cheap, although component costs to use it were significantly higher.

Manufacturers faced the dilemma between shifting production lines entirely to low-GWP refrigerants or building cars on two platforms, one for Indian consumers and one for exports. Nearly all vehicle manufacturers in China, Europe, India, Japan, and North America had chosen HFO-1234yf as the next-generation refrigerant (European and North American automakers had already introduced hydrofluoroolefin [HFO]-using models). There was an opportunity to leapfrog to low-GWP gases but the costs remained unclear.

India’s Aviation Sector Takes Off

International airline operators had historically won the lion’s share (approximately 60–90 per cent in key sectors) of India’s international aviation market. However, thanks to rapid growth in Indian aviation, the share of Indian operators in international passenger traffic increased from approximately 29 per cent to 38 per cent during 2004–16 (their share in freight traffic consistently stayed below 20 per cent) (Aggarwal et al. 2016: 6; Directorate General for Civil Aviation n.d.).

Would the GMBM adversely impact Indian operators? In the short run, the bulk of the impact would be on foreign operators. However, growth for the Indian operators would also be affected as their market shares rose. Moreover, there was a concern that some

foreign operators might undercut their competition by not passing costs of emission offsets on to the passengers. Many West Asian carriers, receiving significant government subsidies, could potentially offer discounted prices, whereas private Indian carriers would lose market share or profits if they had to absorb the costs of offsets (Jansen 2015; Open and Fair Skies 2015).

Contestations Redux: The Role of In-Country Analysis and Consultations

Changing market conditions and the emergence of new negotiating platforms had made it harder for India to reject discussions on HFCs and aviation outright. New analysis and consultations were needed.

Consultations with industry and other stakeholders were integral to evolving a negotiating posture. Research institutions such as the Centre for Science and Environment (CSE), CEEW, the Institute for Governance and Sustainable Development (IGSD), and the Natural Resources Defense Council (NRDC) organized several consultations. They also partnered with the Indian government or participated in consultations that the Ministry of Environment, Forest and Climate Change convened. Consultations included individual companies (Honeywell, Daikin, Panasonic, Godrej, Tata Motors, or Maruti Suzuki) and industry associations (Confederation of Indian Industry, Refrigeration Air Conditioning Manufacturers' Association, and Society of Indian Automobile Manufacturers).

Estimating HFC Emissions and Costs of Transitions

The consultations laid bare five issues of key concern to India (Ghosh 2013): (i) ensuring that CO₂ mitigation continued even if HFCs were phased down; (ii) identifying temperature impacts on India if HFCs, CO₂, or both, were not curtailed; (iii) understanding costs of transition, efficiency gains/losses, changing standards in export markets, commercial opportunities, and patent-related concerns; (iv) testing for safety and establishing standards for alternative refrigerants; and (v) seeking compensation for firms for lost business or help with new skills and technologies.

In 2015, Indian researchers analysed 16 industrial sub-sectors and estimated that, with no phase down, HFC emissions would increase to 500 metric tonnes of carbon dioxide equivalent (MtCO₂-eq) in 2050 (cumulatively, 6.55 gigatonne [Gt]CO₂-eq). About 63 per cent of HFC emissions in 2050 would be dominated by residential and commercial cooling sectors (Chaturvedi et al. 2015). Low-GWP refrigerants, energy-efficient products, and smaller floorspace could reduce residential air-conditioning emissions up to 46 per cent during 2010–50 (Chaturvedi and Sharma 2016). In commercial buildings, emissions could jump from 1.8 MtCO₂-e in 2015 to 211 MtCO₂-e in 2050 (Sharma, Chaturvedi, and Purohit 2017).

Costs of transition included that of alternative refrigerants, training servicing personnel, product design, and servicing equipment. In 2016, another study estimated economy-wide costs for India to be €12 billion (2015 prices) if India froze HFCs after 2030 (Purohit et al. 2016). This would rise to €34 billion with an earlier freeze date.

Once the analyses became public, India sought extra time to make a commitment. In bilateral consultations, American negotiators pushed back against using economy-wide costs as the basis of negotiations. The US-based NGOs also focused on funding under the MLF. A group of philanthropic foundations created a US\$53 million initiative for energy efficiency to complement the shift to HFC alternatives. However, Indian negotiators insisted that the full costs of transition had to be accounted for, and rejected other methodologies.

