# Green Impact Fund for Technology

This paper introduces the Green Impact Fund for Technology (GIFT) which is intended to expand and accelerate the use of patented GHG-reducing technologies (GRTs) in developing countries. We are seeking your views and comments, including on the feasibility and the value of such a fund.

## 0. Introduction

As the IPCC's Sixth Assessment Report shows, the world needs "immediate, rapid and large-scale reductions" in the emission of greenhouse gases (GHGs). To this end, new technologies must be developed and globally deployed. Unfortunately, incentives to adopt top green technologies are weak in the developing countries, which typically lack strong environmental regulations and a substantial price on emissions. The problem is made worse by the fact that many of the best green technologies are protected by 20-year patents that allow firms to restrict, and then to charge high prices for, their use. This paper shows how a new system of rewards can complement the existing patent system to support rapid diffusion of GHG-reducing technologies (GRTs), as well as provide supplementary incentives to develop GRTs of special relevance to developing countries. Wide adoption of new climate-friendly technologies requires both positive incentives for uptake and the absence of barriers to adoption. Because most developing countries have not enacted economically meaningful carbon taxes, the incentives to adopt new low-carbon technologies are weak. At the same time, patents create unnecessary barriers to adoption of new technologies; for example, the USPTO grants approximately 15,000 patents annually directly related to climate change mitigation, representing a potentially important barrier to diffusion of these technologies.

The most obvious opportunities for achieving large reductions in GHGs exist in developing countries, where the most growth in population and consumption will occur.

Yet, the greatest efforts to reduce emissions are made in high-income countries (HICs), where taxes and market prices on emissions are highest. It makes good sense according to historical behavior, under the polluter-pays and ability-to-pay principles, that HICs should bear most of the burden of addressing the climate crisis. But much more of this effort should be focused on lowering emissions in developing countries, especially by making more suitable GRTs available, by reducing barriers to GRT adoption and by increasing incentives for technology transfer.

## 1. Brief Summary of the GIFT

The proposed Green Impact Fund for Technologies (GIFT) is intended to support the development and diffusion of patentable GRTs that are suitable for use in developing countries. It offers innovators the option to waive in perpetuity their monopoly privileges on a patentable GRT in the GIFT Zone, consisting of all low- and lower-middle income countries (abbreviated below as "developing countries"). In return, the GIFT would pay the registrant of each GRT for the assessed reduction in GHGs achieved within the GIFT Zone during its first six years. The GIFT would do this by annually distributing a fixed reward amount, to be divided among registered GRTs according to the GHG reduction achieved with each in the preceding year. The patentee of each registered GRT would be rewarded with a share of the annual disbursement equal to its share of assessed GHG reduction in the GIFT Zone. This would create competition among participants and establish an endogenous reward rate per ton of CO2e averted.

The GIFT would be funded through long-term commitments, based on national income, by willing HICs and UMICs in order to minimize uncertainty by potential registrants. The proposed annual funding amount is EUR 500m – 2bn. The administration of the GIFT could be established within the Green Climate Fund, which is mandated to provide "support to developing countries to limit or reduce their greenhouse gas emissions."

From the perspective of developing countries, the GIFT would enable rapid adoption of emerging technologies in a range of fields related to emissions reductions. Ideally, firms in developing countries would be able to adopt multiple innovations registered with the GIFT. For example, a manufacturer of wind turbines in developing countries might be able to use patented inventions related to different components – blade materials, software, gear design, etc., – which would allow for maximal efficiency. In this way, the GIFT would essentially resemble a patent pool for low-carbon technologies, in which contributors to the pool would be rewarded on the basis of the extent to which their contributions resulted in measurable reductions in GHG emissions,

and firms in developing countries would have access to a large set of low-carbon technologies.

