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THE BOTTOM LINE

Past market failures to deliver clean cooking and heating solutions, especially to low-income households, suggest the continued need for subsidies if universal access is to be achieved. To succeed, however, subsidies must be well-targeted, have low potential for "leakage," and be calibrated to avoid destroying commercial incentives and discipline. Results-based financing, which disburses public resources against demonstrated results, can be used to mobilize and sustain private-sector participation in scaling up access to clean stoves. Pilots implementing this approach under the World Bank's Clean Stove Initiative show promising results.

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Results-Based Financing to Promote Clean Stoves: Initial Lessons from Pilots in China and Indonesia

What is the problem?

Creative ways are needed to incentivize the use of clean stoves

Today, about 2.8 billion people worldwide—more than a third of the world's population—still use solid fuels to meet their cooking and heating needs. Household air pollution resulting from the incomplete combustion of solid fuels is linked to some 4 million premature deaths each year (Lim and others 2012). Traditionally, improved stove programs have relied on public procurement, a top-down approach focused on large investments in project inputs (stoves). Government entities have been responsible for deciding on the stoves' technical specifications, and for identifying eligible suppliers, delivery methods, and the households that will receive the free or heavily subsidized stoves. Such programs have the advantage of aggregating demand and accelerating implementation. But with few exceptions, results have fallen short of expectations.

Governments and development agencies are eager to test promising policy instruments that use public resources more effectively and efficiently to spur the clean stoves market. Results-based financing (RBF) is one such approach. The RBF concept comprises a range of instruments that link incentives, rewards, or subsidies to the verified delivery of predefined results. Evidence is emerging that the RBF approach can improve access to and delivery of basic infrastructure and health services for the poor, but the concept is relatively new with respect to clean stoves.

RBF disburses public resources not for project inputs but in response to demonstrated, independently verified outputs or outcomes, thus shifting investment and performance risks from the public to the private sector. Governments can play a facilitating role, providing policy support and financial incentives to motivate market development, while the private sector responds to incentives and delivers the desired results. The challenge for stove suppliers is to design clean stoves that households are willing to buy and use and that meet predefined certification criteria. Suppliers have the flexibility to innovate in how they design, produce, and sell the stoves, based on their familiarity with local conditions—customary cooking practices, stove affordability, resource availability, and after-sales service (Zhang and Knight 2012).

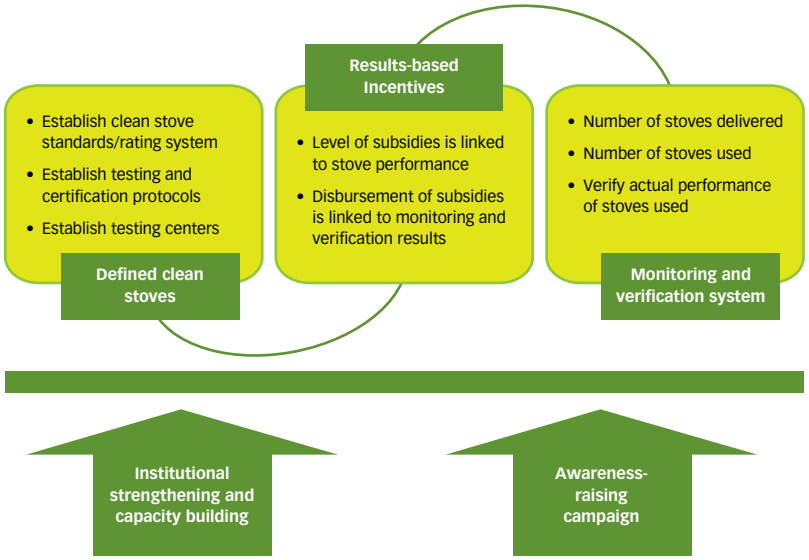
What has been the response?