Another concern was access to technology. Environmental NGOs demanded a shift to natural refrigerants (CO₂, ammonia, hydrocarbons, water, or air), which would avoid locking in manufacturers and consuming industries into new chemical refrigerants (Environmental Investigation Agency 2016). Substitute gases did not have manufacturing facilities in India (only Naveen Fluorochemical had started manufacturing HFO-1234yf under contract for Honeywell). Industry representatives repeatedly demanded access to patent-free alternatives. Although patents had historically not been a barrier to replacing ozone-depleting substances under the Montreal Protocol, concerns were rising regarding HFC alternatives: increased use of process, equipment, and application patents to extend intellectual property protection and create a

near monopoly for HFO blends (Bhushan 2016); whether the MLF would fully compensate for licensing costs; and need for greater R&D investment at home (Chaturvedi et al. 2016). Some Indian firms were developing alternatives, but industry as a whole was not ready. An overarching objective was to avoid periodic shifts from one refrigerant to another and, instead, find alternatives that would help Indian industry leapfrog over HFCs and avoid the 'chemical treadmill' altogether (Bhushan 2015).

Analysing and Projecting Aviation Growth and Emissions

The proposed GMBM for aviation emissions also embodied many uncertainties. First, the main proxy for calculating emissions was revenue tonne kilometres (RTKs), or the weight of revenue passengers and freight multiplied by kilometres flown. However, even with the same RTKs, fuel-efficient aircraft would emit less than less-efficient ones. For India, with relatively modern fleets, RTKs would either overestimate emissions or not give due credit for aircraft efficiency.

The second uncertainty was the impact on India's National Civil Aviation Policy, which targeted 200 million passengers and 10 million tonnes of freight by 2027, implying annual growth rates of 14 per cent and 20 per cent, respectively. By making air travel more expensive, the GMBM would make it harder to meet targets and erode market share for Indian operators.

A third issue was how to maintain differentiation and leave room for growth. In late summer 2016, although there had been almost no consultations with Indian airline operators, the government urgently sought new analysis to develop its negotiating position. Based on aviation trends in nearly 140 countries, a new study proposed four factors to evaluate options: inbound tourism/arrivals; outbound tourism/departures; per capita income; and presence of an aviation hub (Aggarwal et al. 2016: 7–8).

With growing incomes, demand for international air travel would rise. For middle-income countries, the ratio of outbound departures to population was 5–8 per cent; and for India, it was only 1.2 per cent. As Indians grew richer, outbound departures could rise to 40 million and inbound tourism up to 20 million annually. Even

without hosting a major international aviation hub, India would witness significant growth in international aviation.

Consequently, India's RTKs were estimated to rise from 6.5 billion to 19.3 billion when it reached middle-income status (around 2030), but only to 10 billion in 2020. If the GMBM capped RTKs in 2020, then by 2030 India would have to be offsetting 10 billion RTKs annually. As proposed, the GMBM would put significant burden on Indian aviation and undermine the principles of differentiation and respective capabilities under the Chicago Convention.

Getting the Deals

From a position of significant uncertainty, by 2015 and 2016, Indian negotiators had much more analysis on which to depend. The Paris climate deal also added momentum for deals on HFCs and aviation.

Kigali Amendment Balances Demands on HFCs

Soon after the in-country HFC emissions scenarios were published in 2015, India submitted a proposal to amend the Montreal Protocol: freezing HFC emissions in 2030–1 and reducing them to 15 per cent of peak value by 2050. Overall, 4.2 GtCO₂-eq could be avoided between 2010 and 2050 (41 GtCO₂-eq during 2050–2100). The shift occurred, thanks to in-country analysis, recognition of changing markets, and technology development within Indian industry. As a good faith measure, during the Kigali negotiations, India unilaterally promised to cease production of HFC-23 (Sarkar 2016).

Earlier proposals from North America, Europe, and small island states had demanded a 2021 freeze date for all countries. Eventually, developed countries agreed to an earlier baseline (2011–13) and freeze year (2019). For most developing countries (including China), the baseline was set at 2020–2, with 2024 as the freeze year. India and a few others secured a later baseline (2024–6), with freezing in 2028. By not satisfying everyone's demands, the Kigali Amendment signalled a good compromise.

Why did India change its stance? In November 2014, China and the US 'agreed to work together towards the global phase down of HFCs'

(The White House 2014). It became clear that India would have to craft its own strategy and not hitch its fortunes to China's. It, therefore, compromised and agreed to negotiate HFCs under the Montreal Protocol (Ghosh 2014). In June 2016, India and the US issued another joint statement 'to adopt an HFC amendment in 2016 with increased financial support from donor countries to the Multilateral Fund ... [and] to work together ... to address [GHG] emissions from international aviation' (Ministry of External Affairs 2016).