# 2. Properties of the GIFT

## 2.1 Performance-based incentives for innovation & diffusion

The GIFT creates a mechanism that effectively supports innovations that are implemented. Unlike innovation prizes, the GIFT rewards an innovator only insofar as the invention is deployed. Because GIFT incentives are based on performance, innovators will focus on ensuring that their inventions are both implementable and implemented. For example, if technical assistance is required to implement a technology, GIFT-rewarded patentees are motivated to provide such assistance.

## 2.2 A fair and predictable reward rate

With fixed annual disbursements, the GIFT reward rate is elegantly self-adjusting: when it is perceived as highly attractive, registrations proliferate, causing the reward rate to decline. Conversely, when innovators perceive the reward rate as unattractive, registrations dry up and the rate rises as older GRTs exit at the end of their reward period. Such automatic self-adjustment reassures contributors that the reward rate will be held down by competition among innovators. And it gives prospective innovators a reasonable assurance that this rate will not decline to an unreasonable level.

## 2.3 Easy access to technologies in the GIFT Zone

The GIFT would ensure that companies and households in the GIFT Zone can access registered GRTs without monopoly markups. GIFT-rewarded innovators would be motivated to facilitate uptake by supplying appropriate information and know-how, by supporting a favorable regulatory environment and even by selling below cost in special cases – if and insofar as such promotional investments are expected to cost less than the additional impact rewards they generate.

For countries in the GIFT Zone, easier access to low-carbon technologies would help them to achieve their Nationally Determined Contributions without harming their economies.

## 2.4 Principled allocation of costs

The cost of the GIFT should largely be borne by HICs. They can bear it most easily and are the main beneficiaries of historical emissions. Currently, the situation is often reversed with patentees in the HIC extracting licensing fees from firms in poorer countries for the use of GRTs – with the result that uptake is poor.

### 2.5. The GIFT and the Paris Agreement

The GIFT fits the Paris Agreement's framework for financial, technical, and capacity-building support for developing countries. It removes the headwind of monopoly markups and encourages promotional investments by GIFT-rewarded innovators. And it fosters capacity-building by rewarding the development, manufacture, installation, and use of appropriate GRTs in developing countries.

## 3. Design Options

### 3.1 Fields of technology

In principle, the GIFT could be open to technologies of any kind that reduce emissions. Experience with the Clean Development Mechanism (CDM) shows, however, that additionality is easier to identify for some GRTs than for others. A GRT improving efficiency of carbon capture and sequestration would clearly qualify. But a GRT improving efficiency of the internal combustion engine is more complex as it might end up increasing emissions by inducing people to drive more and in larger vehicles. Such rebound effects have often accompanied technology advances, and they must be accounted for appropriately. It might be appropriate, in these circumstances, to limit the GIFT to designated fields of technology.

### 3.2 Reward duration

During the reward period of *T* years, the patentee is to be paid according to the reduction in emissions attributable to its GIFT-registered GRT. The precise length of *T* is not of great importance because the reward rate will automatically adjust to it: the shorter the reward period, the higher the equilibrium reward rate, with the number of GRT registrations and the distribution percentages roughly the same.

Rapid technological advance suggests that most of a GRT's benefit comes in its first few years. Because innovative firms typically have a relatively high cost of capital, they might prefer a short reward period, under which they would be paid sooner — and

which would also encourage them to work toward rapid diffusion. All these considerations favor a short reward period of perhaps 5–6 years. A short reward period may disadvantage, and thereby discourage GIFT-registration of, GRTs whose uptake or implementation is expected to be slow. The GIFT might mitigate this problem by allowing registrants to defer their reward period (*e.g.*, to be rewarded for their GRT's impact in years 3-8 rather than years 1-6).

A related question is how to account for the future emissions reductions created by the installation of long-lived assets. For example, consider a technology for improved efficiency of photovoltaic panels. The panels can be expected to operate over, say, 20 years, and the technology will continue to enhance their output for the entire time. Currently, the electricity from the panels displaces coal-fired generation, but it is anticipated that coal may be replaced by gas at some point. The GIFT would have to make an estimate of the panels' effect on future emissions reductions at the time of installation.

