# Cash on Delivery Aid for Energy

**William Savedoff**

## Abstract

Energy is critical to human welfare, yet energy consumption in developing countries is extremely low relative to modern living standards. Conventional aid programs have invested in energy production with some success but also with many notable failures. This paper discusses how a distinctive approach to development aid—disbursing funds against improved outcomes—could make aid more effective in the energy sector. In particular, it explores the use of Cash on Delivery Aid (COD Aid) to resolve perennial difficulties encountered by conventional aid programs in energy sector development.

After reviewing energy sector experiences with results payments and presenting the COD Aid model, the paper illustrates the new approach with three examples. The first example involves paying for increases in per capita electric consumption along with rewards for reducing average greenhouse gas emissions per kilowatt-hour. The second example suggests paying for each additional household that is consuming electricity at a basic level of 300 kWh per person per year. The third example promotes financial sustainability by paying a matching grant for appropriately billed and collected energy bills. The paper concludes with a discussion of common objections to the approach.

Center for Global Development
2055 L Street NW
Fifth Floor
Washington DC 20036
202-416-4000
**www.cgdev.org**



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# Introduction

Energy is critical to human welfare. We use it to produce goods and services, transport objects and travel, communicate and entertain. Yet energy production and use in low- and middle-income countries is extremely low relative to modern living standards. The average amount of electricity produced in many countries is insufficient for every household to power a simple appliance like a refrigerator or stove. Conventional aid programs have invested in energy production with some success but also with many notable failures.

This paper investigates whether a distinctive approach to development aid—disbursing funds against improved outcomes—could make aid more effective in the energy sector. In particular, it considers how to design a Cash on Delivery Aid (COD Aid) agreement for energy and assess whether this approach might resolve perennial difficulties encountered by conventional aid programs for energy sector development. It begins with a review of energy sector experience with results payments; presents the COD Aid concept; explains why COD Aid is likely to be useful in the energy sector; discusses unique features of the energy sector that need to be addressed by any agreement; presents ideas for designing COD Aid for energy along with three examples; and then addresses common objections to using this approach in the energy sector.

# 1. Paying for results in the energy sector

The energy sector has a long history of programs which pay for results, both in domestic contexts and with foreign aid.[1] Many programs pay for deliverables which are essentially inputs—letting out contracts for construction of a generator, a hydroelectric dam, a pipeline or a transmission line. Others pay for outputs, such as the number of connections to an electric grid or an expansion of generating capacity (Mumssen et al. 2010). Multilateral development banks have directly disbursed policy loans against changes in laws, regulations or institutional features of the sector (Koeberle et al. 2005).

Countries have mobilized private investment and private sector expertise with a range of innovative models. In Build-Operate-Transfer (BOT) schemes, governments commit to pay private firms for constructing generating capacity and operating it until it is transferred to public ownership (Walker and Smith 1995; Levy 1996). In many countries performance contracts are drawn up with private or public entities which not only specify prices but also include rewards or penalties related to transmission losses or reliability (World Bank 2009). Finally, governments have used energy prices to stimulate changes in the energy market. For example, feed-in prices have been used to encourage the use of energy from renewable sources and indirectly reshape the cost structure of energy supply (Coulter et al. 2010; DFID 2009). (See Box 1 for other promising uses of performance payments in energy).

[1] For discussions of programs that pay for results in other sectors, see Janus 2014; Mumssen et al.2010; Musgrove 2010; Pearson et al. 2010; R4D 2016; and Savedoff 2011.

While this rich tradition of paying for results has sometimes been successful, it rarely addresses the major problems that hinder expansion of energy systems on a national scale. The failures of a country like Nigeria to expand energy access to its population and businesses after decades of foreign aid has less to do with hardware, technology and financing than it does to politics, social processes, and management (Berkman 2008, Adenikinju 2008). The way to address the full range of technical and social issues that hold back energy development in most countries is not likely to occur through external assistance unless it is driven primarily by indigenous problem-solving (Andrews et al. 2013).

One way to support such domestically-driven approaches is called Cash on Delivery Aid (COD Aid) (Birdsall and Savedoff 2010). COD Aid differs from other commonly-used results-based payment operations in three important ways: it pays for outcomes (not inputs); it pays governments (not service providers); and it gives the recipient full discretion over how to achieve that outcome. For example, a COD Aid agreement might offer funds to a government in proportion to expanded availability of electrical energy. The government could then achieve that expansion in many different ways: by directly expanding generation; by reducing transmission losses; by creating a regulated market with incentives for private firms to generate and sell power; by altering the incentives faced by public enterprises; or even, depending on the context, by pressuring public agencies to pay their energy bills on time. By linking funds to outcomes, such a program gives recipient governments the space to pursue the most effective strategies, to experiment with new ideas, to adapt as new information comes to light, and to address political and social obstacles that are not easily handled by conventional funder-led designs. The link to outcomes also assures that if governments are not fundamentally committed to change, slow progress will result in lower payments and the program will not have to waste aid money on an initiative that lacks domestic ownership.

## Box 1: Some performance programs in the energy sector

**Improved cook stove project with carbon finance in Nepal.**

"Carbon revenues are used to provide a direct consumer-subsidy for the stove. An affordability and willingness-to-pay study was conducted prior to project launch. The carbon revenues are earmarked to close the gap between cost of the ICS [Improved Cook Stove] and consumers' ability to pay—in this case it was 500 NPR, or approximately $5 USD. Other plans for carbon revenues include focus on research and development; a research wing at the partner organization continuously works on improving the product design based on user feedback and to improve efficiency and performance. A portion of the carbon revenue is also used for after-sales maintenance and stove replacement."

Source: Gold Standard Foundation 2016.

**Off-grid solar household systems in Bangladesh.**

Bangladesh's Infrastructure Development Company Limited (IDCOL) promotes the installation of household systems for producing electricity with solar panels through a combination of incentives to local agents and credit to households. Local agents sign an agreement with IDCOL for refinancing as much as 80 percent of a loan which is passed on to their clients. These agents provide some of their own funding and receive technical and institutional support. Households make down payments and agree to pay off the loan in installments over a three-year period. As service providers have gained experience with the market and the program, IDCOL has been able to reduce the subsidy from its initial level of about US$90 per system to less than US$25 per system in 2012.

Source: Asaduzzaman et al. 2013.

**Advance Market Commitments in Sweden, the United States and Germany**

In the early 1990s, Sweden encouraged the growth of a market for high-efficiency lighting by arranging for public sector buyers to commit to purchasing a large volume of high-frequency electronic ballasts. Sweden also supported the development of heat pumps by offering a procurement tender for a year's worth of devices. This led to a more rapid expansion of the heat pump market in Sweden than in Finland which had pursued a similar goal but without an associated advance market commitment. In 1991, Germany introduced feed-in tariffs for renewable energy production that ultimately led to large increases in wind generating capacity.

Source: DFID 2009.

**Advance Market Commitment for Biogas in Nepal**

"The Nepalese Biogas Support Program (BSP) ran from 1992-2005 co-ordinating and subsidising the supply of biogas digester to poor, rural, Nepalese households. A subsidy of $100 was provided for each successful installation of a standardised biogas digester if it came with a guarantee and service commitment. The payment covered one third of the capital cost and reduced the payback time for an average household from 57 months to 39 months. The program has been successful, beating its installation target by 60,000 units and winning numerous awards, such as the Ashden Award in 2005."

Source: DFID 2009.

