

# INCENTIVIZING A SUSTAINABLE CLEAN COOKING MARKET

Lessons from a Results-Based Financing Pilot in Indonesia









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## **ACRONYMS AND ABBREVIATIONS**

- BRI Bank Rakyat Indonesia
- CO Carbon Monoxide
- CSI Clean Stove Initiative
- CSI-WHT Clean Stove Initiative-Water Heating Test
  - GERES Renewable Energy, Environment, and Solidarity Group
    - GHG Greenhouse Gas
    - IAP Indoor Air Pollution
    - LPG Liquefied Petroleum Gas
    - M&V Monitoring and Verification
    - MFI Microfinance Institution
    - NGO Nongovernmental Organization
    - NTT East Nusa Tenggara
    - PM Particulate Matter
    - RBF Results-Based Financing
    - SDG Sustainable Development Goal
- SEforALL Sustainable Energy for All
  - SME Small- and Medium-Sized Enterprise
  - WBT Water Boiling Test
  - WHO World Health Organization
  - WHT Water Heating Test
  - YDD Yayasan Dian Desa

## **SUMMARY OVERVIEW**

ccess to clean cooking solutions remains one of the most daunting development challenges. Based on the latest Global Tracking Framework, an additional 82.8 million people gained access to clean cooking solutions during 2014–16, but the annual access growth rate of 0.46 percentage points did not keep pace with population growth. In fact, the global population without access increased by 2 million annually, reaching 2.98 billion in 2016, which has profound impacts on public health and gender equality, poverty alleviation, environmental quality, and climate change.

Because cooking is a highly contextualized system, local innovation and contextualized solutions are critical for long-term sustainability. Common barriers to adopting clean cooking solutions must be overcome, but there is no one-size-fits-all solution. The best ones will vary from place to place because of differences in behavior, culture, resources, institutions, and market conditions. Therefore, empowering the development of contextualized solutions, based on learning from international experience, including the latest technology innovations, will be key because those solutions are more likely to be sustainable. And only when solutions are sustainable can they be truly transformative.

**Incentives or subsidies will be needed to achieve universal access to modern energy cooking solutions.** Like universal access to electricity–which no country has achieved without some form of subsidy–subsidies will be needed to achieve universal access to modern cooking solutions. Market forces and mechanisms are powerful tools for ensuring a sustainable supply of modern cooking technologies and should be harnessed in a way that helps the private sector to develop, market, and deliver modern cooking solutions. But left to market forces alone, access will be limited by affordability and other constraints that affect mainly poorer households, particularly in less developed and more remote areas. Thus, government policies are needed to (i) establish and maintain adequate levels of subsidy and (ii) design and implement effective subsidy allocation mechanisms to mobilize and sustain private-sector participation in scaling up access to modern cooking solutions and targeting households who have an affordability gap.

The pilot experience in Indonesia shows that the results-based financing (RBF) framework can be an effective tool for unifying key elements for developing a sustainable clean cooking market. Development and implementation of the RBF pilot program under the Indonesia Clean Stove Initiative (CSI) confirm that RBF is a replicable and scalable mechanism for using public resources to incentivize the clean stoves market and can be adapted to other country contexts. Indeed, in addition to the RBF pilot in Indonesia, the World Bank has implemented the RBF framework in numerous client countries (e.g., China, Mongolia, Lao PDR, Bangladesh, Uganda, and Kenya) to support efficient and clean cooking and heating solutions, with variations based on country conditions.<sup>1</sup>

<sup>&</sup>lt;sup>1</sup> Similar RBF pilots are being implemented by EnDev's RBF facility, whereby incentive payments are offered to private-sector market actors in the low-carbon, off-grid energy sector in developing countries (https://endev.info/content/Results-Based\_Financing).

Baseline stoves in typical Java kitchen

## SECTION 1 INTRODUCTION

lean cooking and heating are pivotal to achieving goals in public health, gender equality, and climate-sensitive development. According to the World Health Organization (WHO), household air pollution from cooking with traditional solid fuels contributes to 3–4 million premature deaths each year—more than malaria and tuberculosis combined. Women and children are disproportionately affected by the health impacts, and bear much of the burden of collecting firewood and other traditional fuels. Adopting clean cooking and heating solutions can catalyze transformative health and economic benefits for some of the world's most vulnerable citizens. Moreover, it can reduce greenhouse gas (GHG) and black carbon emissions and thus help mitigate the adverse impacts of climate change.