## 3.3 Funding

The GIFT should be large enough at $500m – $2bn *per annum* to justify the costs of administration and impact assessment. Should it work well, it could be expanded to support an increasing portfolio of GRTs.

There is an obvious funding source: developed countries (via the United Nations process) have pledged $100bn annually to support developing countries on a low-carbon path, including both mitigation and adaptation. HICs have fallen short of fulfilling this pledge. (Indeed, most of the financing has come in the form of loans.) The GIFT could be funded with some of the commitments already made to support developing countries. It seems likely that HIC governments would find it attractive if patentees domiciled in their own countries were eligible to benefit from payments.

To ensure that patentees would be willing to forgo their patent rights in GIFT Zone countries, contributing countries should make firm long-term funding commitments. Any contributor would of course have the option of withdrawing its support; but this would have to be a phased withdrawal over T years so as not to disappoint legitimate registrant expectations.

While the GIFT could be funded by a single country, if international cooperation in funding exists, one reasonable way to establish contribution requirements would be to base funding per country on [population times (income per capita minus $10000)]. Countries with income below $10,000 per capita (lower middle-income and lower-

income countries) would not contribute. Countries with higher average income would contribute at a higher rate relative to their gross national income.

### 3.4 GIFT Zone countries

Which countries should be eligible for royalty-free licenses under the GIFT? A reasonable approach is to limit the GIFT Zone to countries with income per capita less than about $10,000. If this threshold were higher, the GIFT would require greater annual funding; moreover, the funding countries might have increased concerns that they were assisting industrial competitors. This range of countries includes many upper middle-income countries that are important contributors to GHG emissions globally and important manufacturing locations, as well as low-income countries that much less industrial development.

### 3.5 Accounting for trade

The GIFT should account for trade in goods embodying patented technologies, although getting this right is complex. Products embodying patented technologies (e.g., cars or wind turbine components) manufactured in countries outside the GIFT Zone, but exported to the GIFT Zone, could also be exempt from registered patents. This does create a variety of complications which deserve further consideration, particularly in the context of patent laws. Similarly, products embodying registered patents and exported from the GIFT Zone should not benefit from royalty-free licensing.

### 3.6 Administration

Assuming that the GIFT is financed by many countries, the most plausible administrative entity would be the Green Climate Fund, established under the Cancún Agreements in 2010 as a dedicated financing vehicle for developing countries within the global climate architecture, serving the Financial Mechanism of the UNFCCC and the Paris Agreement. However, it is also possible for a single country such as the United States or a single region such as the European Union to finance the GIFT, in which case the funder would presumably also control the administration.

## 4. Measuring Additionality

The key challenge for the GIFT is measurement of the effect of a given innovation. This is not a problem specific to the GIFT, since all carbon credit schemes

must address it. The Clean Development Mechanism (CDM), for example, has issued carbon offset credits for over 2bn tons of CO2e. The GIFT presents some novel issues, relating to the fact that it measures the effect of a patented technology rather than an investment, but the core issues of assessing additionality are similar. The International Carbon Reduction and Offset Alliance has produced a Code of Best Practice, which could form a starting point for assessing the effect of using a specific technology. Verra offers a set of methodologies to assess GHG reduction for various types of projects, which show both the challenges of assessment as well as its feasibility.

Frequently GRTs are implemented within a complex package of technology. For example, a patented technology for improved control of a wind-turbine may be implemented when wind turbines and the accompanying transmission facilities are built. The contribution of the innovator may simply be the patented technology, or it may consist of a broader package which enables that innovation to be implemented. Often there are complementary components requiring technical expertise. Identifying the specific contribution of the patented technology is therefore an important requirement for the GIFT.

Generally, because of the complexity of predicting how a technology might be used, as well as the impact of the technology on the market, there is likely considerable uncertainty as to the likely impact of a given technology on emissions. A reasonable way of addressing this is for the GIFT to commit to a simple rate per use of the technology, *e.g.*, for each implementation of technology x, the GIFT would credit the patentee with 2.5 tons of CO2e averted. However, other approaches are also possible; the GIFT could commit to a general methodology for assessing emission reductions.