**Output-based payments for electricity access in the Philippines.**

"[T]he Philippines Non-Grid Power Supply project, a small power utility group (SPUG), uses ongoing output-based subsidies to improve electricity supply in remote areas. The ongoing subsidies (US$0.028 per kilowatt-hour for the first pilot) are paid on the basis of the energy supplied to the rural energy distribution cooperatives (not on the basis of the electricity produced) by the competitively selected private generators."

Source: Mumssen et al. 2010.

## 2. What is Cash on Delivery Aid (COD Aid)?

COD Aid involves an agreement between a funder and a government that pays in proportion to progress at achieving a shared objective, such as completion of primary school, reduced transportation costs or expanded access to energy. Key elements are:

- **Payment for outcomes and not inputs**. The outcomes have to be related to an objective shared by funder and recipient. Outcomes should be measurable and continuous so that progress can be rewarded over time in proportion to incremental improvements.
- **Recipients assume full responsibility**. Funders do not specify or monitor inputs, set policy conditions, insist on particular institutional arrangements or approaches, or track use of COD Aid funds. Rather, they verify "delivery" of the outcome and pay for those outcomes according to the terms of the COD Aid agreement.
- **Independent verification of progress**. Both the funder and the recipient need to have confidence in the integrity of the progress indicator. Funders need to know that they are paying for something that really happened; while recipients need to know that they will get paid when they make progress.
- **Transparency and public dissemination**. Both the contract and progress measures should be as simple as possible and publicly disseminated by funders and recipients. This increases credibility and accountability, and encourages broader social engagement in aspects of progress that are not part of the agreement.
- **Complementarity with other aid programs**. COD Aid is intended to complement and not disrupt ongoing programs, whether funded by local or external sources. COD Aid should help the country use all available resources—domestic and foreign—more effectively. The country can also seek technical assistance to help it make progress, but at its discretion and from whichever sources it judges to be the most useful.

COD Aid is a useful complement to other aid instruments because its characteristics differ fundamentally from conventional aid. By paying for outcomes, COD Aid requires funders and recipients to be clear about the true aims of their programs. It reduces transaction costs associated with conventional aid by eschewing joint planning and monitoring. Instead, it puts resources into revealing information about outcomes in ways that facilitate experimentation and learning. It leads to positive self-selection: countries that are committed to making progress are willing to engage in a program that relieves them of managerial burdens in return for rewarding them for achieving outcomes. But most importantly, COD Aid supports the normal process of political change and institutional development by which modern societies have evolved. Conventional aid injects foreign agencies into the process of developing national institutions and diverts government accountability from its citizens to external agents. By contrast, COD Aid transfers funds in proportion to the success that countries make in resolving their own particular political-economy problems and as they learn how to make public policies work within their particular context.

## 3. Why COD Aid for energy?

Energy is an essential part of modern human societies. It is used in every human activity including growing and processing foods, constructing homes and powering workplaces, providing transportation, heating and cooling buildings, manufacturing goods and providing services. It is also essential to participation in modern society through personal communication devices, access to news and information, and engagement with arts, music, sports and entertainment. The kinds of energy we use affect health, education, economic growth, and equity (Energy Access Targets Working Group 2015). However, our goals for the energy sector are not simply to produce and consume more of it. The goal is to have plentiful energy available for all these different activities and yet to consume it efficiently in relation to its value and true costs.[2]

Many countries have achieved modern levels of energy services in a relatively short time. Some countries have made enormous progress on their own; others have made progress by accepting assistance through bilateral and multilateral assistance. Yet many countries have failed even with conventional aid. For example, Nigeria received billions of dollars in aid for its energy sector during the 1970s and 1980s without appreciably expanding access to electricity and continuing to face severe energy shortages (Berkman 2008). More recent experiences are equally disappointing. For example, between 2006 and 2010, Pakistan received $1 billion in aid for its energy sector; yet per capita electricity consumption *fell* an average of 1.2 percent annually between 2006 and 2013. Over the same period, Sub-Saharan Africa received about $2 billion in aid for the energy sector; yet, again, per capita electricity consumption fell on average by 1.1 percent annually between 2006 and 2013.[3] Overseas development assistance is not generally the main source of funding for energy projects—international private flows and domestic public funds are the most significant sources. Nevertheless, this demonstrates that conventional aid is not strategically promoting or even accompanying the expansion of the energy sector. The combined failures of conventional aid and domestic policies means that today three-quarters of the world's population still consume only 10 percent of global energy production; more than 1 billion people lack any access to electricity; and almost 3 billion still cook food on open fires (IEA 2015).

The countries which have succeeded at expanding energy services are not those which have solved technical problems or received more funding. Successful countries are those which made the provision of energy on a national scale a domestic priority and which solved domestic social and institutional problems related to building a financially sustainable energy sector. This public and political strategy for building and expanding the energy sector is, in effect, the strategy followed by all countries that enjoy universal energy access today.

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[2] The World Bank's Energy Sector Management Assistance Program (ESMAP) defines energy access "… as the ability to avail energy that is adequate, available when needed, reliable, of good quality, affordable, legal, convenient, healthy and safe, for all the required energy services across household, productive and community uses."

[3] Author's calculations using data on overseas development assistance from OECD.Stat (http://stats.oecd.org/Index.aspx?DatasetCode=TABLE2A) and on electricity consumption from the World Bank (worldbank.org/data).

Thus, the main reason that *external assistance* in the energy sector fails is a lack of *domestic ownership* of energy sector strategies. The most direct way to assure that funds flow to countries that prioritize solving difficult political-economy problems in the energy sector is to pay for outcomes rather than inputs. This is why COD Aid is an instrument worth trying in the energy sector.

While the idea of COD Aid is inherently simple, designing such agreements requires careful thought about the desired outcome, the appropriate indicator of progress, the amount paid for each unit of progress, the process of verification, and transparency. Unlike conventional aid, the strategies and plans for achieving progress are left to a parallel process that may or may not involve the same actors—a process led by the recipient country and which may still involve seeking outside technical assistance and capital, but only at *the country's* discretion.

## 4. What is so special about the energy sector?

Some measures of development are ends in themselves, like education and health. Other measures of development, like per capita energy consumption, are a means to other ends. The goal is not consumption of more energy *per se* but rather of more energy services. In this, energy is similar to sectors like finance and transportation. But energy has a number of features which distinguish it and which are critical to determining whether a COD Aid program could be feasible and desirable. These include:

- Price distortions
- Natural monopolies
- Heterogeneity of energy production
- Heterogeneity of energy use
- Multiple attributes of energy

### Price distortions

Energy use is not valued in and of itself. Rather, energy is valued for its contribution to human welfare and therefore has to be considered in relation to its costs—including environmental and social externalities. The price paid for energy by business, government and household consumers generally diverges from its true social, environmental and economic costs for a variety of reasons. As a result, COD Aid agreements for energy need to pay for indicators that address the costs as well as the benefits of energy consumption.

Energy producers have strong incentives to extract energy at the lowest cost and sell it without regard to whether the process of extraction pollutes the environment or displaces communities; and whether its consumption will generate unhealthy particulate matter or greenhouse gases that contribute to climate change. When energy producers address these negative effects of generation and consumption it may be due to a commitment to social responsibility or a response to regulations and liability risks. Either way, they can mitigate these negative effects throughout the process of designing, allocating resources, promoting research, and implementation. Nevertheless, without strong price signals or regulatory frameworks, the tendency is to underinvest in addressing these concerns relative to their full social and environmental costs (Fisher and Rothkopf 1989).