The World Bank is piloting the use of results-based financing to promote adoption of clean cookstoves

The World Bank's East Asia and Pacific (EAP) Clean Stove Initiative (CSI)—a phased program launched in 2012 to increase household access to modern cooking and heating solutions in the EAP region—is implementing RBF pilots in four participating countries (China, Indonesia, the Lao People's Democratic Republic, and Mongolia). This note summarizes the experiences gained from implementing the pilots in China and Indonesia (Zhang 2014). The lessons learned can help CSI stakeholders better prepare for rollout of scaled-up programs at the national level and give policy makers in other countries valuable insights on the feasibility of adopting the RBF strategy to promote clean stoves.

"Household demand in both China and Indonesia is large enough to create a market-based clean stove industry."

Figure 1. RBF framework with three building blocks and two supporting pillars



Source: Zhang and Knight 2012.

The CSI program's RBF framework has three building blocks: (i) defined clean stoves, (ii) results-based incentives, and (iii) a monitoring and verification (M&V) system. These building blocks are supported by two pillars: (i) institutional strengthening and capacity building of key market players and (ii) public awareness-raising campaigns to stimulate household demand (figure 1) (ASTAE 2013a, 2014).

The CSI program focused much effort on defining clean stoves. Considered the cornerstone of the RBF approach, this building block involves the establishment of clean stove standards (and a related rating system), testing and certification protocols, and stove-testing centers. Results-based incentives, the second building block, link the incentive level to stove performance and its disbursement to M&V results. The M&V system, the third building block, includes the number of stoves delivered and used and verification of their performance (Zhang 2014).

The key characteristics of stove markets in CSI pilot countries are household energy demand, on the one hand, and aspects of supply and policy, on the other.

Both China and Indonesia have large, mainly rural populations that depend on solid fuels to meet daily household energy needs. In China, more than half of the population uses coal and biomass for cooking and heating (World Bank 2013). In Indonesia, liquefied petroleum gas (LPG) is the dominant cooking fuel thanks to the government's recent kerosene-to-LPG conversion program (2007–12). Yet two-fifths of households still depend on traditional biomass cooking energy (ASTAE 2013b).

Both countries are socioeconomically, geographically, and culturally diverse, featuring a wide variety of cooking practices and energy resources. Households commonly have two or more stoves, and "stove stacking" is quite common. In China, where winter heating is an issue and better living standards reflect rising household incomes, heating demand is growing. Biogas penetration is high in rural areas, and electricity is used increasingly for cooking. In rural Indonesia, household incomes and living standards are significantly lower; electricity is rarely used for cooking, and three-stone stoves utilizing traditional biomass fuels are quite common.

Household demand in both China and Indonesia is large enough to create a market-based clean stove industry. The current profit margin of stove suppliers is quite low, however, at about 10 percent. Over the past several decades, China has developed a high-capacity stove industry. By 2011, it was producing about 2.6 million clean coal heating stoves, 20 million honeycomb coal cooking stoves, and 1.6 million clean biomass stoves (World Bank 2013). But its commercial market still relies heavily on government-funded programs and subsidies. By contrast, Indonesia's commercial market is, for the most part, limited to low-capacity, artisan producers without government support (ASTAE 2013b).

In both China and Indonesia, the criteria used to select areas for participation in CSI's RBF pilot included the representativeness of household cooking/heating demand and local partners' implementation capacity.

Because China already had large government-funded programs, its criteria included local governments' willingness and commitment

Box 1. Characteristics of RBF pilot locations

Location	Characteristics
China	
Gaoshanbao village, Liaoning province	247 households, heating season from November through March, average low temperature of –8 to 1ºC, average annual per capita income of $2,750, 180 stoves in pilot
Baiguoshu village, Hubei province	495 households, heating season from November through March, average low temperature of 2 to 9ºC, average annual per capita income of $640, 300 stoves in pilot
Indonesia	
Yogyakarta and Central Java	High population density and high concentration of wood users; abundant biomass; covered by national LPG conversion program; good logistics network
Sumba Island (second phase)	Low population density but high concentration of wood users (>90%); scarce biomass; not covered by national LPG conversion program; poor economy and logistics network

Source: Zhang 2014.

