



STAFF CLIMATE

NOTES

Proposal for an International Carbon Price Floor among Large Emitters

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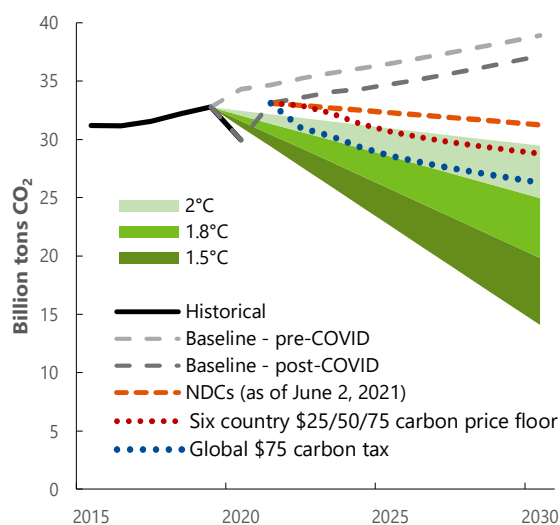
Summary

Countries are increasingly committing to midcentury ‘net-zero’ emissions targets under the Paris Agreement, but limiting global warming to 1.5 to 2°C requires cutting emissions by a quarter to a half in this decade. Making sufficient progress to stabilizing the climate therefore requires ratcheting up near-term mitigation action but doing so among 195 parties simultaneously is proving challenging. Reinforcing the Paris Agreement with an international carbon price floor (ICPF) could jump-start emissions reductions through substantive policy action, while circumventing emerging pressure for border carbon adjustments. The ICPF has two elements: (1) a small number of key large-emitting countries, and (2) the minimum carbon price each commits to implement. The arrangement can be pragmatically designed to accommodate equity considerations and emissions-equivalent alternatives to carbon pricing. The paper discusses the rationale for an ICPF, considers design issues, compares it with alternative global regimes, and quantifies its impacts.

Introduction

Global carbon dioxide (CO₂) emissions, along with other greenhouse gases (GHGs), must be cut by around a quarter to a half by 2030 to be on track to stabilize the climate. With currently implemented policies, central case (post-pandemic) projections suggest global CO₂ emissions will rise from around 30 billion tons in 2020 to 37 billion by 2030. Illustrative pathways suggest that containing warming to ‘well below’ 2°C and ideally towards 1.5°C above pre-industrial levels requires global CO₂ emissions in 2030 to be limited to about 15 to 25 billion tons (Figure 1). Without these reductions, the likelihood of stabilizing the climate will decline rapidly, especially if there is lock-in of long-lived fossil fuel capital (for example, coal plants). Cutting emissions at this pace requires additional measures equivalent to a global carbon tax of around \$75 per ton by 2030 (and rising further beyond 2030).

Figure 1. Global CO₂ Projections and Pathways for Warming Targets



Source: IMF staff estimates using UNEP (2020) & IEA (2020). Note: \$25/50/75 carbon price floor is for China, US, India, EU, Canada, UK - conditional on achieving NDCs. Global \$75 carbon tax starts at \$15/ton, rising steadily from 2022 to 2030. Pathways assume energy-related national CO₂ emissions are reduced in proportion to total greenhouse gas emissions. COVID = coronavirus; NDCs = nationally determined contributions.

Under the Paris Agreement countries are increasingly pledging emissions neutrality targets for midcentury... A total of 195 parties signed the Agreement and most submitted first-round mitigation pledges in their nationally determined contributions (NDCs), many to be met by 2030. Countries are now submitting revised pledges ahead of the Glasgow climate conference (COP26) in November 2021 as part of the first five-yearly iteration of the Agreement's "ratchet mechanism." As a result, countries are increasingly committing to long-term 'net-zero' emissions targets.¹ To date, 59 countries accounting for 54 percent of global emissions have committed to net-zero emissions by midcentury, including Canada, the European Union, Japan, Korea, the United Kingdom, the United States (all 2050), and China (2060).²

...but there is a need to ratchet-up near-term climate ambition... The Paris Agreement's universal country participation is critical for its legitimacy. But ratcheting up ambition among 195 parties simultaneously is proving challenging. To date, 85 countries have submitted revised targets, but many do not entail substantial additional emissions reductions by 2030.³ Meanwhile, at a global level, revised commitments – even if fully implemented – remain insufficient to meet the Paris target of limiting warming to "well below 2°C" (Figure 1).

...and, crucially, there is a need to match near-term ambition with credible policy action. While most near-term country targets state the end goals in terms of national emissions levels by 2030, few provide detail on the means to achieve those reductions. Even if countries further tighten their 2030 pledges (by better aligning them with long-term emissions neutrality), there is no automatic mechanism ensuring targets are actually achieved—in fact, scaling up mitigation policy unilaterally can be extremely challenging given concerns about competitiveness and that other countries may not achieve their mitigation commitments.

An international carbon price floor (ICPF)⁴ offers a realistic prospect of catalyzing the needed global action in the next decade, and its success is in participants' individual and collective interests. The ICPF has two key components: (1) it would be negotiated between a small number of key large emitting countries, and (2) negotiation would focus on the minimum carbon price that each must put on their CO₂ emissions.⁵ Ratcheting up ambition among a smaller group of countries such as the large emitters would be more straightforward than a global agreement, and regional carbon price floors would also be a possibility. Concerns about other countries low-balling their ambition, failing to implement commitments, and the potential adverse impacts on competitiveness of domestic exporters from unilateral action would all be addressed. Negotiating based on minimum price levels would be transparent, and would focus policymakers on the means to achieve the emissions cuts required in this decade. All participants would be made better off by an effective agreement,

¹ Also known variably as "carbon neutrality," "emissions neutrality," or "climate neutrality," with varying definitions such as coverage of GHGs and treatment of the land use sector.

² As of 26 May 2021. See www.iea.org/reports/world-energy-outlook-2020/achieving-net-zero-emissions-by-2050.

³ With some exceptions, for example, the European Union has recently pledged to cut GHGs 55 percent below 1990 levels by 2030 (up from a previous 40 percent reduction pledge) and the United States has pledged to cut emissions 50-52 percent below 2005 levels by 2030.