Public policies within and outside the energy sector also cause prices to diverge from the true social, environmental and economic costs of generating and distributing power. Many countries actively subsidize gasoline consumption which encourages inefficient use of fuels in transportation and inefficient electric generation (e.g., small generators). Tax policies influence the mix of energy sources when they allow accelerated depreciation of large fixed investments, define allowable business costs, or establish differential treatment for capital gains. Energy price regulations can also influence investment choices, energy source mix, and the efficiency (or inefficiency) of consumption decisions. In many countries, energy prices are kept artificially low, leading to decapitalization of state enterprises, limiting private sector interest in energy investments, and putting pressure on the public sector budget (Levy and Spiller 1997).

The IMF has estimated that government subsidies for energy are equivalent to about 6.5 percent of global GDP. The largest share of this is related to energy prices not incorporating negative externalities (e.g. local air pollution), but a significant share is still related to policies that keep consumer prices below the costs of supply (approximately 0.7 percent of global GDP in 2013 and projected to be 0.4 percent in 2015) (Coady et al. 2015).

So long as prices do not truly reflect the social, environmental and economic costs, public policy—including aid programs—will have to grapple with a number of tradeoffs by making judgments specific to each context. For example, encouraging household consumption of gasoline and electricity in contexts where prices are below the long-run marginal costs of production is not necessarily a bad idea if current consumption is extremely low and the fiscal costs of subsidies are manageable. In such a context, the benefits of increased energy consumption may far exceed the costs. However, in circumstances where consumption is already high and inefficient, the benefits of increasing consumption would be well below the costs and should not be encouraged.

COD Aid agreements need to take prevailing price distortions into consideration when defining objectives and selecting appropriate indicators. In some contexts, it may be appropriate to reward increases in consumption while in others considerations of efficiency or environmental impact might require explicit treatment.

## Natural monopolies

The preponderance of energy used today has features of natural monopolies—declining average costs that make it more efficient to supply power through one or a few enterprises. If left alone, such sectors are likely to be dominated by one or a few suppliers because the larger firms have a natural cost advantage that discourages new entrants and competition. Consequently, profit-maximizing energy firms have strong incentives to first seek to dominate a market and then to raise prices and restrict supply to the point where their profits are maximized. Public policies aiming to counter this tendency toward undersupply have followed three broad strategies. Many countries create public enterprises to generate and distribute energy, creating an explicit mandate to serve the public's interest rather than to maximize profits (e.g., municipal electric companies in US; the Costa Rican Electricity Institute in Costa Rica). A second strategy is to regulate private energy suppliers by: setting

rules for pricing distribution of electricity through transmission networks (e.g., UK); establishing requirements of service to the poor with explicit subsidies (e.g., Chile); requiring approval for construction of new generation or extractive facilities; setting standards for environmental and social impact; establishing penalties for emitting pollutants; or requiring the purchase of pollution "rights" from cap and trade markets (e.g., SO2 and NOX markets in the US and markets for greenhouse gas emissions in the EU). A third strategy is to promote the expansion of energy sources that are amenable to production and distribution through competitive markets—such as solar panels, small generators, or cleaner fuels through supply subsidies, feed-in tariffs or tax credits.

Distributed generation is not currently providing wide scale access to modern levels of energy consumption in any country and so, for the medium term, most programs aiming to rapidly expand the energy services in low- and middle-income countries are likely to face the key issues that arise with natural monopolies—finding ways to make public and private enterprises function efficiently and with due regard to the social, environmental and economic costs of energy production, distribution and use. This suggests that most COD Aid agreements will be grappling with the same issues that have confronted conventional energy programs—addressing the political-economy of large-scale centralized generation and distribution. But COD Aid agreements easily accommodate other approaches including distributed generation models. By paying for increased energy services, rather than energy production, recipients can choose whether they want to pursue the goal through large-scale generation and transmission or through mini-grid and distributed generation.

## Heterogeneity of energy production

Energy is produced, delivered and used in many different ways. Electrical energy can be generated by large power plants, with electricity transmitted long distances, and then distributed through electrical grids; but it can also be generated and provided by mini-grids, small diesel generators or solar panels. Fuels for cooking and heating can be refined from petroleum and distributed as oil, kerosene, and natural gas; but they can also be collected from forests by logging companies or by households for own-use.

The mix of energy generation and delivery mechanisms affects the design of a COD Aid program in several ways. First, it affects the appropriate level of government for the agreement, depending on whether the relevant authorities are national, state or local. Second, it affects the kinds of indicators that can be used because of the different measurement and verification technologies available. Finally, energy sources differ in terms of their social and environmental risks and impacts. In certain contexts, the energy sources most likely to be utilized might require serious attention to population displacement while in others such concerns may be of little consequence. Differences in terms of emissions or catastrophic risks may also require attention depending on context.

## Heterogeneity in energy use

Energy use is also extremely heterogeneous, making it difficult to measure and interpret. This has further implications for the choice of indicators and verification procedures for a COD Aid agreement.

At a minimum, energy use can be separated between consumption by households, private firms, and public agencies. Household consumption itself varies across uses such as cooking, lighting, and electronic appliances. Electricity, gas, and biofuels may variously predominate in different places, making it difficult to identify consistent energy consumption measures across households. Households may also use energy for commercial activities in agriculture, agricultural processing, small manufacturing and retail services.

Private firms depend heavily on energy for production of goods and services. Manufacturing, agriculture, construction and transportation can be particularly intensive in their use of energy. Heterogeneity across firms and sectors, between private firms and public agencies, also makes measurement of equivalent energy uses and prices difficult.

## Multiple attributes of energy

Measuring progress in energy production and use is also difficult because energy has many attributes in addition to the power it provides. It also varies in terms of the ease with which it can be converted into services and whether its availability is reliable and predictable. Despite this, aid agencies have typically measured energy access with simple indicators that are poor proxies for energy services. Typically, household access to electrical power has been measured in terms of whether or not there is a connection to the electric grid, regardless of the number and duration of outages or fluctuations in voltage that can damage appliances. The price of electrical power is sometimes used as an indication of energy availability to manufacturers without regard for whether power is regularly available.

The indicators being proposed for tracking the Sustainable Development Goal of "access to affordable, reliable, sustainable, and modern energy for all" are currently vague, starting with the proportion of the population with "access" to electricity and which primarily rely on clean fuels. The United States' Power Africa initiative is more specific, setting two indicators to judge improved energy access: increasing installed generation capacity by 30 GW and increasing the number of businesses and households connected to the grid by 60 million, but neither reflects the actual use of energy services. Similarly, the World Bank recounts its power sector successes by listing, for example, its expansion of transfer capacity from 21 to 37 GW in India; construction of 969 MW of renewable energy capacity in Turkey; and 5.5 million families using energy-saving lamps in Mexico.[4]

[4] http://www.worldbank.org/en/results/2013/04/10/sustainable-energy-for-all-results-profile accessed Oct. 28, 2016.

By contrast, the World Bank's Energy Sector Management Assistance Program (ESMAP) has attempted to fully address the multidimensional nature of energy by developing a comprehensive scheme of energy attributes (Bhatia & Angelou 2015). In the case of electricity, the ESMAP framework identifies seven attributes:

1. capacity,
2. duration (including daily supply and evening supply),
3. reliability,
4. quality,
5. affordability,
6. legality, and
7. health & safety.

It would be ideal to pay for delivery of energy only when it has satisfactory attributes along all of these dimensions but in practice it is difficult to have reliable and precise measures for all of these things at once. Consequently, COD Aid agreements must choose indicators related to the most important outcomes and which, to the extent possible, are positively correlated with as many other attributes as possible. The goal is not a perfect indicator but one which is good enough, which balances precision with ultimate goals, and which minimizes the potential for perverse incentives.