# 5. Carbon taxes and other GHG mechanisms

## 5.1 Carbon taxes

One important benefit of the GIFT is that it can be integrated with existing mechanisms, such as carbon taxes. In general, the higher the carbon tax, the greater the incentive to implement GRTs. However, the patent system makes this problematic in developing countries, since increasing the carbon tax leads to more transfers to GRT patentees, who tend to be in HICs. First, this is unjust in the sense that it places the burden of GHG reduction on consumers and firms in developing countries. Second, it discourages countries that lack a substantial base of patented GRTs from increasing

carbon taxes, as a higher carbon tax will increase royalty payments to foreign shareholders.[1]

It is important to recognize that patented GRTs and carbon taxes "compete" against each other. As the carbon tax increases, emitters will have increased incentives to purchase and use GRTs, resulting in fewer emissions on which the carbon tax is paid. In essence, governments choosing a carbon tax face the problem of tax revenue leakage to foreign patentees. Thus, governments will set carbon taxes with the understanding that the demand for patented GRTs is sensitive to the carbon price and that patentees will respond strategically to carbon prices.[2]

The conflict between patents and carbon taxes is resolved with the introduction of the GIFT: manufacturers have access to the zero-carbon technology with a zero royalty, and will use it given any level of carbon taxes. No perverse incentive is created; and the carbon tax does not lead to substantial transfers of wealth from developing countries to foreign patentees as financing of the GIFT is provided by HICs. This means that governments can set the tax without worrying about tax revenue leakage to GRT patentees. This does not mean that the GIFT creates carbon tax revenues; but unlike patents, it does not create wealth transfers from technology-importing countries.

## 5.2 The Clean Development Mechanism (CDM) and offsets

[1] In the extreme case, consider a product that has a constant marginal cost of production, say $5 per unit in country X. Unfortunately, producing this good generates CO2 emissions which create damages to the global environment valued at $10 per unit produced. An "optimal" carbon tax would be $10 per unit. If the product is competitively supplied, applying the carbon tax increases its price from $5 to $15. The national government collects $10 per unit sold. Now suppose that there is an alternative, patented, zero-carbon way of producing the good. The patentee licenses its technology to manufacturers for $9 per unit sold, allowing manufacturers to avoid the carbon tax. The competitive price is now $14 per unit. This is, from the world's perspective, not a bad outcome. But from the perspective of the government in that country, the carbon tax was preferred, as most of the damage from CO2 emissions arose elsewhere, and the government collected the revenues from the tax, which it could apply to local interests. In effect, the patent system creates the possibility of "revenue leakage" from the carbon tax to patentees, which typically will result in money flowing from developing to developed countries, contributing to global inequality. Given this situation, the government is incentivized to keep the carbon tax low. Indeed, the higher the carbon tax, the higher the patentee may choose to set the royalty on its invention.

[2] This is true also for other competitively provided mechanisms of reducing GHGs. However, when a product is competitively provided, its price is generally a function of cost, not of the market opportunity. The patentee of a GRT who has market power will strategically respond to the carbon tax, adjusting the royalty to maximize profits.

Established as part of the 1997 Kyoto Protocol, the CDM allowed emission-reduction projects in developing countries to earn certified emission reduction (CER) credits, each equivalent to one ton of CO2. These CERs could be traded and sold, and used by industrialized countries to meet a part of their emission reduction targets under the Kyoto Protocol. The volume of CERs issued since initiation exceeds 2bn tons. (For scale, global emissions currently are around 50bn tons of CO2e per year.)