"Because they built on existing government-supported programs and a long-established institutional network, the pilots in China were implemented quickly. All work—from planning and selection of the villages and stoves to stove delivery, third-party M&V, and incentive payment—was completed between July 2013 and April 2014."

to participate in the RBF pilots and the qualifications of local suppliers. Two representative villages were selected for the pilot: Gaoshanbao, located in Liaoning, a northern province where winter heating demand is pronounced; and Baiguoshu, situated in a poor minority area of the southern province of Hubei (box 1). In Indonesia, the representative pilot areas were Yogyakarta/Central Java and Sumba Island. The former is characterized by high population density, abundant biomass resources, coverage by the LPG conversion program, and a good logistics network, while the latter has low population density, high reliance on scarce biomass resources, and a poor logistics network. It is not covered by the LPG conversion program (Zhang 2014).

The pilots in China were jointly managed by China's Ministry of Agriculture and the World Bank; they were implemented by the ministry's Rural Energy and Environment Agency with local government support. Because they built on existing government-supported programs and a long-established institutional network, the pilots were implemented quickly. All work—from planning and selection of the villages and stoves to stove delivery, third-party M&V, and incentive payment—was completed between July 2013 and April 2014.

In Indonesia, where no major stove programs had previously existed, pilots are taking longer to implement, but the additional time has created the opportunity to design a full, market-based RBF scheme. The project is jointly managed by the Directorate of Bioenergy within Indonesia's Ministry of Energy and Mineral Resources and the World Bank. In response to a call for stove technologies (February–April 2014), the designated stove testing center received 22 technologies from 15 companies, 17 of which were accepted for testing (May–October 2014).[1] The project received two recipient-executed trust fund grants from the World Bank: a US$300,000 grant to the Indonesian government for setting up the national stove-testing and certification lab, designing the national scaled-up program, and supporting project management and implementation; and a separate $190,000 grant to PT Bank Rakyat Indonesia Tbk (BRI), a state-owned Indonesian bank, to manage the RBF fund. A call for market aggregators was announced in November

[1] Stove technology refers to the combination of stove model and fuel.

"The results showed households to be quite satisfied with the clean stoves. All of the sampled respondents reported better indoor air quality and convenience, and the vast majority reported a higher comfort level and user satisfaction."

2014.[2] Pilot implementation, now under way, is expected to be completed by late 2015.

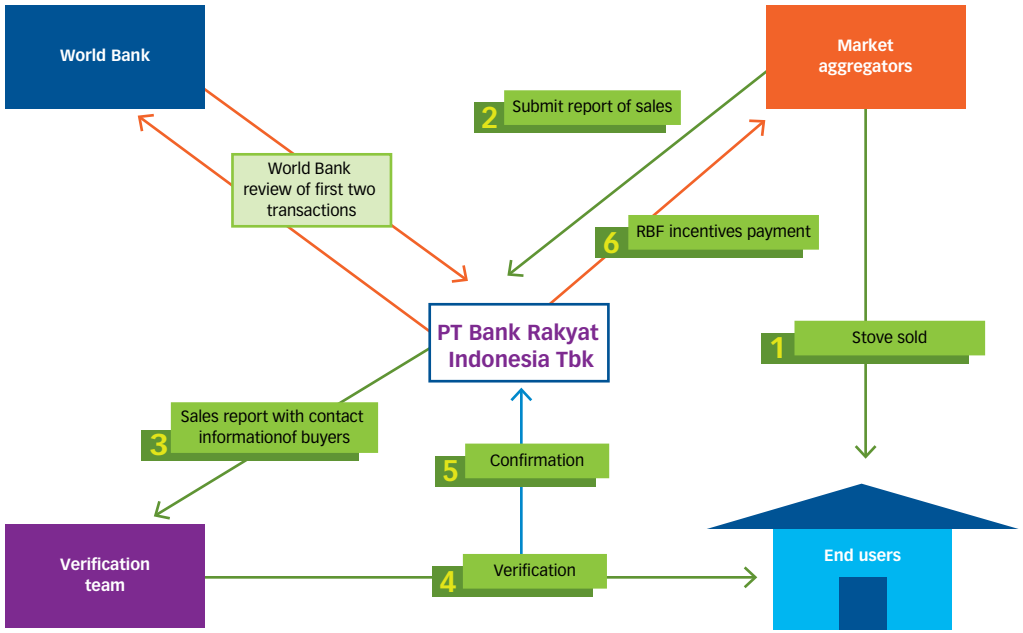
How has the RBF framework been implemented?