* * *

In sum, programs designed to improve energy services in low- and middle-income countries have to contend with a number of complexities. Paying for performance in the energy sector requires addressing potential tradeoffs among high-order objectives, namely economic growth, consumption, and social and environmental health. Five basic features of the energy sector—price distortions, natural monopolies, heterogeneity in energy production, heterogeneity in energy use, and multiple attributes of energy—have important implications for designing COD Aid agreements in the energy sector. In particular, these features should influence the design of COD Aid agreements in energy in terms of the appropriate level of government that should be the recipient, the kinds of indicators chosen, and the verification procedures that are used.

# 5. What would a COD Aid agreement for energy look like?

## General design principles for COD Aid

The COD aid approach to development requires that funders and recipients have a common goal that can be specified in one or a few indicators. Unlike conventional aid projects, this requires funders and recipients to be clearer about what they are trying to achieve so that they can find ways to measure it explicitly, reliably and with precision.

The essential elements of a COD Aid program are a shared objective between the funder and the recipient in terms of a desired outcome; an indicator for that outcome or a close proxy; a unit payment associated with improvements in that outcome; and a verification process.

Once the outcome is identified, a good indicator has several features. First of all, it is close to the desired outcome. For example, vaccinating children is a healthcare service not a health outcome; yet we know that vaccinating a child is so closely related to averting death or illness from diseases that it is a very good proxy for improved health. By contrast, connecting households to the electric grid may seem like a good proxy; but in contexts where power systems are not maintained and service interruptions are common, just being connected to the grid is not a good indicator of being able to consume energy services.[5]

Good indicators are also responsive to policy. This does not mean that the recipient controls all the factors necessary to achieve outcomes, but it does mean that the recipient's actions make a significant difference to the outcome. Governments make a big difference to the likelihood that children complete school, even though family background also plays a role. Government policy significantly promotes or discourages energy production, even though actual consumption will depend on demand factors. By contrast, indicators like children completing school or energy consumption in a given region may be beyond the capacity of specific schools or energy companies to deliver if factors outside their control, like migration and grid connections, are significant.

Good indicators have to be quantifiable with sufficient precision to make periodic payments. Most indicators are estimates of changes in outcomes and may be affected by a variety of measurement errors. The more precise an indicator can be, the more likely that payments will be made against real changes rather than random factors. On the other hand, if programs are long-term, measurement errors one year may be offset by those of subsequent years.

Good indicators are designed to minimize unintended consequences. Paying for a particular indicator can lead recipients to focus on that outcome to the detriment of other equally important goals; to use methods that violate social, environmental or ethical norms; or to manipulate the measurement process itself. Choosing broad goals; working with higher level recipients (like governments); and designing lower-powered incentive programs are some ways to mitigate these problems. When specific consequences can be identified, indicators can be modified to address them. For example, an indicator defined as "children who pass a test" is closer to the desired outcome (educated children) than "children who take a test". Nevertheless, the latter indicator may be preferable when manipulation and precision of test results could be serious problems (Birdsall & Savedoff 2010). Independent verification (discussed below) is an important part of avoiding manipulation of indicators.

In addition to choosing a good indicator, a COD Agreement requires setting a unit payment for the outcome. For service providers, the unit payment has to cover the average or marginal costs of provision depending on their cost and financing structure. However, whenever the recipient is already committed to achieving outcomes from its own resources (as in the case of governments, NGOs, households, and some private firms), the unit payment may not have to cover costs. Rather, it might be sufficient to subsidize or reward the improvements in outcomes.

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[5] Bhatia & Angelou 2015 uses the concept of an "energy results chain" (see pages 52ff) to visualize how closely different indicators are to the desired outcome and how responsive they are to policy.

The fundamental parameters for choosing the payment amount are the funder's willingness to pay and the recipient's willingness to accept (ESMAP 2015, p. 56). The funder has some value that they place on the outcome—which could be related to the cost of achieving the same outcome by conventional means or the value placed on taxpayers and donors on the results. The recipient's willingness to accept is probably related to the marginal cost of achieving each unit of improvement in the outcome (incorporating political and social factors) less the value that the recipient places on achieving the outcome.

The willingness to pay and willingness to accept establish the upper and lower bounds for the COD unit payment. Paying near the upper bound will provide greater visibility to the agreement and increase the recipient's interest in achieving the goal but raise the costs to the funder. Paying near the lower bound will encourage recipients to achieve outcomes at lower cost and to be more diligent about waste and corruption (Kenny and Savedoff 2013) at the risk of undercompensating recipients' efforts.

Uncertainty around the value attached to outcomes and the costs of achieving them further complicate the process of setting a unit amount. Consequently, dynamic strategies for setting payments may be worth considering. Funders offering a unit payment could start with a low price offer and see how many recipients respond at that level. Alternatively, recipients could offer to achieve certain outcomes at a relatively high price and test funders' willingness to come forward. If the COD Agreement is being negotiated, the parties may reference other aid flows, comparable projects, and cost-models to select a unit amount (ESMAP 2015, p. 56 ff).

Finally, the COD Agreement requires an explicit process for independently verifying the progress indicator in a timely fashion. The purpose of verification is to make sure, for both funder and recipient, that the indicator is not manipulated. Funders do not want to pay for illusory outcomes and recipients want to be assured that the results of their efforts are fully counted. In some COD agreements, recipients will self-report their achievements and the verification process will check the accuracy of that reporting. In other cases, the process of measuring changes in outcomes will itself be done by an independent agent and further verification will not be required. For example, a COD Agreement for reduced infant mortality might rely on government reports that are assessed through independent surveys (checking for both administrative reporting errors and non-reporting bias for infant deaths outside of healthcare facilities). Alternatively, such an agreement might rely entirely on estimates from an independent household survey.

The independence of the verification process has two aspects. First, the people or institutions who verify the findings should be motivated to be truthful, either because they have full financial and institutional independence from the parties to the agreement or because they have some other strong professional or reputational motivation. Second, the data collected to verify the indicator must be independent of the data used to provide other estimates. In other words, it is not sufficient to test whether a recipient's report faithfully reflects outcomes recorded locally. Rather, verification requires a way to test the veracity of self-reported information against some alternative data source.

## Choosing Objectives and Indicators for Energy

Applying these principles to the energy sector requires first of all clarifying the objective. Efforts to help developing countries address their energy needs typically address three kinds of goals based on energy's contribution to:

- economic growth,
- consumption possibilities, and
- a healthy environment.[6]

These three objectives can be compatible if energy is priced at its true cost because consumers and producers will then decide on how much and which kinds of energy to use in ways that reflect not only the costs of production but also social and environmental externalities. In practice, however, price signals are do not adequately incorporate these externalities.

Thus, the existence of three sometimes competing and sometimes compatible goals in the energy sector complicates the process of designing COD Aid agreements. This is, however, one of the values of a COD Aid agreement: it demands that funders and recipients address these tradeoffs by choosing one or a few indicators that appropriately balance objectives with potential consequences.

The choice of indicators will vary depending on the primary focus of the funder and recipient. The COD Aid agreement could be designed to pay for indicators that are primarily associated with *economic growth* such as:

- higher business energy consumption;
- lower average energy costs;
- more energy availability in distribution networks; or
- more energy generation.

… or with *consumption*, such as:

- higher per capita energy consumption;
- higher average household consumption; or
- additional households consuming a basic energy package.

… or with *environmental health*, such as:

- lower greenhouse gas emissions;
- higher share of renewable energy generation;
- lower quantities of pollutants; or
- reduced land use impact.