The CDM's purpose was clear: if emissions reductions can be done more cheaply in developing countries than in HICs, then HICs can achieve equivalent reductions in emissions at lower total cost by buying credits from developing countreis. The CDM, however, has attracted considerable criticism since if emission reductions are not "additional" (i.e. occurring only because of the CDM), then the effect is that the HIC can increase its emissions without a real matching reduction in developing country that sells the credit. In this case, there is simply a transfer of money to the developing country as a payment for the credit, but no restraining effect on total global emissions. In effect, the CDM resembled a carbon tax with payments flowing to those developing countries that were able to establish a mechanism to measure emissions reductions. In general, one would favor such an allocation as a contribution to sustainable development, but that was not always the case for the CDM. At a price of about $20 per ton, the CER market represented a meaningful source of income in some countries. Given declining demand and excess supply, prices of the CERs collapsed in 2012. As of 2019, the price range was US$0.15 - $0.24 per ton of CO2e.

There are numerous other offset mechanisms that allow for the transfer of "credits" from one party to another. (See World Bank, 2020, Chapter 3.) The experience from these mechanisms generally suggests that to be effective, "integrity of carbon credits must be maintained to provide confidence to purchasers that the credits accurately represent genuine and real emission reductions."(World Bank 2020, p. 49)

The GIFT would be complementary to offset mechanisms; however, rather than reward investors in GHG-reducing projects, it would reward firms that shared their GRTs with developing countries. This would allow firms to acquire and use those GRTs without licensing fees.

## 5.3 Patent pledges

There have been numerous efforts to share knowledge through patent pledges. The "Eco-Patent Commons", for example, was formed by several large industrial companies to share green technologies. Operating from 2008-2016, participants in the

Commons pledged 248 patents for royalty-free use. A "post-mortem" of the Commons found that the pledged patents were not used more than others, suggesting little impact on diffusion. The post-mortem concluded that "effective technology diffusion requires more than patent non-assertion, especially in the developing world. Technical assistance and know-how are essential for implementing environmental technologies..." It also found that there was a lack of tracking capability of whether or how patents were used, thus discouraging companies from contributing. This was in part due to inadequate administrative and managerial resources dedicated to advancing the Commons. Finally, it seems that the patents pledged tended to be less valuable. A similar initiative labelled the "Low-Carbon Patent Pledge" has recently been formed by Microsoft, Facebook and Hewlett-Packard, suggesting that firms continue to seek mechanisms to share relevant green technologies.

The GIFT would resolve the problems identified with the Eco-Patent Commons: it would reward firms for making available their valuable technologies; it would support diffusion, since patentees would only be rewarded if their technologies were implemented; and it would support a continuous process of successful tracking that would demonstrate the utility of both the GIFT and the patented technologies that were registered with it. Moreover, potential users of green technologies would find in the GIFT an easy place to identify high-value technologies that they might use.

## 6. The technology-transfer staircase

An important feature of the GIFT is that it would support technological development at different stages of development. The World Bank describes a technology staircase, with the first steps being adoption and then domestic diffusion of foreign innovations; higher levels of the staircase are imitation, collaborative innovation, and indigenous invention. Moving up the staircase requires increasing levels of human, organizational, institutional, physical, and financial capital. Economies differ widely on these metrics.

The GIFT could address the needs of different types of countries in a more comprehensive manner. For countries that are in the stage of importing and implementing products embodying low-carbon technologies, the GIFT would offer support through reducing the prices of those technologies, while also giving incentives to the suppliers to enable appropriate use of the products to maximize GHG emission reduction.

For countries seeking licenses to implement technologies, there would be not only zero-priced licenses, but also incentives for innovators to supply additional technical training required to maximize the effective use of the licensed technology.

Firms in countries on the highest steps on this staircase would be eligible for direct reward by the GIFT for inventions directed at their own needs and subsequent diffusion.

For all countries, the GIFT would help encourage the development of appropriate technologies that could be implemented in the GIFT Zone. Since local innovators are generally best placed to recognize the innovations that could be best applied in a given country, the GIFT would support indigenous technological capacity through enhancing demand.

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https://globaljustice.yale.edu/green-impact-fund-technology