⁴ As initially proposed in IMF (2019a, 2019b). The proposal shares some features of the "Climate Club" suggested in Nordhaus (2015) where a coalition of willing countries would implement a common carbon price while imposing a general tariff on nonparticipants. The current proposal differs by seeking to build off and reinforce, rather than substitute for, the Paris process, and to enhance practicality through pragmatic design. McKibbin and others (2014) also discuss integrating price targets into negotiations over countries mitigation commitments.

⁵ Besides carbon pricing (or other mitigation instruments), supporting policies will also be needed (for example, public investments in clean technology infrastructure networks and critical technologies, and measures to promote just transitions). These supporting measures can be largely decided at the national level, however.

as all would benefit from the collective action to address climate change. And an agreement among the major economies would strongly influence other countries to follow suit.

To make progress on the price floor, flexibility provisions are likely needed on pragmatic grounds to address equity concerns and potential obstacles to carbon pricing in some large emitters. Given their lower per capita income, smaller contribution to historical emissions, and generally higher emissions intensity of production, lower price floor requirements for emerging market economies (EMEs) may be appropriate and needed to encourage their participation. Provisions allowing for some inclusion of non-pricing approaches which yield equivalent emissions outcomes to pricing may also be needed to accommodate countries for whom, due to domestic political or other factors, standard carbon pricing instruments are difficult to implement or increase.

An ICPF would also likely circumvent pressure for unilateral border carbon adjustments (BCAs)... In the absence of internationally coordinated carbon pricing, jurisdictions moving ahead with aggressive carbon pricing may well impose BCAs (that is, charges for the embodied carbon in imports) on jurisdictions without adequate carbon pricing. BCAs are far less efficient and effective than price floors in achieving emissions reductions as they apply to only a small portion of a trading partner's emissions.

...and the prospects for implementing a pragmatic ICPF may be better than those for alternative regimes to supplement the Paris Agreement, namely “pure” carbon pricing or annual country-level emission targets. A pure carbon pricing agreement—for example, one which specifies a single carbon price level implemented exclusively through explicit carbon pricing instruments—has fewer degrees of freedom for addressing international equity issues and precludes participation of countries where explicit carbon pricing is currently difficult to implement. Reaching agreement over country-level emissions targets is difficult because of the zero-sum nature of negotiating each individual target,⁶ is less aligned with the operating logic of the Paris Agreement,⁷ and entails more uncertainty over the specific policy actions countries will take.

The ICPF would complement rather than conflict with the existing Paris Agreement. The Agreement allows for “mini-lateral” agreements to augment ambition, since it was well-known by negotiators at the time of drafting that the then-intended nationally determined contributions were not sufficient for achieving the Agreement's temperature goals. The focus on price floors, rather than price levels, accommodates countries needing to exceed the floor price to meet their Paris mitigation pledges. In effect, the ICPF and the Paris Agreement would reinforce one another, and other countries may follow the lead of the large emitters in setting up similar carbon price floor arrangements, such as regional schemes.

An ICPF could be especially timely, providing the basis for countries to “build back better” in a collaborative and coordinated fashion. The health and economic crisis precipitated by the COVID-19 pandemic has not obviated the urgent need for cutting global GHGs (Figure 1). Governments are scaling up investment plans to boost their economies while managing the risks of burgeoning fiscal deficits. In this context, it is important that fiscal policy reorients private investment towards the development, adoption, and diffusion of low-carbon technologies while maintaining fiscal space. Carbon pricing achieves both objectives, by

⁶ See Weitzman (2017).

⁷ Whereas the previous international climate agreement (Kyoto Protocol) comprised quantified and legally enforceable emissions targets, the Paris Agreement is based on voluntary contributions which are expected to increase over time.

simultaneously providing the essential price signal needed to foster private investment in clean technologies and mobilizing much-needed revenues, which are especially valuable in the aftermath of the pandemic.

However, to ensure the arrangement is effective and provides incentives for sustained participation among key parties, getting the design details right for an ICPF would be critical. This paper elaborates on the rationale for an ICPF, discusses the main design issues, compares the price floor with other international regimes for scaling up global mitigation, and assesses the global emissions implications of alternative ICPF designs.

Rationale for an ICPF

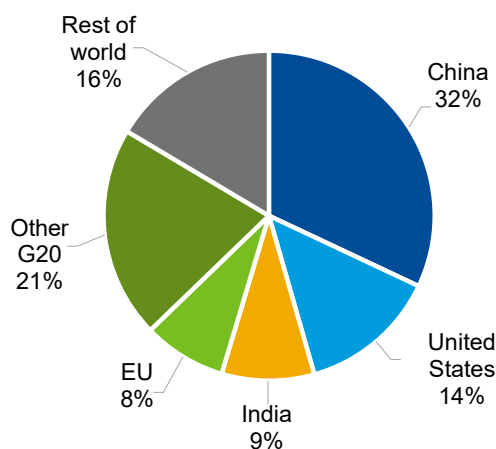
The main rationales for an ICPF are that it can (1) facilitate negotiation in a transparent manner and (2) scale up ambition and policy action by addressing key obstacles. These are described as follows.

Ease of Negotiating Policy Action

NUMBER OF PARTIES: Agreement over an ICPF may be more likely than a negotiated strengthening of near-term mitigation pledges for the Paris Agreement because far fewer parties are involved.

The very large number of signatories to the Paris Agreement makes it very difficult to agree on both (1) a coordinated scaling up of mitigation pledges over the next decade, and (2) incentive mechanisms to encourage countries to comply with their pledges. In contrast, the ICPF would be limited to a small number of large emitters which could still cover the bulk of global emissions. For example (see Figure 2), China, India, and the US account for 57 percent of baseline CO₂ emissions in 2030, and the Group of Twenty (G20) makes up 85 percent (including EU countries).⁸

Figure 2. Global Share of Baseline CO₂ Emissions by Country and Region, 2030



Source: IMF staff calculations.
Note: Baseline refers to projected emissions without new, or tightening of existing, policies. G20 = Group of Twenty.