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[6] This paper uses the term "healthy environment" to encompass all characteristics of the environment that make our planet a livable place, including biodiversity and climate change, and not just those that have direct and immediate effects on human health like the release of particulate matter into the air.

Paying for indicators that are closely related to the desired outcome (e.g., efficient consumption) rather than being tied to particular types of energy, technology or strategies has substantial benefits. By paying for a close proxy of outcomes, a COD Aid program can be neutral with regard to technologies and institutional arrangements. If, on the other hand, it focuses on particular kinds of energy outputs, then the definition of indicators has to take into account ways in which the incentive may privilege one sector, form of energy, technology or institutional arrangement over another.

For example, if the goal of a national program is to expand access to electrical energy for both households and businesses, a COD Aid agreement need not specify whether progress is accomplished through public authorities, private companies, or decentralized markets; whether it primarily utilizes renewable or nonrenewable sources of energy; or whether it promotes centralized or distributed generation. A program focused on improving access to energy for cooking in rural communities, however, may have to address a range of direct effects on local markets, livelihoods, and distributional concerns. It might even have to specify which kinds of cook stoves are eligible on the basis of efficiency and safety.

As noted earlier, paying for indicators at higher levels of aggregation (e.g., national) also carries distinct benefits. When critical obstacles to improving energy access are related to the national policy environment, the functioning of the energy system as a whole, or to political and social factors, then only the national government has the full range of policy instruments to address them. While local problems can be solved by particular providers or local governments, these actors have a more constrained range of action and decision-making authority. For example, it would certainly be feasible to pay a private consortium for electricity provided to the grid; but there would be no way for that private consortium to assure that this energy would reach businesses and households.

## Three Examples of COD Aid for Energy

To illustrate how the foregoing principles could be realized through specific COD Aid for Energy programs, this section presents three examples with specific attention to the indicator and verification process. The existence of a shared objective and appropriate amount are likely to depend on negotiation between the two parties—unless a funder were willing to make a global offer (See Box 2). In each case, the payment is made to a government which has the authority to make regulatory changes, borrow funds, invest, seek technical assistance, and/or establish incentive programs to promote the expansion of energy services.

**Box 2: COD Aid with a Global Offer**

COD Aid could be designed as a global offer, in which one or more funders agree to pay for improved outcomes as measured by a particular indicator for a certain number of eligible countries. Eligible recipients would choose whether or not to take advantage of the agreement. Examples of such global offers are provided in Birdsall and Savedoff (2010) and Savedoff (2016).

Practical issues arise in establishing such a global offer. First and foremost, the eligibility standards for recipients will have to include the ability to verify results. Beyond that, funders may want to limit eligibility to countries by some measure of income, social wellbeing, or resources or offer to pay for a limited set of indicators that would be chosen based on context. Funders may also need to set a cap on total disbursements or limit the total number of countries that can participate as recipients.

A global offer has several advantages over negotiating bilateral agreements. First, designing a single offer reduces administrative costs. Secondly, if a group of funders agree on the terms—particularly the goal, indicator and verification process—the creation of a global offer automatically harmonizes and coordinates funding flows across agencies. Third, a single offer limits opportunities to manipulate the design in favor of particular interests. A global offer would promote fairness by offering a uniform payment that values benefits equally across countries and beneficiaries. Finally, a single offer promotes transparency because a single, clearly measured and communicated indicator would help citizens and civil society groups in understanding whether their countries are achieving the goals of improved energy access set out in the international agreement.

Sources: Birdsall & Savedoff 2010; Savedoff 2016.

## Example 1: Sustainable Path to Energy for Growth & Wellbeing in Low-Income Countries

The broadest COD Agreement for electrical energy might focus on overall consumption, providing a subsidy for each kilowatt-hour consumed over the course of a year. The principal problem with such a payment is that it would reward both inefficient production (e.g., generating power that pollutes excessively) and inefficient consumption (e.g., leaving appliances on when not in use). A solution to the first problem would be to provide a complementary payment for averted metric tons of CO2 emissions (MT CO2). While this is not a perfect indicator, it would promote production efficiency for energy sources that generate one of the most serious pollutants and encourage the use of energy sources that emit fewer (or no) greenhouses gases. The second problem, inefficient consumption, may be relatively insignificant in contexts where consumption is constrained by low incomes. In 18 countries, average per capita consumption of electrical energy for all uses (including private sector production) is less than the power consumed by a single refrigerator.

A COD Agreement for energy growth and wellbeing might have the following key features:

- **Shared Goal**: All people should enjoy the benefits of modern electrical power compatible with a sustainable environment.
- **Indicative Units of Progress**: (1) Kilowatt-hours per year and (2) decline in CO2 emissions relative to a reference level (e.g., the current MT CO2 emissions per megawatt hour consumed).
- **Payments**: The funder pays the government (1) $0.01 for each additional kilowatt-hour consumed and (2) $15.00 for each ton of avoided CO2 emissions relative to the reference level.
- **Transparency**: An independently administered survey is carried out to estimate total electricity consumption (kWh) and CO2 emissions (MT), cross-checked with administrative and remote sensing data, and with results posted to a website.

The implications of such an agreement in terms of annual payments and net present value is presented in Appendix 1 for a range of consumption levels and based on scenarios under which countries increase energy services by 5 percent and 10 percent annually. The estimates assume that new electricity generation only 25 percent as much carbon into the atmosphere as the reference level, chosen to equal the average carbon emissions for a kWh of consumption in the United States.

For a country like Cambodia, increasing annual per capita electricity consumption from 164 kWh to 173 kWh yields a payment of about $450,000, while an increase to 181 kWh would yield a payment of almost $1 million. If Cambodia were to sustain these increases over a 20-year period, the annual payments would be equivalent to a net present value of $1.7 million and $3.4 million, respectively (assuming a 10 percent discount rate).

For a country like Pakistan, increasing annual per capita electricity consumption from 449 kWh to 472 kWh yields a payment of about $6.6 million, while an increase to 494 kWh would yield a payment of more than $13 million. If Pakistan were to sustain these increases over a 20-year period, the annual payments would be equivalent to a net present value of $56 million and $112 million, respectively (assuming a 10 percent discount rate). If instead, the discount rate were chosen to be 1.75 percent (which is the rate that the World Bank is charging Pakistan for a $500 million power sector policy credit), then the net present values of the hypothetical COD Aid Agreement are $110 million and $220 million for the two scenarios, respectively.

In both cases, about two-thirds of the payments are due to the increase in consumption and the rest is due to the low rate of carbon emissions. The payment amount for averted MT CO2 ($15) was chosen so that zero emission expansions of energy services will almost double the payment per kWh of electricity.

In Pakistan's case, the *grant* value of the COD Aid Agreement would be equivalent in magnitude to the World Bank power sector loan. However, the World Bank loan disburses *ex post* only in relation to the promulgation of policies which may or may not result in cost-savings for Pakistan and which will not necessarily lead to increases in energy services to the population. The stream of grant funds that Pakistan could obtain with a COD Aid Agreement would be of much greater financial value and be more closely tied to progress in increasing energy services.

## Example 2: Paying for Reliable and Adequate Household-Level Services

A COD Agreement for increasing household access to electrical energy would require a good indicator of household access. Paying per household connected to an electric grid is likely to be a poor indicator because the existence of a connection does not guarantee sufficient energy capacity, reliability or duration to represent real energy access (Energy Access Targets Working Group 2016). A better option is to conduct a survey of households that would verify the amount of electrical power available, along with its reliability and duration. New technologies are making it possible to install energy-use monitors that transmit periodic data to improve on self-reported usage in questionnaires. Depending on the interests of the funder and recipient country, other energy attributes (e.g., legality) might also be considered.