The RBF framework was applied differently in China and Indonesia

In China, key RBF elements were followed throughout pilot design and implementation. These included the establishment of selection criteria for stove technologies and stove suppliers, incentive levels, disbursement conditions and schedules, a third-party M&V system, and training and awareness-raising activities.

In Indonesia, the pilot scheme includes a six-step disbursement process linking incentives to the participating market aggregators (figure 2), followed by third-party verification that the qualified clean stoves have been sold and are being used by the purchasing households.

Figure 2. The six-step disbursement process used in the Indonesia pilot



Source: ASTAE 2014.

China. Defined clean stoves were required to meet published industrial standards. Certified testing reports were submitted by the municipal bureau for product quality and inspection. Stove suppliers had to be reputable enterprises with good track records. In addition, the Rural Energy and Environment Agency conducted on-site investigations of suppliers' capacity and networks. Technical performance levels were a key consideration for determining results-based incentives.

Closing the affordability gap depended on the prices of the clean stove and of the fuel it used, households' income level and willingness to pay, local market prices, and local government support. In both Baiguoshu and Gaoshanbao, the results-based incentives amounted to more than half of the unit price (figure 3). Because households in neighboring villages could purchase subsidized stoves under parallel stove programs, results-based incentives had to be adjusted to fit households' expectations.

The M&V system included third-party verification of stove enterprises, sales, quality, and after-sales service; household sample surveys on results indicators; and additional measurements (control versus treatment group, fuel savings, and emissions reduction). The results showed households to be quite satisfied with the clean stoves. All of the sampled respondents reported better indoor air quality and convenience, and the vast majority reported a higher

[2] Market aggregators, who apply for the incentives, are legal entities willing to take investment and performance risks. They may include stove producers, wholesalers, retailers, and project sponsors (ASTAE 2013b).

"The fact that stove programs had not previously existed in Indonesia created a unique opportunity to design a new system for testing and rating stoves, building on lessons from international experience."

Figure 3. Selected stoves for China RBF pilot

Clean cooking and heating stove using firewood in Baiguoshu village

Clean cooking and water-heating stove using biomass briquettes in Gaoshanbao village

comfort level and user satisfaction (table 1). Stove-switching resulted in significant fuel savings, and the payback period for the stoves was less than a year. Based on the M&V results, all RBF-eligible incentives were disbursed.

Institutional capacity building included training of local government officials, while public awareness-raising activities focused on stove-user training by suppliers, in collaboration with local government. To ensure that all households were using the stoves, two follow-up training sessions were held. In all, about 126 villagers in Gaoshanbao and 299 villagers in Baiguoshu attended.[3] In addition, local media reported on the pilot activities.

Indonesia. The fact that stove programs had not previously existed in Indonesia created a unique opportunity to design a new system for testing and rating stoves, building on lessons from international experience. The stove-testing method adopted, which measures the entire burning/cooking cycle, takes into account local cooking practices and is an innovative method based on anthropological field studies and large-scale, detailed household cooking surveys in the pilot areas. Results-based incentives for suppliers are linked to a three-star rating system. Table 2 shows how the rating system is defined by key performance indicators, while table 3 provides examples (ASTAE 2013b).