NUMBER OF PARAMETERS: The ICPF offers focused negotiation as it targets a shared price floor, which can be adjusted in response to new information, rather than country-specific parameters. Multilateral dialogue over scaling up ambition under the Paris Agreement is further hindered because (1) each party has their own mitigation pledge, and (2) the process for submitting revised pledges is uncoordinated and assessments of the global emissions implications can only occur after the submission process is largely completed. In contrast, a common emission floor price requirement improves the transparency of countries' mitigation actions and limits the discussions to just one key parameter. Assessments of the emissions impact of different scenarios for ICPF participation and price levels can be done ahead of time (see the following) to inform dialogue over design specifics. Provisions for discretionary adjustment of price floors if collective

⁸ In a broader context, there have been escalating tensions over trade and security issues between some of the potentially key players, though ring fencing climate may be possible (see, for example, www.state.gov/u-s-china-joint-statement-addressing-the-climate-crisis).

emissions are not on track to meet objectives can be included. Pragmatic considerations—notably equity issues—likely require some deviation from a pure price floor however (see below).

TYPE OF PARAMETERS: Negotiation for an ICPF is also facilitated by focusing on a transparent and efficient policy action, the price floor. It is widely accepted that carbon pricing is the most efficient mitigation instrument—it cost-effectively provides across-the-board incentives to reduce energy use and shift to cleaner fuels as well as establishing the essential price signal for redirecting new investment to clean technologies. Indeed, there appears to be global momentum for carbon pricing with, for example, over 60 pricing schemes now implemented at regional, national, and subnational level, major pricing initiatives launched in China and Germany in 2021, and rising prices in the EU Emission Trading System (ETS)⁹—global coordination over pricing is needed, however, given the global average price is still only \$3 per ton.¹⁰ In contrast, NDCs under the Paris process focus on targets that are heterogeneous, therefore making pledged ambition difficult to compare across countries.¹¹ This also leaves large uncertainties over the specific policy actions countries will take to implement their mitigation pledges, reducing the credibility of the pledges.

Addressing Obstacles to Scaling Up Policy Action

CONCERNS OTHER COUNTRIES WILL LOWBALL OR RENEGE ON THEIR COMMITMENTS: The coordinated approach under an ICPF, with countries agreeing on ambition and acting simultaneously on the needed policies, helps to address concerns that deter stronger unilateral ambition and policy actions. Countries acting unilaterally under the Paris process may be reluctant to pledge greater mitigation ambition, and scale up mitigation policies, as they would bear the costs while the global climate benefits of their actions mostly accrue to other countries. A “minilateral” approach, where a smaller group of countries agree on the global goal and act simultaneously on the pricing to achieve it, helps to address these concerns—even if a country does not see it as being in its own unilateral interest to adopt a carbon price, it can still be far better off due to the collective benefits if all relevant countries adopt the same price.¹² In fact, country participants may support robust floor prices as this leads to bigger emissions reductions for all participants and bigger benefits for all—this is the key incentive to join the agreement. The ICPF may also encourage nonparticipants, and participants for whom the minimum price is not binding (because they implement a higher price to meet their NDCs), to strengthen their mitigation actions.

COMPETITIVENESS (CONCERN ABOUT RELATIVE COST OF DOMESTIC/FOREIGN GOODS): An ICPF can neutralize the effect of carbon pricing on the relative cost of domestic and foreign goods and head off the prospect of unilaterally imposed BCAs. As countries move towards higher emissions prices and deeper decarbonization, other measures—for example, free allowance allocations in the EU and Korean emissions trading systems (ETEs)—for addressing competitiveness impacts on energy-intensive, trade-exposed (EITE)

⁹ World Bank Group (2021).

¹⁰ Staff calculations, including jurisdictions where the price is zero.

¹¹ Current pledges for 2030 vary in terms of (1) target variables (for example, emissions, emission intensity of GDP, clean energy shares), (2) nominal stringency (for example, percent emission reductions), and (3) baseline years against which targets apply (for example, historical versus projected baseline emissions). See <https://www4.unfccc.int/sites/NDCStaging/Pages/Home.aspx>.

¹² In fact, even acting unilaterally, most countries should be better off from carbon pricing because the domestic environmental co-benefits should outweigh any carbon mitigation costs—see, for example, Parry and others (2015).

industries will become less effective.¹³ A system of unilaterally imposed BCAs would be highly inefficient in the sense that: (1) BCAs would be restricted to emissions embodied in exports from EITE (or perhaps some broader group of) industries, whose emissions are typically around 2 to 10 percent of domestic CO₂¹⁴; and (2) multiple BCA regimes emerging unilaterally may lead to a proliferation of different prices on a country's exports depending on their trading partners. On the other hand, if a unilateral regime of BCAs does emerge, it may catalyze interest in a more comprehensive and uniform international pricing regime.

INTERNATIONAL EQUITY: International equity concerns can be addressed in a transparent manner under an ICPF. Scaling up action in large EMEs (with high dependence on coal) is critical; however, under the Paris process: (1) these countries have differentiated, but unspecified, responsibilities and (2) financial compensation mechanisms for their mitigation effort are opaque.¹⁵ An ICPF could be designed with this international equity principle in mind, for example, through higher price floor requirements for higher-income countries and/or a simple transfer mechanism to lower-income members of the ICPF.

DOMESTIC DIFFICULTY OF CARBON PRICING: International coordination on carbon pricing might reduce domestic opposition (for example, from industry), but realistically some accommodation for countries where pricing remains difficult is likely needed. Carbon pricing is potentially more difficult when countries are acting unilaterally due to competitiveness concerns. But even when major trading partners simultaneously scale up pricing, the acceptability of higher energy prices at home may be constrained by, for example, opposition from household and industry groups. Further flexibility to accommodate non-pricing approaches with emissions-equivalent outcomes may therefore be needed (see below).

Design Issues for an ICPF and Comparisons with Alternative Regimes

There are several major design issues that would need to be considered for an ICPF. These include country participants, emissions coverage, floor price levels, possible differentiated pricing, compensation payments or other inducements to join, allowable instruments for meeting requirements, and compliance monitoring.¹⁶ The following discussion takes each in turn, recommending a pragmatic design for the ICPF, and then briefly compares this with a pure pricing regime and annual country-specific emissions targets.

¹³ See Keen and others (2021). The EU, for example, plans to transition to a BCA by 2023, which would apply charges to the carbon content of imports competing with EITE industries and perhaps rebate EITE exporters for domestic carbon charges (see https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en). Other countries are considering this approach (see, e.g., www.aljazeera.com/economy/2021/2/5/bb-uk-pm-to-push-allies-to-agree-on-carbon-border-taxes-report) and the Biden Climate Plan contained a proposal for a BCA (see <https://joebiden.com/climate-plan>).

¹⁴ See Keen and others (2021).