A COD Aid payment for improving household access could use a number of different indicators, each with advantages and disadvantages. For example, the agreement could pay for (1) more households with basic energy access (as defined by the Energy Access Targets Working Group 2016), (2) more household energy consumption (measured in kilowatt-hours), or (3) improvements in an index of energy availability (e.g. like the ones described in ESMAP 2015, See Box 3).

Taking the first of these, such an agreement might have the following key features:

- **Shared Goal**: All households should have access to reliable and adequate electricity services.
- **Indicative Unit of Progress**: A household with access to electricity for an average of 23 hours a day and able to consume 300 kWh/person/year (an amount typically adequate to operate lights, fans, radios, a shared refrigerator, a shared television, and other appliances).
- **Payment**: The funder pays the government $100 for each household consuming 300 kWh/person/year relative to a moving average baseline of households at this level.
- **Transparency**: An independently administered nationally representative household survey is carried out in monthly installments, with results posted to a website.

For example, a country with 20 million people in 5 million households would get paid for each additional household that gets basic energy access. If a baseline determined that only half of the households (2.5 million) had basic energy access and the country expanded this by 200,000 households each year, it would receive annual payments of $20 million.

A COD Aid agreement for increasing *business* access to electrical energy would have to find a similar measure of energy availability for businesses. It would require establishing a baseline for a range of businesses, probably stratified by firm size or energy use. The indicator would have to address at least the capacity, reliability and duration of power.

**Box 3: Paying for Improvements in an Index of Household Energy Access**

The multi-tier framework for measuring access to electricity, developed by ESMAP, offers a unique opportunity to tie aid payments to energy outcomes.

• It measures the usability of electricity supply in terms of eight different attributes through representative household surveys. These different attributes are aggregated into a tier score for each household that ranges between 0 (no electricity access) to 5 (high quality accessibility of electricity).

• Payments could be tied to changes in the average tier score. This links well with how the indicator may be used in the SE4ALL initiative, but it may not be flexible enough to allow the reward structure to target particular user groups. For instance, it would require the same payment to be disbursed for a single tier improvement experienced by a user who already had good electricity access as for a single tier improvement experienced by a user with no access to electricity.

• Payments could be tied to individual tier improvements. For instance, $200 could be disbursed for any household moving from Tier 1 to Tier 2, $150 for any household moving from Tier 2 to Tier 3, and so on. This allows the reward structure to be more carefully targeted, but would somewhat complicate presentation and explanation of the program.

• Payments could be tied to individual attributes of electricity access. For instance, a payment of $100 could be made for each household that experiences improved quality or affordability of supply. This approach provides a simple, easy-to-explain incentive that could be used to target particularly salient barriers.

Source: ESMAP 2015, p. 68.

## Example 3: Paying for Financially Sustainable Power Utilities

An extremely common problem in programs that have supported the expansion of electrical power in low- and middle-income countries is decapitalization of electrical power firms due to commercial losses or tariffs that are set below long run marginal cost. When electrical power is not properly billed and revenues fail to be collected, then consumers have no incentive to conserve energy and the electric company will lack funds necessary to maintain, operate and expand the system.

Aid agencies and multilateral development banks typically include conditions on their loans and grants that require tariffs to be raised or provide technical support to improve billing and collection; yet the track record on such approaches has not been very good.

A COD Aid agreement could approach this problem in a new way. A COD Aid agreement could pay the government a grant of $1 for every $10 in revenues that are appropriately billed (i.e. the energy was actually provided to a customer) and collected (i.e. the electric

company received payment) by electricity distributors.[7] This arrangement gives the government level that sets tariff policy a stake in assuring that energy prices are adequate (high enough to cover long-run marginal costs and not too high to discourage consumption); that public entities fulfill their obligation to pay their electric bills; and that regulations promote adequate capitalization for maintenance and expansion of electrical energy services.

Such an agreement might have the following key features:

- **Shared Goal**: Reliable and adequate electricity services are available to consumers of all kinds through financially sustainable utilities.
- **Indicative Unit of Progress**: Appropriately billed and collected electricity revenues; that is, revenues derived from (a) electricity delivered as demanded by consumers, (b) properly metered consumption, (c) consumption invoiced, and (d) invoiced amounts collected by the distributor.
- **Payment**: The funder pays the government $1 for every additional $10 in appropriately billed and collected revenues by electricity distributors.
- **Transparency**: Financial and administrative reports are cross-checked by periodic and random visits to collect information from consumers on consumption levels, billing, and payments with results published quarterly.

For example, a county that consumes 6,000 GWh each year at a price of $0.10/kWh with commercial losses of 40 percent would generate revenues of US$360 million per year and forego another US$240 million. This COD payment would create a subsidy to the government of US$12 million per year if the country successfully reduced these commercial losses in half.

* * *

In sum, many indicators could be used in a COD Aid agreement for energy. A good indicator will be a close proxy of the desired outcome, responsive to policy, measurable, and independently verifiable. The payment amount is bounded by the funder's willingness to pay and the recipient's willingness to accept and may have to be negotiated or set dynamically (ESMAP 2015). But once ideas are placed on the table, informed by expert advice, it should be possible to agree upon an appropriate and feasible agreement.

## 6. Concerns over using COD Aid for energy

COD Aid agreements are novel and therefore look risky. In particular, people have raised a number of concerns about the COD Aid approach and in particular as it might be applied to the energy sector. The most common of these worries are that energy sector expansion requires large infusions of capital "up front"; that COD Aid is too unpredictable and puts too much risk on the recipient; that measuring outcomes is too difficult; that payments to increase energy consumption will exacerbate climate change; that incentive payments like COD Aid will lead to other unintended consequences for society and the environment; that COD Aid fails to help the poorly-governed countries that need funding the most.

[7] To our knowledge, this idea was first proposed by Kaplan in relation to the water sector, see Kaplan (2010).

## Up front investments

A COD Aid agreement that pays annually against increases in energy availability might seem antithetical to a sector which tends to require large fixed investments and long gestation periods. While this is true for specific investments in generation and transmission, however, it is not true of an energy system as a whole. For example, a country that signed a COD Aid agreement for increasing electrical energy services could achieve initial improvements through regulatory changes, reducing losses in transmission and distribution, or increasing the efficiency of generation plants. The funds it receives from the agreement could then be programmed to support bond issues or provide counterpart to private investments in large longer-term expansions of capacity. If the COD Aid agreement has a long enough time frame, the promised payments could guarantee a future revenue stream adequate to interest private investors.

## Unpredictability and risk

A COD Aid agreement only pays out in proportion to success in achieving the outcome. Therefore, it appears to put much greater risk on the recipient than conventional aid programs. This is, however, an illusion. Conventional aid can itself be volatile and disruptive, with the variability in payments affected as much (if not more) by changing politics and policies of funders than recipients (Desai and Kharas 2010; Kharas 2008). By linking payments to an independently verified outcome which is responsive to the recipient's actions, COD Aid may actually reduce risks which are outside of the recipient's control and make payments more predictable. COD Aid does not transfer risks from funders to recipients. Rather it redistributes risks. The question is whether the resulting arrangement transfers responsibilities for risks to the actor who is best placed to manage them.

## Difficulty of measuring outcomes

Measuring outcomes is not always easy and can be costly. But critics of paying for outcomes tend to ignore the difficulties of measuring inputs, the benefits of accurately measuring outcomes, and the strategies for minimizing monitoring costs.