The final push in the late summer of 2016 was to introduce a wedge between India's and China's projected emissions. They are the only developing countries that manufacture HFCs but China's output is much bigger. In 2050, India's unabated HFC emissions would have been 7 per cent of the total against China's 31 per cent. India's air-conditioning market and HFC consumption were expected to accelerate only after 2025. Differentiation with China, which would witness rapid emissions during 2015–30, was warranted (Chaturvedi and Sharma 2015). India held this line on differentiation with China in Kigali—notably, a very different form of differentiation than that between North and South that has dominated the UNFCCC negotiations.

Overall, India demonstrated willingness to be part of a multilateral deal but secured a differentiated outcome. First, its heating, ventilation, and air-conditioning (HVAC) sector could grow, while refrigerant manufacturers got time to shift to alternatives. Second, the MLF would cover incremental costs related to production, consumption, servicing, and patents. Third, a review of technological options was envisaged so that India could test alternatives. In September 2016, it announced a domestic, collaborative R&D programme to develop next-generation, sustainable refrigerants (Bhasin, Sridhar, and Chaturvedi 2017). Fourth, despite three baselines, the bulk of global HFC emissions would be phased down earlier. Fifth, the deal was legally binding.

Differentiation Undermined in the ICAO Deal

In aviation, there remained considerable points of difference leading up to the 2016 ICAO Assembly. Both Brazil and China demanded autonomy to set criteria on eligibility of emissions units (ICAO

2016e, 2016f). China also proposed a voluntary first phase for the GMBM (2020–5). The EU insisted that voluntary steps would render it ineffective and wanted a ratcheting mechanism to increase ambitions based on periodic reviews (ICAO 2016c). The US suggested an opt-out mechanism, giving states flexibility to decide when to participate.

India's interests were more aligned with Brazil and China. They also converged, to an extent, with proposals from small island nations, which argued that tourism was an important component of their economies (ICAO 2016g). Several NGOs—the International Coalition for Sustainable Aviation (ICSA)—protested that the GMBM's exemptions weakened its environmental integrity. The ICSA wanted more focus on alternative fuels and quantifying life-cycle emissions for CO₂ standards (ICAO 2016d). These positions were consistent with India's demand for greater balance between offsets and other approaches.

The final GMBM deal came at the cost of both ambition and differentiation. It did not focus on actual emissions, giving manufacturers no incentive to develop more efficient aircraft. It prioritized offsets and shifted the burden to consumers. The GMBM becomes mandatory for all countries (barring small island states and least developed countries) only in 2027. Unlike the Kigali Amendment, there was no differentiation between developed and emerging economies, or among developing countries.

Estimated costs for offsetting vary from US\$2.66 to US\$18.82 per tonne of CO₂ (Chawla and Aggarwal 2016), but the deal does not distribute costs proportionately or based on historical responsibility. The shift from a 'sectoral' approach to 'individual offsetting' from 2030 discriminates against India. The draft ICAO proposal used the former whereby a single average growth factor for emissions would apply to all operators. The US, instead, wanted the individual approach, wherein operators with higher growth rates in RTKs would have to offset more. This approach absolved airline operators in developed countries from historical responsibility and laid disproportionate burden on airlines in fast-growing developing countries.

Climate governance is characterized by regime complexity. Although UNFCCC serves as the umbrella convention, issue-specific governance has emerged in several areas and via other institutions/initiatives, including HFCs (Montreal Protocol), aviation (ICAO), marine bunker fuels (International Maritime Organization), energy R&D cooperation (Mission Innovation), and solar energy promotion (International Solar Alliance). The HFC and aviation negotiations should be viewed in that context.

For several years, India resisted unilateral measures as well as international regulation outside the UNFCCC framework. Evolving market conditions, growing political pressure from bilateral deals, and the momentum created by the Paris Agreement changed the context and calculus for Indian negotiators. While the Paris Agreement relied on a bottom-up architecture, permitting each signatory to define its low-carbon pathway, the HFC and aviation deals were, ultimately, top-down.

The real shift within India was its attempt to make sense of complex technical issues on its own terms. Indian industry and negotiators recognized shifts in global markets. Research, analytics, and extensive consultations helped to move the needle. By showcasing economy-wide costs, India held the line for a later date for its own HFC phase down. In aviation, late-stage analysis and consultations helped India somewhat, but it failed on differentiation. The international deals created the condition for a common framework and avoided the risk of unilateral actions. However, in the future, domestic regulation, investment in technology, training of technical/servicing personnel, and nudging consumer behaviour will become central to achieving the aims of emission reduction while maintaining growth in an emerging economy.

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