¹⁵ Advanced countries pledged to mobilize \$100 billion annually from 2020 onwards, through public and private sources, for mitigation and adaptation on a project-by-project basis in developing countries (OECD 2019a put flows at \$71 billion for 2017, though there is much dispute over the additionality of these flows). The future accessibility of this funding to an individual country, and the potential dollar amount, is highly uncertain, however.

¹⁶ Additional practical and institutional details would need to be agreed, such as mechanisms for adjusting the minimum price, converting the agreed price into local currency, emergency clauses allowing temporary violations, and procedures for admitting new countries. These issues should be manageable, however, with a small number of countries involved. Legal issues must also be resolved, for example whether the agreement is voluntary as under a softer law instrument (for example, memorandum of understanding or some form of executive agreement) or takes the form of an international treaty (like the UN Convention and Paris Agreement). The former would be more feasible (for example, in the United States, a treaty would require ratification by Congress) but inclusion of possible compensation mechanisms may imply the creation of international legal obligations which would usually require a treaty.

Key Design Issues

PARTICIPANTS: It makes sense to simplify negotiations by limiting the initial setup of the agreement to a core group of large emitting countries. For example, potential participants might include China, the European Union, India, the United States, and other G20 members with ambitious pricing already in place, like Canada and the United Kingdom. Procedures for allowing others to subsequently join the agreement should be established, but without compromising the decision-making capability of the core group.

EMISSIONS COVERAGE: Starting with a narrower emissions focus may facilitate accomplishing the initial steps. At first, the ICPF requirement might apply to fossil fuel CO₂ emissions from the power/district heating and industrial sectors because (1) fossil fuel CO₂ emissions are consistently monitored,¹⁷ (2) they are generally the most responsive emissions to pricing and therefore play the key role in the early stages of clean energy transitions,¹⁸ (3) most ETSs are currently limited to these sectors, and (4) fuels in these sectors are largely untaxed (or generally subject to minimal excises in terms of CO₂ equivalent taxes)¹⁹. Progressively, the ICPF might then be extended to all fossil fuel CO₂ emissions (about two-thirds of global GHGs) though an issue becomes how to treat preexisting transportation fuel taxes (see below). Eventually, the arrangement could cover broader emissions sources (for example, from industrial processes, methane leaks from fuel extraction and distribution, and forestry) as capacity for monitoring and pricing these emissions evolves.²⁰

FLOOR PRICE LEVELS: In principle, floor prices should be set to align aggregate emissions from ICPF participants with global temperature objectives (see the following). Participants would meet whichever is the more stringent of the price requirement or their Paris mitigation pledge. In practice, these prices will emerge from dialogue among ICPF participants and may not be fully consistent with temperature objectives—nonetheless, an ICPF that closed much of the current 2030 emissions gap would be a major step forward.

COMMON VERSUS DIFFERENTIATED PRICING: The possibility of differentiated minimum prices for advanced and nonadvanced countries should also be part of the dialogue to help address international equity issues. The price floor is designed to scale up action in key countries that currently have relatively lax pledges while, in principle, a common price may not bind for countries already implementing aggressive pledges (see Annex 1). This suggests that multiple price minima might be specified, according to accepted conventions for the level of country development, to promote a more even distribution of burdens across countries (though the trade-off would be some loss in economic efficiency from a global perspective). Moreover, the emissions intensity of industrial production in large EMEs is generally greater than advanced countries,²¹ which reinforces the pragmatic case for differentiated pricing to ease transitions for these countries.

¹⁷ For example, by the International Energy Agency for most countries.

¹⁸ In China, India, and the United States around 70 to 90 percent of the economywide CO₂ emissions reductions under a comprehensive \$50 carbon price in 2030 would come from the power and industrial sectors alone (IMF 2019a, 2019b).

¹⁹ See IMF (2019b, 91–93) and Organisation for Economic Co-operation and Development (2019b).

²⁰ Agricultural emissions remain difficult to monitor directly, though proxy emissions pricing schemes may be feasible based on farm-level data on livestock, feed, crop production, and fertilizer use, and merged with default data on emission rates. Also, given the very different issues surrounding agricultural emissions, and different groups of large emitters, a separate price floor arrangement could be considered for these emissions.

²¹ See Keen and others (2021).

COMPENSATION OR OTHER MECHANISMS FOR PROMOTING PARTICIPATION: As part of the ICPF, a transparent fiscal transfer system could be set up to compensate developing member countries.

International transfers of some sort—financial or technological assistance, or perhaps a “grand bargain” with enhanced overseas development aid, and transfers of other (nonenvironmental) technologies—might be needed to induce participation of lower-income EMEs. For illustration, one possibility might be an annual fund allocated to these countries in proportion to their share of emissions in total emissions among lower-income ICPF participants in a recent year. A fund of, say, \$10 billion a year would be equivalent to about 1 percent of the revenues from a \$50 price on G20 carbon emissions.²² In principle, a BCA exempting trade among ICPF participants might be used as an enforcement mechanism. In practice, however, the incentives for participation from this mechanism may be limited (as noted, carbon embodied in traded goods is a modest share of domestic emissions) and its design complicates negotiations over establishing an ICPF.

ALLOWABLE MITIGATION INSTRUMENTS: A carbon price could best be met through a carbon tax (a charge on the carbon content of fossil fuels) but an ETS (where firms acquire allowances to cover their emissions subject to a cap on total allowances) is readily accommodated. In the latter case, emissions prices are uncertain but this can be addressed through: (1) combining an ETS with price stability mechanisms (for example, requiring allowances to be auctioned at a minimum price) or (2) setting the allowance cap so that the expected emissions price is equal to the floor price. A good prototype is Canada where the federal government sets the needed carbon price (rising progressively from CAN\$10 per ton of CO₂ in 2018 to \$50 in 2022 and \$170 in 2030) and provinces and territories have the flexibility to meet it through taxes or ETSs.²³

The political acceptability of carbon pricing differs across countries, however, and needs to be accommodated. For example, policymakers may be reluctant to significantly increase energy prices if this is politically sensitive, their energy prices are already on the high side relative to those in competitor countries, or it runs counter to expanding greater energy access to poor households. An ICPF could be designed flexibly to accommodate different policy approaches at the national level, as long as these approaches have equivalent emissions impacts as meeting the price floor (perhaps subject to third-party verification). Keeping the ICPF simple and transparent suggests this flexibility provision should ideally be the exception rather than the rule.