First, outcomes are not necessarily more difficult to measure than inputs. Systems for verifying the purchase and delivery of inputs are also costly and imperfect. In fact, the process of purchasing and delivering inputs is often less visible than the activities involved in consuming and benefiting from outputs.

Second, reliable information about outcomes is extremely helpful for policymaking and public accountability. Thus, the benefits of having reliable information on outcomes are the appropriate criterion for assessing whether the measurement process is too costly or not.

Finally, COD Aid agreements can minimize the costs of measuring outcomes by judicious use of existing administrative data systems with statistically robust verification systems. For example, if recipient countries were to report their annual progress from administrative data, independent verification agents could test the accuracy of this report from a relatively small

statistically representative sample.[8] In cases where administrative data reporting is not available, representative samples will have to be larger, but may still be cost-effective in light of the benefits of collecting this information.

## Climate change

Climate change is one of the gravest threats we face in the coming decades and the burning of fossil fuels to generate energy is one of the primary causes. In the transition to a future in which greenhouse gas emissions are reduced to zero, unequal access to energy remains a serious issue. The IEA estimates that more than 1 billion people lack access to electricity at a time when consumption of electricity by the richest countries contributes significantly to global warming. For example, electricity consumption in the United States generates more than 6 MT CO2 per person per year. Even Germany's energy consumption, which has a high share of renewable energy sources, generates over 4 MT CO2 per person annually. Refusing to finance energy access for the poor on the justification that it will accelerate climate change is simply unethical and unnecessary because alternatives exist.

First, by focusing on the end goal—energy access—COD Aid agreements do not prejudge how energy will be produced. Thus, in contrast to conventional programs, they anticipate and allow the use of energy sources that are renewable or generate fewer greenhouse gas emissions. Second, in many poor contexts, governments could pursue strategies that replace existing inefficient energy sources—small diesel generators, wood-burning stoves—with more efficient ones that increase energy access while reducing average greenhouse gas emissions. Finally, substantially greater reductions in greenhouse gas emissions can be achieved by improving efficiency and conservation in middle- and high-income countries than by denying energy access to people in poor countries.

This does not mean that a COD Aid agreement should ignore the impact on climate change. The first example in this paper includes one idea for incorporating such concerns in a COD Aid agreement by paying for reductions in average greenhouse gas emissions alongside a reward for facilitating increased energy consumption.

## Social and Environmental Risks

Conventional aid programs have rules for addressing social and environmental risks such as displacing people from their communities; disrupting livelihoods; polluting; and increasing vulnerabilities to natural disasters (e.g., earthquakes). Preventing, mitigating or compensating for such risks is a basic responsibility of all countries so that when an aid program finances a specific plan of action, with pre-identified activities, it is reasonable to ask how recipient governments will address such concerns.

[8] For a description of this process, see Birdsall & Savedoff 2010 as applied to education.

COD Aid agreements do not fund specific activities; they reward countries for improving outcomes. Consequently, *ex ante* efforts to impose restrictions on countries are likely to undermine the logic of paying for results by constraining adaptation and slowing programs without demonstrably protecting people and the environment. In this way, concerns with hypothetical risks may overwhelm the concerns with energy poverty.

COD Aid agreements, therefore, need to address social and environmental concerns in a way that preserves the recipient's space for innovation and adaptation while allowing domestic constituencies and the international community to monitor adherence to accepted principles of social and environmental protections. The energy sector is different in this regard from other sectors because, of the many ways to expand energy access, some achieve success by inappropriately forcing the costs onto society or the environment. Fortunately, the energy sector also has developed a range of instruments and practices to address these very concerns. Therefore, a well-designed COD Aid agreement for energy access, will not impose prior requirements for social and environmental safeguards in the way done by conventional aid. Rather, it will include a list of commonly accepted principles and standards that recipients will be expected to follow. The COD Aid agreement can then include a provision that, in the case of significant breach of these standards, would allow funders to petition an arbitration board to rescind the agreement.[9]

## Poorly governed countries

Aid agencies often argue that performance payments should be reserved for countries that have strong institutional capacity and that performance payments are inappropriate for poorly-governed countries. This presumption explicitly relies on the argument that poorly-governed countries have difficulty designing and implementing programs and implicitly on the argument that conventional aid projects can compensate for this lack of capacity. The latter argument is unproven and largely unexamined.

Progress in poorly-governed countries is difficult regardless of the way in which external assistance is provided. Conventional aid will be more successful in such contexts to the extent that external actors have relevant and applicable technologies and resources that match the motivation and interests of domestic actors. In cases where this match is lacking, funds tend to disburse with little effect. By contrast, COD agreements will be successful to the extent that domestic actors are interested in achieving the goal, assume responsibility for making progress, and engage in domestic problem-solving. When domestic actors do not make these efforts, progress will remain stalled but at least funds will not be disbursed and wasted.

[9] The contract models provided in the appendix to Birdsall & Savedoff 2010 includes a description of an arbitration panel that could be constituted to address disagreements between funders and recipients over the conduct of the contract. The inclusion of such a provision and the involvement of external actors protects both funders and recipients from arbitrary and unforeseen actions during the course of the agreement.

Thus, COD Aid might actually be more successful in fragile states than traditional forms of aid. First, COD Aid requires serious efforts to gather data and establish information systems that can make a large difference to subsequent policymaking. All too often, this core requirement of good governance is left to be addressed after more immediate needs are met—even when it is unclear if the immediate actions are making any difference. Second, while it may be risky to rely on governments in fragile states to design and implement their own programs, traditional approaches that substitute foreign for domestic institutional capacity also encourage dependence and compromise sustainability. Third, fragile states may have greater flexibility to respond to the COD Aid incentives with innovative approaches because vested interests tend to be weaker and government bureaucracies are less entrenched and less resistant to introducing innovations.

* * *

COD Aid is not without its risks. While the concerns addressed here can be mitigated by good designs, they cannot be eliminated. The arguments here are aimed at demonstrating that the risks of trying COD Aid to promote energy access are not necessarily greater than those associated with conventional aid and the potential for achieving successes in contexts where conventional aid has been ineffective makes it worth trying.

## Conclusion

Improving access to energy in the world's low- and middle-income countries is a central challenge to improving lives and opportunities. Conventional approaches have achieved a great deal of progress in many countries, but in numerous contexts, conventional approaches are failing. The COD Aid approach offers a different way to work with developing countries and support the domestic political processes that are needed to promote the public policy environments and investments required for expanding access to energy.

This paper explained how a COD Aid proposal for energy can clarify objectives, identify indicators, set payment amounts, and establish verification mechanisms. It provides design principles and examples of applying the approach to expand energy access in low- and middle-income countries. In particular, it describes proposals to pay:

- $0.01 for each additional kilowatt-hour of electricity that is consumed and $15.00 for each metric ton of avoided CO2 emissions relative to a reference level;
- $100 for each additional household consuming 300 kWh/person/year; or
- $1 for every additional $10 in appropriately billed and collected electric power revenues.

The examples provided here certainly require further refinement, so the next step is for potential funders and recipients to convene energy sector experts and policymakers to work through the goals, indicators, and verification procedures for a workable agreement. By offering to pay Cash on Delivery for expanded energy access, foreign assistance could test whether paying for outcomes would be more successful at supporting the energy sector expansion that is necessary for economic growth, institutional development, and social welfare.