The United Nations Sustainable Development Goal 7 (SDG 7) has set the ambitious target of achieving universal access to modern energy services by 2030. The most sustainable way to bring modern cooking and heating solutions to the hundreds of millions of families that are likely to depend on solid fuels beyond 2030 is to develop a thriving global industry in clean cookstoves and fuels that is constantly innovating to improve design and performance, while lowering stove and fuel costs (GACC 2011).

**Governments and development agencies are eager to test promising policy instruments that use public resources more effectively and efficiently to spur development of the clean stoves market.** 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 identifying eligible suppliers, delivery methods, and households to receive the free or heavily subsidized stoves. Such programs have enjoyed the advantage of aggregating demand and accelerating implementation. But, with few exceptions, results have fallen short of expectations.

**Emerging evidence shows that results-based financing (RBF), a relatively new concept with respect to clean stoves, can enhance access to and delivery of basic infrastructure and social services.** The RBF concept comprises a range of public policy instruments, whereby incentives, rewards, or subsidies are linked to the verified delivery of predefined results. RBF disburses public resources in response to demonstrated, independently verified outputs or outcomes (not project inputs), thus shifting investment and performance risks from the public to the private sector. This distinguishing feature can mean more effective and efficient use of public funds and improved support of market interventions (Zhang and Knight 2012).<sup>2</sup> 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.

Applying the RBF approach to clean stoves programs gives suppliers the flexibility to innovate in how they design, produce, and sell stoves, based on their familiarity with local conditions—customary cooking practices, stove affordability, resource availability, and after-sales service (Zhang and Knight 2012). The RBF approach focuses on results that the public sector cares about and rewards the private-sector suppliers who can deliver them.

<sup>&</sup>lt;sup>2</sup> Some of the better-known RBF approaches include output-based aid (GPOBA 2011), conditional cash transfers, carbon finance, and advance market commitments.

The challenge for private-sector suppliers is to design clean stoves that households are willing to buy and use and that meet predefined certification criteria.

### THE INDONESIA CONTEXT

Indonesia has made great strides in moving its citizens toward modern cooking solutions, but the sustainable dissemination of liquefied petroleum gas (LPG) is reaching its technical and economic limits. The government's successful Kerosene-to-LPG Conversion Program (2007–12) distributed some 54 million LPG packages (stove and cylinder).<sup>3</sup> But the technical challenge of reaching dispersed islands and other remote rural areas is growing, along with an increasing subsidy burden (estimated at Rp. 46.87 trillion in 2018). As a net importer of LPG, Indonesia faces increased risk exposure to international price fluctuations. Should the international price of LPG rise again as it did in 2008–13, the fiscal impact would be significant since the number of households using LPG as their primary fuel has more than tripled since 2008. If subsidies were reduced and retail prices raised, many households would likely have little choice but revert to firewood as an alternative fuel.<sup>4</sup>

Household cooking fuel choices in Indonesia vary by region; the majority use a mix of fuels, especially when alternative ones are available at an affordable price. While LPG is widely available, most households in Yogyakarta-Central Java use both LPG and biomass to meet their cooking needs. A 2014 survey of households' cooking habits in a peri-urban area of Yogyakarta-Central Java showed no clear dichotomy of LPG and wood use

National statistics may conflict with on-the-ground realities; in the context of cooking—a highly cultural activity—even a successful modern fuel program can leave many households behind or only partially served. as cooking fuels, as suggested by national statistics. About half of households across all income groups use both LPG and firewood. The percentages of those using firewood or LPG only were inversely proportional to monthly income (figure 1.1). When electricity was added to the mix, the survey showed that only 27 percent of households use only one fuel; 47 percent use two fuels, and 28 percent use all three (Durix, Rex, and Mendizabal 2016).

That some three-fourths of households in Yogyakarta-Central Java include biomass as a primary or backup cooking fuel suggests a broad and quite differentiated market for clean biomass stoves. For example, the expectations of a low-income household that uses fuelwood only may differ from those of a high-income household that

<sup>&</sup>lt;sup>3</sup> There is also a significant niche market potential for biogas, with more than 10,000 units already having been installed in rural areas with suitable conditions.