MEASURING COMPLIANCE: Prices in existing carbon tax and ETS schemes are readily available²⁴ and could be the focus in the early stages of the agreement, especially if it is confined to power and industry emissions. It would make sense to compare existing prices to a benchmark with zero pricing for transparency and to avoid penalizing countries that have already implemented aggressive pricing.

As the ICPF is extended to cover other sources of fossil fuel CO₂ emissions, measuring effective carbon pricing may become an issue. Agreement may be needed on how to account for preexisting transportation fuel taxes and for the possibility that countries may exempt certain fuels/sectors (for example, due to political

²² For comparison, IMF (2019a) put economic efficiency costs of a \$50 carbon price in India (consumption benefits to fuel users less savings in supply costs) in 2030 at about \$15 billion (though transition costs are not included). Such costs are swamped by health benefits from reduced exposure to local air pollution leaving India better off on net before considering climate benefits or transfers.

²³ The federal government steps in with a backstop pricing scheme where provinces and territories are out of compliance. See Environment and Climate Change Canada (2020) and Parry and others (2021).

²⁴ World Bank Group (2021).

sensitivities).²⁵ To ensure comparability of effort, the ICPF might focus on countries' "effective" carbon prices. These can be calculated by: (1) expressing existing fuel taxes on a CO₂-equivalent basis (that is, dividing the fuel tax rate by CO₂ emissions per unit of fuel use); (2) weighting CO₂-equivalent fuel taxes and explicit carbon pricing schemes by their relative effectiveness at reducing economy-wide CO₂ emissions compared with a comprehensive carbon price; and (3) aggregating across these tax and pricing systems.²⁶

There is little basis on economic efficiency grounds for equating effective carbon prices since these vary considerably across countries. For example, pre-existing transport fuel taxes may have been set accounting for domestic environmental problems (for example, local air pollution, congestion), revenue needs, and risks of diverting fuel purchases to neighboring countries—factors which are highly country-specific. Rather than equalizing effective carbon prices, the ICPF might instead focus on a required absolute increase in countries' effective carbon prices relative to effective prices in a benchmark year. This would allow countries flexibility in meeting the requirement (for example, through extending coverage of emissions pricing, raising preexisting fuel excises) but prevent relabeling of fuel taxes imposed for other reasons as carbon taxes. Benchmark prices might be defined excluding explicit carbon pricing schemes again to avoid penalizing those who have already acted.²⁷ Debate over measuring effective carbon prices should not hold up the establishment of the ICPF, hence the suggestion to initially consider observed emissions prices for power/industry.

Comparison with Other Global Regimes

In terms of facilitating negotiation, a 'pure' carbon price floor and the pragmatic approach outlined previously may be similar, but a pure carbon price floor has fewer degrees of freedom for addressing equity and competitiveness concerns and does not accommodate countries where pricing is difficult.

Under the pure pricing scheme with advanced economies and EMEs subject to the same price floor, equity issues can only be addressed through transfer mechanisms and there is no scope for offsetting the relatively larger impacts of pricing on the competitiveness of EMEs. Moreover, the approach provides no accommodation for countries facing severe domestic (political or other) obstacles to carbon pricing.

Annual emissions targets have more scope for addressing equity/competitiveness concerns than a pure pricing regime, and they accommodate different policy approaches, but they are more difficult to negotiate than (pure or pragmatic) pricing regimes and they leave less certainty about concrete policy actions. Allocating a global emissions target across large emitting countries is a zero-sum game—individual countries may have an incentive to claim they are a special case and need a more generous emissions target but this will simply pass some of the burden of mitigation from them onto others. Moreover, the focus on emissions targets leaves more uncertainty about concrete policy actions countries will take, potentially implying a greater need for enforcement mechanisms, for which agreement is difficult to reach. Table 1 provides a summary comparison of the pragmatic pricing regime emphasized here with the alternative regimes in terms of their effectiveness at addressing obstacles to scaling up mitigation action under the Paris Agreement.

²⁵ Some countries subsidize fossil fuel consumption by holding down domestic energy prices below international prices. These subsidies do not apply to coal (the most carbon-intensive fuel) and are relatively small for large emitting countries (Coady and others 2019).

²⁶ First-pass estimates of effective carbon prices for 135 countries are provided in IMF (2019b, 91–93). Organisation for Economic Co-operation and Development (2019b) provides a more detailed profile of how countries are currently pricing emissions through energy taxes/subsidies, though their estimates do not account for differences in the price responsiveness of fuels in different sectors.

²⁷ Participants might claim that road fuel taxes prior to the benchmark year were partially intended to charge for carbon emissions. The issue should be manageable, however—for example, prior fuel taxes contribute less than \$5 per ton to the effective carbon price in China, India, and the United States (IMF 2019b).

Table 1. Comparing Regimes for Scaling up Global Mitigation Policy by 2030

Metric		Supplementary Arrangement Among Large Emitters			
		Paris Process by Itself (all parties)	Price Floor (with annual ramp up)		Country-level annual emissions targets
			Pragmatic (allowing differential pricing and equivalent approaches)	Pure	
Ease of Negotiating Policy Action	Number of Parties	Hampered by: (1) large number of parties (2) unilateral submission process	Focused negotiation	Focused negotiation	Focused negotiation
	Number of Parameters	Hampered by large number of parameters (one per party); no mechanism for annual progress	Focused negotiation over parameters for broad country classifications	Focused negotiation over one price floor (but negotiations may be harder with just one parameter)	Negotiation over country-specific targets more complex (than for price floor)
	Type of Parameters	Focus on emissions/other targets: (1) that are difficult to compare (2) leave uncertainty over policy actions	Focus on specific policy actions	Focus on specific policy actions	Focus on emissions targets leaves uncertainty over policy actions and greater need for enforcement mechanisms
Addressing Obstacles to Scaling up Policy Action	Free Rider (concern about ambition and meeting pledges)	High risk countries will not: (1) set sufficiently ambitious targets; (2) achieve targets	Small group provides pressure for adequate ambition and meeting pledges	Small group provides pressure for adequate ambition and meeting pledges	Small group provides pressure for adequate ambition and meeting pledges
	Competitiveness (concern about relative cost of domestic/foreign goods)	Only addressed by unilateral measures→pressure for inefficient system of unilateral BCAs	Partially addressed (allows equivalence for non price measures with smaller competitiveness impacts than pricing)	Addressed (but larger cost increases for EMEs with higher emissions intensity)	Weakly addressed (cost increases vary by country depending on target and policy instruments)
	International equity	Differentiated responsibilities difficult to compare, additionality of \$100 billion finance and who gets it unclear	Allows differentiated floors and clarity on transfer mechanisms	Puts all onus on transfer mechanisms	Allows differentiated targets and clarity on transfer mechanisms
	Domestic difficulty of carbon pricing	Allows for non-pricing, but difficult to scale up either approach unilaterally and no mechanism to ensure global adequacy	Allows for non-pricing approaches with equivalent emissions outcomes	Does not allow for non-pricing approaches	Allows for non pricing approaches

Source: IMF staff calculations.