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# Appendix 1: Financial Implications of A COD Agreement for Energy

The first example of a COD Aid Energy Agreement provided in the text has a goal of a "Sustainable Path to Energy for Growth & Wellbeing in Low-Income Countries." The specific features proposed for that agreement are:

- *Shared Goal*: All people should enjoy the benefits of modern electrical power compatible with a sustainable environment.
- *Indicative Units of Progress*: (1) Kilowatt-hours per year and (2) decline in CO2 emissions relative to a reference level (e.g., the current MT CO2 emissions per megawatt hour consumed).
- *Payments*: The funder pays the government (1) $0.01 for each additional kilowatt-hour consumed and (2) $15.00 for each ton of avoided CO2 emissions relative to the reference level.
- *Transparency*: An independently administered survey is carried out to estimate total electricity consumption (kWh) and CO2 emissions (MT), cross-checked with administrative and remote sensing data, and with results posted to a website.

Table 1 shows the implications of such an agreement for a range of contexts and assumptions. For each country, estimates are made based on an increase of 5 percent and 10 percent of energy consumption. For comparison, per capita electricity consumption in low-income countries has increased on average by about 4.5 percent annually between 1990 and 2013. It is further assumed that the new energy services are responsible for carbon emissions that are only 25 percent as high as for the reference level, chosen to equal the average carbon emissions per kWh of consumption in the United States.

The country with the lowest electricity consumption in this illustrated example is Cambodia which consumes about 164 kWh per person per year (or a total of 240 GWh each year). With this particular COD Aid Agreement for Energy, Cambodia would be able to obtain payments of about $450,000 each year that it increases electricity consumption by 5 percent and almost $1 million each year that it achieves a 10 percent increase. Almost two-thirds of this increase is due to the increase in consumption and the rest is due to the low rate of carbon emissions.

A steady increase in annual per capita electricity consumption of 9 kWh (or 18 kWh) would generate a stream of payments over 20 years, equivalent to a net present value of $1.7 million (or $3.4 million). In other words, this hypothetical COD Aid Agreement for energy would be the equivalent of a one-time up-front grant of anywhere between $1.7 million and $3.4 million under the assumption that Cambodia could achieve such an expansion over this time frame.

Pakistan is the largest country in this illustration. It consumes about 449 kWh per person per year, and given its population this represents 7,914 GWh each year. With this particular COD Aid Agreement for Energy, Pakistan would be able to obtain payments of about $6.6 million each year that it increases electricity consumption by 5 percent and more than $13

million each year for a 10 percent increase. Again, almost two-thirds of this increase is due to the increase in consumption and the rest is due to the low rate of carbon emissions. For Pakistan, low carbon emissions are particularly likely if it were to, first, reduce the high technical and commercial losses and, second, better exploit its hydroelectric potential.

For Pakistan, a steady increase in consumption by these amounts would generate a stream of payments over 20 years, equivalent to a net present value of $56 million (or $112 million). Thus, this hypothetical COD Aid Agreement for energy would be the equivalent of a one-time up-front grant of anywhere between $56 million and $112 million under the assumption that Pakistan could achieve such an expansion over this time frame.

This hypothetical COD Aid Agreement with Pakistan can be contrasted with a conventional policy loan recently approved by the World Bank. In 2015, Pakistan received a power sector loan ("policy credit") from the World Bank for $500 million at an interest rate of 1.75 percent. The World Bank credit will be disbursed if Pakistan promulgates a series of measures to reduce consumer subsidies, regularize tariffs, and reduce commercial losses.

Using the World Bank's interest rate as the discount rate (rather than 10 percent as in Table 1) for the hypothetical COD Aid Agreement generates a net present value of $110 million and $220 million for the two scenarios. Thus the *grant* value of the COD Aid Agreement would be equivalent in magnitude to the World Bank power sector loan. However, the World Bank loan disburses *ex post* only in relation to the promulgation of policies which may or may not result in cost-savings for Pakistan and which will not necessarily lead to increases in energy services to the population. The stream of grant funds that Pakistan could obtain with a COD Aid Agreement would be of much greater financial value and be more closely tied to progress in increasing energy services.

# A COD for Energy Proposal—Illustrations using 2013 as Baseline

## Electricity consumption payments:

$0.01 per additional kWh consumed & $15 per ton of avoided CO2 emissions relative to reference level.

| **EXAMPLES** | | Cameroon | Cameroon | Cambodia | Cambodia | El Salvador | El Salvador | Pakistan | Pakistan |
|---|---|---|---|---|---|---|---|---|---|
| Population | | 21,156,272 | 21,156,272 | 14,605,862 | 14,605,862 | 6,256,242 | 6,256,242 | 176,166,353 | 176,166,353 |
| Elect. Consumption (kWh/pers/yr) | | 256 | 256 | 164 | 164 | 830 | 830 | 449 | 449 |
| Future Elect Cons. (kWh/pers/yr) | | 268 | 281 | 173 | 181 | 871 | 913 | 472 | 494 |
| | Total GWh | 541 | 541 | 240 | 240 | 519 | 519 | 7,914 | 7,914 |
| | Inc GWh | 27 | 54 | 12 | 24 | 26 | 52 | 396 | 791 |
| | Future GWh | 568 | 595 | 252 | 264 | 545 | 571 | 8,310 | 8,706 |
| | MT CO2 / GWh in the US | 593 | 593 | 593 | 593 | 593 | 593 | 593 | 593 |
| | Ref Level (RL) emissions (MT) | 16,015 | 32,031 | 7,113 | 14,226 | 15,375 | 30,751 | 234,461 | 468,922 |
| | Ratio: new MT C02 / RL | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| | Actual MT CO2 increase | 4,004 | 8,008 | 1,778 | 3,556 | 3,844 | 7,688 | 58,615 | 117,231 |
| | Avoided MT CO2 | 12,011 | 24,023 | 5,335 | 10,669 | 11,532 | 23,063 | 175,846 | 351,692 |
| **Proposal** | | | | | | | | | |
| price per kWh | $0.01 | $ 270,300 | $ 540,600 | $ 120,050 | $ 240,100 | $ 259,500 | $ 519,000 | $ 3,957,150 | $ 7,914,300 |
| price per MT CO2 | $15.00 | $ 180,172 | $ 360,344 | $ 80,021 | $ 160,042 | $ 172,973 | $ 345,946 | $ 2,637,688 | $ 5,275,376 |
| **Total Payment (1 Year)** | | **$ 450,472** | **$ 900,944** | **$ 200,071** | **$ 400,142** | **$ 432,473** | **$ 864,946** | **$ 6,594,838** | **$ 13,189,676** |
| INVESTMENT EQUIVALENT OF ANNUAL RECEIPTS OVER TIME PERIODS AND WITH DISCOUNT RATE | | | | | | | | | |
| | Time Periods (Years) | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | Discount Rate (%) | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% |
| | Present Value | $ 3,835,121 | $ 7,670,241 | $ 1,703,316 | $ 3,406,631 | $ 3,681,886 | $ 7,363,772 | $ 56,145,572 | $ 112,291,144 |

Sources: Electric energy consumption and population data come from the World Bank at http://data.worldbank.org/

Carbon emissions per unit of electrical energy in the US was found at http://blueskymodel.org/kilowatt-hour

Notes: 1. The two scenarios for each country represent increases of 5% and 10% in electric energy consumption.

2. *Discount rate* : A recent World Bank power sector loan for $500 million to Pakistan had an interest rate of 1.75%. If that rate were applied as the discount rate, then the NPV for Pakistan of the two scenarios presented here would be $147 million and $294 million, respectively.

3. Price of averted carbon emissions is calibrated such that the use of zero emissions energy sources will double a country's receipts for each additional kWh per person per year.