<sup>&</sup>lt;sup>4</sup> Even now, many households are unwilling to pay for LPG, even at the subsidized price, if they can freely collect firewood from the local environment. And many households counted as primary LPG users complement their LPG cooking with wood, especially in peri-urban and rural areas.





uses LPG as a primary cooking fuel with wood used as a backup fuel or for specific tasks, such as boiling water. How much biomass households use corresponds with income and varies over time.

While fuel-use patterns are differentiated, most households in the region undertake similar cooking tasks, regardless of fuel combination. Social assessment work conducted under the Indonesia Clean Stove Initiative (CSI) yielded "social intelligence" on stove use (Durix, Rex, and Mendizabal 2016). The 2014 peri-urban survey found that breakfast is the most active cooking time for most households (lasting 65–80 minutes), comprising the largest variety of daily fresh-cooking tasks performed. Boiling water, cooking rice, making soup, and deep frying are the most common tasks. Task-fuel combinations vary according to multiple factors, including location, income, time availability, and convenience, as well as season of the year and among generations.<sup>5</sup> While the fuel types used vary among households, common cooking tasks identified at the local or regional level can help define a stove's minimum performance requirements for tasks needed by the cook.

<sup>&</sup>lt;sup>5</sup> This quantitative information, along with an ethnographic description of each task performed, formed the basis for elaboration of a burn cycle representative of cooking habits in the region (Durix, Rex, and Mendizabal 2016).

## **INTRODUCING THE RBF APPROACH FOR CLEAN COOKING**

On the heels of Indonesia's Kerosene-to-LPG Conversion Program, which entailed mass procurement and distribution of free LPG stoves, the government needed convincing that the same strategy would not work for clean biomass stoves. Under the RBF approach proposed by the Indonesia CSI (box 1.1), public entities would not be responsible for making stove technical specifications or identifying eligible service providers, delivery methods, and end users to receive free or heavily subsidized stoves. Instead, they would specify the intended results, verification methods, and associated incentives, while payments would be made to the service provider against verified delivery of the stoves and their operational performance.

Introducing a new concept and method to deliver access requires convincing national stakeholders of the value of doing so, and also demonstrating the feasibility within their specific socioeconomic context. To test whether the RBF approach could succeed, the Indonesia CSI project team designed a pilot program, which was implemented in two socioeconomically distinct areas of the country. The pilot sought to shift investment and performance risks to the private sector, while protecting the private-sector's flexibility to innovate in designing, producing, and selling clean stoves. The pilot also recognized the need for public-sector support in the early stages of market development owing to suppliers' pre-financing limitations or risk aversion. An underlying principle was to avoid any onesize-fits-all solution, recognizing that understanding local conditions would be critical for success; that is, to sell stoves, suppliers must take into account customary cooking practices, affordability, availability of local resources, and after-sales service (Zhang and Adams 2015).

#### BOX 1.1 Overview of the Indonesia Clean Stove Initiative

In 2012, the World Bank, in collaboration with Indonesia's Directorate of Bioenergy, Ministry of Energy and Mineral Resources (MEMR), launched the Indonesia Clean Stove Initiative (CSI). The broad aim was to scale up access to clean cooking solutions for households who will likely continue using biomass beyond 2030. The Indonesia CSI project was implemented in two phases.

Phase I (2012–13) focused on initial stocktaking, which was critical for developing the implementation strategy, designing subsequent program phases, and establishing policy dialogue with the country's institutional focal point. Activities completed in Phase I included in-depth assessments of household cooking fuel technologies and the existing stoves market; review of the sector policy and institutional framework, as well as experience from the LPG and biogas programs; and development of a roadmap for achieving universal access to clean cooking by 2030.

Based on the findings from Phase I, Phase II (2014–16) focused on four areas of activity to support a strategy for scaled-up market penetration: (i) establishing a stoves standards/testing/certification system, (ii) strengthening institutions and building stakeholder capacity, (iii) designing and implementing the RBF pilot program, and (iv) designing and preparing a master plan for a national scale-up program.

The Indonesia CSI pilot worked, demonstrating that market-based RBF incentives can attract the private sector and stimulate local innovation. The clean stoves pilot activity showed that the RBF approach is replicable and scalable, but it takes time for the private sector, particularly small- and mediumsized enterprises (SMEs), who are quite risk averse, to respond to market incentives. The sections that follow summarize the RBF pilot design and implementation experience and highlight useful lessons for scaling up clean cooking programs in other countries.<sup>6</sup>

Setting a pilot activity within a broader framework helps focus stakeholders' attention and raise awareness. But the sequential nature of a pilot to scaled-up national program can put the latter phase at risk, creating tension between the need for quick results and thorough demonstration.