Note: Red = a problem, green addresses, amber largely addresses, and brown partially addresses the problem. BCA= border carbon adjustment. EME= emerging market economy.

Emission Impacts of Alternative Pricing Scenarios

This section illustrates the emissions impacts of alternative scenarios for country participation and price levels in an ICPF, focusing on global fossil fuel CO₂ emissions and a snapshot for 2030. Scenarios are compared with a baseline projection with no new, or tightening of existing, mitigation policies. Annex 2 describes the modeling framework underpinning the quantitative analyses (in this section and elsewhere in the paper) and caveats—the basic framework involves projecting sectoral emissions at the country level and using assumptions about the price responsiveness of fuel use to infer the emissions impacts of carbon pricing.

Table 2 indicates emissions reductions if countries meet their Paris pledges and either just six parties to the Paris Agreement (China, India, the US, EU, UK and Canada) also participate in an ICPF or all G20 countries do. Scenarios are considered

where advanced/EME countries are subject to price floors of \$50 per ton each, or \$75, \$50, and \$25 for advanced, high-income EME (for example, China), and low-income EME (for example, India) countries, respectively.²⁸ Annex 3 illustrates how a \$50 carbon price would affect energy prices in G20 countries in 2030; coal prices are affected most dramatically though coal is largely an intermediate product—impacts on natural gas, electricity, and retail gasoline prices are smaller but can still be large in some cases. Outcomes are compared with central case estimates of emissions reductions needed for warming targets.

Table 2. Global CO₂ Outcomes under Alternative ICPF Scenarios

Percent reduction in G20 CO₂ emissions below baseline, 2030

Minimum emissions reductions required for temperature goals¹:

2°C	20.8
1.8°C	32.8
1.5°C	46.6

China, US, India, EU, Canada, UK All G20 Countries

NDCs Only	10.9	14.1
NDCs+\$50 Floor	23.4	25.3
NDCs+Differentiated Floor \$75/50/25 ²	22.6	24.6

Source: NDCs from June 2, 2021; and IMF staff calculations.

Note: G20 - Group of Twenty; GHGs - greenhouse gases; NDC - nationally determined contributions.

¹ Assumes energy-related national CO₂ emissions need to reduce in proportion to total GHGs.

² Higher/middle/lower price for advanced/high income emerging market/low income emerging market economies.

Existing NDCs remains insufficient for achieving the Paris Agreement’s temperature targets. Just to reach the top of the 1.5-2°C range requires global emissions cuts of at least 21 percent by 2030 compared with “business as usual” (lightest green area in Figure 1). Current NDCs would fall short—even if all G20 countries achieved their pledges emissions reductions would be just 14 percent below baseline levels.

Reinforcing NDCs with an ICPF – either with a single or differentiated price – would cut emissions sufficiently to enter the upper end of the range for 2°C, even when only the six economies participate.

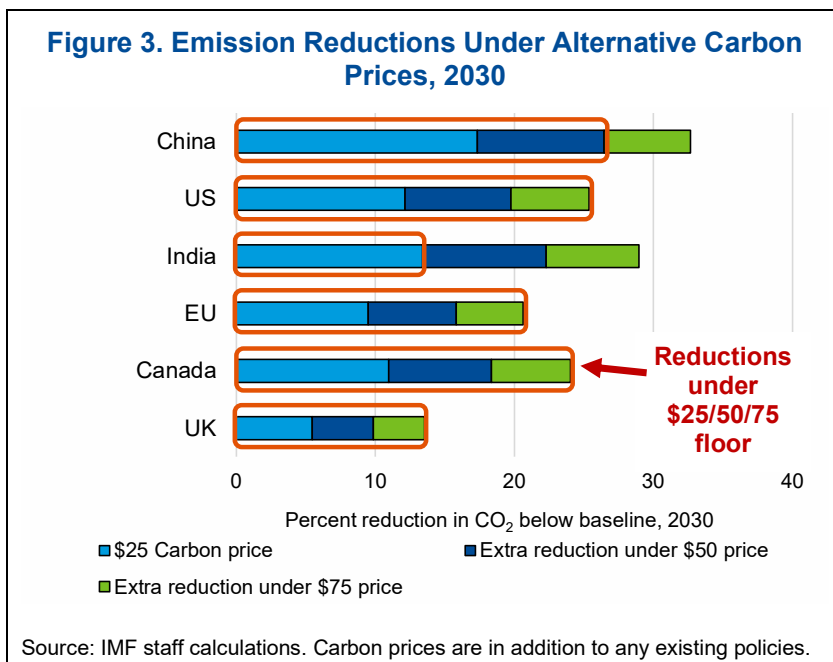
Either a pure \$50 carbon price floor for all six countries or a differentiated price floor of \$25, \$50, and \$75 depending on development levels would reduce energy-related CO₂ emissions 23-24 percent compared with business-as-usual. Extending the ICPF to other G20 countries causes a modest further increase in G20

²⁸ All monetary figures are in 2018 US dollars. The emission impacts of pricing much beyond \$75 a ton become highly speculative, given uncertainties over the future economic and practical viability of low-carbon technologies (for example, carbon capture and storage, advanced nuclear). Prices in carbon pricing schemes are mostly between about \$5 and \$35 per ton at present, though prices should rise over time, and several countries have considerably higher prices (World Bank Group 2021).

abatement. In short, participation in the ICPF by six major economies would greatly enhance the Paris Agreement's effectiveness.