Because a clean stove market has yet to develop in Indonesia, the market price must be discovered. To cultivate a market, RBF incentive levels had to be large enough to attract suppliers (accounting for such added costs as fuel tariffs), while generally

Table 1. Results of household surveys in RBF pilot villages in China

Results indicator	Village	
	Gaoshanbao	Baiguoshu
Annual coal savings (tons)	1.85	1.94
Coal replacement (%)	100, heating	100, heating
	92, cooking	64, cooking
Better indoor air quality (%)	100	100
Greater convenience (%)	100	100
Higher comfort level (%)	98	97
Higher user satisfaction (%)	98	97
Annual fuel savings (US$)	270	166

Source: Zhang 2014.

Table 2. Three-star rating system for defined clean stoves, Indonesia

Star rating	System efficiency		Emissions factor	
	Cooking stove (%)	Water boiling (%)	CO (g/MJ_{NET})	PM2.5 (g/MJ_{NET})
One (★)	> 25	> 45	< 12	< 300
Two (★★)	> 30	> 55	< 10	< 200
Three (★★★)	> 40	> 65	< 8	< 100

Source: Zhang 2014.

Notes: Designated experts determine the safety and environmental aspects of the stoves. All stoves are expected to have a durability of one year.

[3] The pilot sizes for Gaoshanbao and Baiguoshu villages were 180 stoves (247 households) and 300 stoves (495 households), respectively.

"After third-party verification of stove sales is obtained, 70 percent of the total incentive is disbursed. The remaining 30 percent is disbursed several months later, after a verification team confirms that sampled households listed in the sales report are using the certified stoves."

Table 3. Eligible stoves, associated incentives, and three-star ratings from Indonesia pilot

Stove name	Total incentive to be awarded (in rupiah)	Star rating		
		Efficiency	CO (g/MJ_{NET})	PM2.5 (g/MJ_{NET})
RWW1	220,000	★★	★★★	★★★
ZAMA-ZAMA	170,000	★★	★★	★★★
PS1W	220,000	★★	★★★	★★★
Prime Square Wood	190,000	★★	★★★	★★★
Field Dragon	140,000	★	★★	★★★

Source: Zhang 2014.

not exceeding 50 percent of supply costs.[4] To minimize supplier risk, timely disbursement of incentives is critical. The M&V method adopted by the Indonesia pilots entails a two-stage process. After third-party verification of stove sales is obtained, 70 percent of the total incentive is disbursed. The remaining 30 percent is disbursed several months later, after a verification team confirms that sampled households listed in the sales report are using the certified stoves.

The institutional strengthening component of the pilot focuses on supporting the Directorate of Bioenergy as an institutional champion for clean cookstoves, the CSI technical committee as a facilitator of cross-sector coordination, and the Indonesia Stove Alliance as a platform for communication, learning, and cooperation. Much effort has been directed to building the capacity of private-sector players, including market aggregators, who receive technical assistance to conduct product-specific marketing. Public awareness-raising activities include press conferences, workshops, and community meetings; public media campaigns; training of health practitioners; and CSI certification and labeling of eligible clean stoves (Tuntivate 2015).

[4] Three categories of stoves were anticipated: artisan improved, manufactured, and advanced clean stoves with roughly estimated costs of $5–10, $15–30, and $50+, respectively.

What have we learned?

The CSI pilot experiences in China and Indonesia indicate that the RBF framework is an effective way to promote clean stoves

The differences in how the pilots were designed and implemented demonstrate the importance of country context. In China, results-based incentives led stove suppliers to improve after-sales service. Third party M&V improved program management and provided quantitative feedback to further improve program design and user satisfaction. Stove suppliers developed delivery models based on characteristics of the stove technologies. It is expected that a scaled-up program will lower the incentive level and introduce more competition among eligible technologies and suppliers. In Indonesia, the full market-based RBF scheme now under way shows promise in attracting the private sector.

Key lessons to date include the importance of identifying appropriate institutional arrangements, having a flexible design, and consulting all relevant stakeholders to ensure their buy-in. A key operational challenge for both pilot programs has been the need to balance private-sector risks and risk premiums, particularly for smaller suppliers with little prefinancing ability. With the completion of RBF pilot testing, it is expected that national scale-up in both countries will be relatively straightforward.

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