<sup>&</sup>lt;sup>6</sup> Data used in this report are based on surveys conducted before and after the pilot activity, focus group discussions, interviews, and various design documents and knowledge briefs produced during the pilot design and implementation.

Meeting the stakeholders

## SECTION 2 RBF PILOT DESIGN: CONCEPTS AND PROCESSES

**nitial research activities under the Indonesia CSI project showed that Indonesia's market for clean biomass stoves was in a nascent stage,** making it difficult to predict where roadblocks or market failures might occur in the factory-to-consumer chain and where subsidies should be targeted along the production-distributionsales continuum to ensure development of a market (Appendix A). However, sufficient interest in clean biomass stoves among early adopters—those willing to take on some of the risk of paying a higher price—enabled an initial penetration of these technologies on a market basis.

Early on, the project task team decided that the RBF pilot would focus initially on increasing the availability, rather than the affordability, of clean stoves for households. Customers could choose to buy and use clean biomass stoves, which would replace their existing, fuel-inefficient biomass stoves or complement their LPG stoves. This approach attracted Indonesia's established players interested in adding clean stoves as a new line of business, as well as new players, to the fledgling market.

## **MARKET AGGREGATORS AND RBF INCENTIVES**

**RBF incentives were defined to fit a wide variety of potential players and designed to align with the core goal of any retail business: selling products that make customers happy.** Specifically, market players were provided incentives for the sale of clean biomass stoves and their continued use by consumers. The incentive amount was not based on the stove's production cost or sale price, but on the expected service it would provide customers compared to their existing (baseline) biomass stove (i.e., cleaner, more efficient, and healthier). With these elements in mind, rather than trying to target specific players along the factory-to-customer chain, the project task team relied on the concept of market aggregator (box 2.1).

#### BOX 2.1 Application of the Market Aggregator Concept

*Market aggregator* is defined as a market player located anywhere along the factory-to-customer chain that assumes responsibility for aggregating other players and serving as the front entity for communicating with the RBF fund administrator to meet the incentive eligibility conditions, collect the incentive, and redistribute it among the players aggregated. The market aggregator could be a stove producer, wholesaler, importer, distributor, or retailer (or any combination thereof). In the case of a stove producer, the market aggregator could ship its stoves and subcontract the retail sales to agents; if a retail company, it could order stoves from the producer and organize sale to households either directly or through shops.

Under the Indonesia RBF pilot program, market aggregators played a central role. They were free to decide how the incentive for selling eligible clean stoves would be redistributed among the players, as well as consumer stove pricing (e.g., cost; cash or credit). Market aggregators could keep the full incentive for themselves or share it with their associates or consumers. In the case of a stove producer, the market aggregator could decide to use all or part of the incentive to increase its profits, provide its distributors/agents a discount, or reduce the final price paid by consumers (or offer new payment options).

At an early stage of market development, it is difficult to predict which entities will play the most important role. Rather than picking pre-identified winners, the task team applied the RBF and market aggregator concepts, which enabled the participation of many actors with a variety of investment strategies.

## INCENTIVES DISBURSEMENT PROCESS

The RBF pilot scheme was conceived to distribute the incentives through a sequential multi-step process linking key players, following a set of rules designed and supervised by the Government of Indonesia's Project Management Office (PMO), the World Bank, and partner GERES (Renewable Energy, Environment, and Solidarity Group). Appendix B describes the roles of the major supervisory and supporting stakeholders involved in the RBF pilot.

## Four major players actively participated in incentives distribution transactions, as follows:

- Market aggregators—Legal entities (e.g., cookstove producers, wholesalers, distributors, retailers, NGOs, and private companies) selected to participate in the pilot incentives program, whose functions include selling stoves that meet the pilot technical requirements, collecting and reporting on necessary supporting documentation (as described in their operations manual), and receiving incentives once payment conditions are met.
- *End-users*—Households or other consumers who buy cookstoves sold under the pilot program and use them to prepare food and boil or heat water.
- *BRI* (PT Bank Rakyat Indonesia)—Designated funds administrator, chosen for its long track record in managing finances and funds in all parts of Indonesia (particularly rural areas) and microfinance for SMEs and consumers.<sup>7</sup>
- Verification team—Entity contracted by the RBF incentives program to verify sales and use of cookstoves claimed for incentives.<sup>8</sup>