Under a \$25/50/75 price floor emissions reductions compared with baseline vary somewhat with development and pricing levels (Figure 3). Among advanced economies, US and Canada have slightly higher emissions reductions (25 and 24 percent) than EU and UK (21 and 14 percent). This reflects the former's larger carbon intensity of GDP and emissions responsiveness to prices. China and India have larger price responsiveness in general than AEs, but China has larger emissions cuts compared with business-as-usual (27 percent) than India (13 percent),

reflecting the differentiated responsibilities that this regime would allow for. Additionally, only India's emissions rise in absolute terms (by 21 percent, compared to 9 to 30 percent reductions in other countries), reflecting its lower historical contribution and current per capita emissions.



Conclusion

The Paris Agreement is a landmark achievement in international cooperation. It has focused policymakers on the need for comprehensive emissions cuts in all countries, including through achieving net-zero emissions by midcentury. But the critical challenge today is scaling up ambition and policy action sufficiently to cut emissions by one quarter to one half in this decade. Even if current 2030 pledges were achieved then global emissions reductions would still fall far short of those needed to keep open the possibility of limiting future warming to below 2°C. This paper argues that an additional mechanism, an ICPF, is needed to complement and reinforce the Paris Agreement. Precedents for this type of international cooperation include tax floors for indirect taxes in the European Union and the Organisation for Economic Co-operation and Development/G20 Inclusive Framework on Base Erosion and Profit Shifting under which over 135 countries are collaborating to put an end to tax avoidance strategies.²⁹

The paper suggests the following key ingredients might enhance the prospects for a successful ICPF agreement:

- Limiting the initial arrangement to a core group of high-emitting countries (though allowing others to join once design specifics and decision-making processes have been established among the core countries);

²⁹ See www.oecd.org/tax/beps.

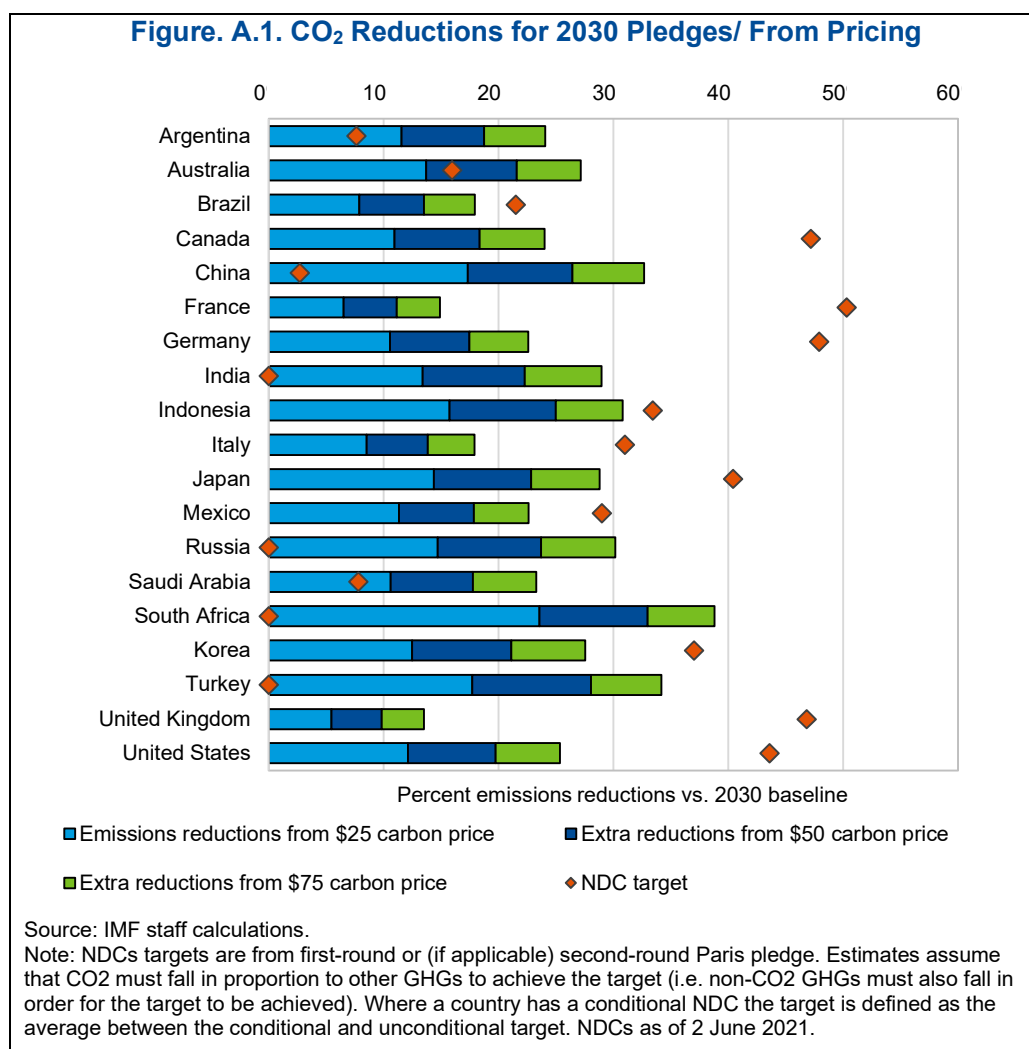
- Focusing the agreement on a common price floor for all participants (rather than, for example, a separate emissions target for each participant);
- Allowing, however, differentiation in price floors according to level of development, and perhaps financial or other transfers, to address international equity;
- Allowing provisions for countries to meet requirements through non-pricing policies with equivalent emissions impacts as the price floor;
- Requiring, initially, carbon pricing for the power and industrial sectors, with progressive extension to other fossil fuel CO₂ emissions and broader sources of GHGs; and
- Focusing the agreement on nominal (easily observed) carbon prices initially, but perhaps transitioning to a focus on effective carbon prices (as monitoring procedures are agreed).

The type of price floor arrangement proposed here could also be implemented at the regional level.

For example, several countries in the Latin American region have implemented carbon taxes but at modest levels (for example, Argentina, Chile, Colombia, Mexico) and several countries in the Asia and Pacific region have implemented, or are considering, carbon pricing (for example, China, Japan, Korea, Philippines, Singapore, Vietnam). Regional carbon price floor arrangements could facilitate a scaling up of these country-level initiatives and provide valuable experience for developing a global price floor arrangement.

Annex 1. G20 Countries Where Carbon Price Floors Would Be Binding

Annex Figure A.1 shows estimates (using the model described in Annex 2) of the percent reduction in fossil fuel CO₂ emissions below baseline levels in 2030 needed to meet G20 countries' mitigation pledges (updated for the latest submissions for COP26). The chart shows estimates of the emissions reductions from carbon pricing of \$25, \$50, and \$75 per ton (on top of current mitigation policies). Assuming that countries achieve their stated 2030 targets, the figure suggests that a \$25 price floor would be binding in six cases (China, India, Russia, Saudi Arabia, South Africa, Turkey); a \$50 or \$75 price floor would be binding in two cases (Argentina, Australia); while even a \$75 price floor would not be binding in eleven cases (Brazil, Canada, France, Germany, Indonesia, Italy, Japan, Mexico, Korea, United Kingdom, United States). In the latter cases, a \$75 price floor is more likely to bind, however, if countries are relying in part on other mitigation instruments—also, as noted in the text, the prospects for meeting the ambitious mitigation pledges (and for further strengthening their pledges) may be enhanced when other countries commit to binding price floors.



Annex 2. Methodology Underlying the Quantitative Analysis

The IMF and World Bank have developed a spreadsheet model—the Carbon Pricing Assessment Tool—which provides, on a country-by-country basis for 180 countries, projections of fossil fuel CO₂ emissions and assessments of the emissions, fiscal, economic, public health, and other impacts of carbon pricing and other mitigation policies.¹

This tool starts with use of fossil fuels and other fuels by the power, industrial, transport, and building sectors and then projects fuel use forward in a baseline case using:

- GDP projections;
- Assumptions about the income elasticity of demand and own-price elasticity of demand for electricity and other fuel products;
- Assumptions about the rate of technological change that affects energy efficiency and the productivity of different energy sources; and
- Future international energy prices.

In these projections, current fuel taxes and carbon pricing are held constant in real terms.

The impacts of carbon pricing and other mitigation policies on fuel use and emissions depend on (1) their proportionate impact on future energy prices, (2) a simplified representation of fuel switching within the power generation sector, and (3) various price elasticities for electricity use and fuel use in other sectors.

The model is parameterized using data compiled from the International Energy Agency on recent fuel use by country and sector and carbon emissions factors by fuel product. GDP projections are from the latest (post-COVID) IMF forecasts.² Data on energy taxes, subsidies, and prices by energy product and country is compiled from publicly available and IMF sources. International energy prices are projected forward using an average of different sources. Assumptions for fuel price responsiveness are chosen to be broadly consistent with empirical evidence and results from energy models (fuel price elasticities are typically taken to be between –0.5 and –0.8).

One caveat is that the model abstracts from the possibility of mitigation actions (beyond those implicit in recently observed fuel use) in the baseline, which is a common approach to provide clean comparisons of new mitigation policies to the baseline. Another caveat is that, while the assumed fuel price responses are plausible for modest fuel price changes, they may not be for dramatic price changes that might drive major technological advances, or nonlinear adoption of technologies like carbon capture and storage (for this reason, results are not reported for carbon prices above \$75 per ton). In addition, fuel price responsiveness is approximately similar across countries—in practice, price responsiveness may be more muted in some countries to the extent that energy price and production regulations are retained over the next decade. The model also does not explicitly account for the possibility of upward sloping fuel supply curves, general equilibrium effects (for example, changes in

¹ Basic versions of the model and its parameterization are described in IMF (2019b) and Parry, Mylonas, and Vernon (forthcoming).

² Extrapolated beyond 2025. A modest adjustment in emissions projections is made to account for structural shifts in the economy caused by the pandemic (for example, more remote working) that will likely have some permanent effect on emissions.

relative factor prices that might have feedback effects on the energy sector), and changes in international fuel prices that might result from simultaneous mitigation action in large emitting countries. However, parameter values in the spreadsheet are chosen such that the results from the model are broadly consistent with those from far more detailed energy models that, to varying degrees, account for these sorts of factors.

Annex 3. Impacts of a \$50 Carbon Price on Energy Prices in 2030

Table A.3. Illustrative Energy Price Impacts for US\$50 carbon tax p/tCO₂e by 2030

Country	Coal		Natural gas		Electricity		Gasoline	
	Baseline Price, \$/GJ	Price Increase	Baseline Price, \$/GJ	Price Increase	Baseline Price, \$/kWh	Price Increase	Baseline Price, \$/liter	Price Increase
Argentina	2.9	172%	3.7	86%	0.08	18%	1.14	13%
Australia	3.4	154%	7.9	37%	0.12	25%	1.13	12%
Brazil	4.4	122%	9.2	34%	0.07	7%	1.23	8%
Canada	2.6	209%	4.2	69%	0.08	10%	1.14	11%
China	4.4	114%	10.5	25%	0.05	46%	1.13	12%
France	6.2	94%	15.8	18%	0.13	2%	1.77	9%
Germany	5.8	91%	12.4	23%	0.17	9%	1.74	8%
India	5.0	99%	3.5	98%	0.06	47%	1.12	12%
Indonesia	2.7	187%	5.7	44%	0.08	57%	0.45	31%
Italy	4.6	116%	15.4	24%	0.12	11%	1.90	8%
Japan	3.7	132%	11.1	24%	0.12	24%	1.37	10%
Mexico	1.8	284%	3.0	91%	0.09	26%	0.97	14%
Russia	2.2	209%	2.7	95%	0.08	36%	0.73	18%
Saudi Arabia			3.9	69%	0.10	33%	0.27	45%
South Africa	1.6	285%	3.7	62%	0.05	66%	1.16	10%
Korea	4.7	103%	11.4	25%	0.08	37%	1.46	8%
Turkey	1.4	421%	7.6	41%	0.06	59%	1.40	10%
United Kingdom	6.9	74%	11.5	27%	0.12	9%	1.72	8%
United States	2.4	220%	4.4	69%	0.07	23%	0.83	16%
Simple Average	3.7	171%	7.8	51%	0.11	39%	1.19	14%

Source: IMF staff calculations.

Note: Baseline prices are retail prices updated from Coady and others (2019) and include preexisting energy taxes. Baseline prices for coal and natural gas are based on regional reference prices. Baseline prices for electricity and gasoline are from cross-country databases. Impacts of carbon taxes on electricity prices depend on the emissions intensity of power generation. Carbon tax prices are per ton. GJ = gigajoule; kWh = kilowatt-hour. All prices are stated in real 2018 terms.

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