Figure 2.1 shows the six steps involved in the disbursement of incentives. The market aggregators (i) promote and sell stoves to the end-users (households) and (ii) submit the report of sales to BRI, the fund administrator, who, in turn, (iii) collects and sends the sales reports to the third-party verification team. The verification team (iv) contacts households to verify that they purchased and use the new stoves and (v) sends this confirmation to BRI, informing it of the extent to which it can issue payment of conditional incentives promised by the program. Finally, BRI (vi) sends the market aggregators the RBF incentives payment.

<sup>&</sup>lt;sup>7</sup> After signing a grant agreement with the World Bank, BRI received a US\$190,000 grant, including an RBF incentives fund to incentivize adoption of defined clean biomass cookstoves and some incremental, task-based operating costs to manage the fund based on the agreed rules and procedures in the RBF incentives program's operations manual.

<sup>&</sup>lt;sup>8</sup> The GERES team recruits and manages the verification team in accordance with the agreed verification manual.

#### FIGURE 2.1 RBF Incentives Payment Cycle



### **PILOT AREA SELECTION**

The pilot program was implemented in Central Java and Yogyakarta Special Province and East Nusa Tenggara (NTT)—two areas with distinct socioeconomic characteristics (figure 2.2).<sup>9</sup> These provinces were selected not only for their high levels of wood consumption, but also for their different socioeconomic features, providing for potential points of comparison. Practical considerations and policy priorities also played a role in their selection, including the presence of a competent Indonesian nongovernmental organization (NGO) in Yogyakarta-Central Java with a long history in the field of cookstoves.

Choosing a geographicallysequenced rollout was guided by practical and logistical constraints. Surprisingly, NTT Province had the highest market dynamism despite budget and time limitations and implementation hurdles that delayed start-up.

<sup>&</sup>lt;sup>9</sup> Central Java is one of 34 provinces in Indonesia, located in the middle of Java Island. Its administrative capital is Semarang. The province is 32,800 km<sup>2</sup> in area, equivalent to approximately one-quarter of Java's total land area. It is the country's third most populous province, with 33.7 million people (2015 Census figure). Yogyakarta Special Region, located south of Central Java, covers only 3,133 km<sup>2</sup> and has an estimated total population of 3.5 million (2014 figure). The capital is Yogyakarta City. East Nusa Tenggara or NTT (Nusa Tenggara Timur) is Indonesia's southernmost province, comprising more than 500 islands, the three largest being Flores, Sumba, and West Timor. NTT has a total land area of 47,245 km<sup>2</sup>, with an estimated population of 5 million (2014 figure). The provincial capital is Kupang on West Timor.





## **RBF FRAMEWORK**

The conceptual framework for the RBF pilot design included three building blocks—defined clean stoves, results-based incentives, and a monitoring and verification (M&V) system—supported the pillars of institutional strengthening/capacity building of key market players and awareness-raising campaigns to stimulate household demand (figure 2.3) (ASTAE 2013).



#### **DEFINING CLEAN STOVES**

The Indonesia CSI project focused much effort on defining clean stoves since the prevailing available definitions of clean stoves were inadequate for use in an RBF process. Considered the cornerstone of the RBF approach, this first building block involved developing user-relevant testing protocols and standards, establishing a stove testing laboratory, and setting performance standards for clean stoves.

#### Developing User-Relevant Testing Protocols and Standards

For the RBF mechanism to work properly, three main sets of players needed confidence that they were being presented a fair deal. First, the clean stove designers and manufacturers needed assurance that their products would be judged fairly against the competition for incentives eligibility. Second, market aggregators not involved in stove design or manufacturing and consumers needed to know that the recommended clean stoves would suit the needs of end-users. Third, the incentive providers (donors, financiers, and governments) needed to know they were subsidizing products that would improve the lives of the beneficiary households and generate the intended public benefits.

This meant that the stoves' eligibility for incentives had to be based on factual and reproducible tests sufficiently representative of actual patterns of household use. This requirement led the task team to establish and apply a methodology to identify and classify common stove-use behaviors among a wide variety of users in the

province and then, in a laboratory setting, develop scientifically valid and reproducible testing protocols reflective of these behaviors. The team rapidly set up a sufficiently equipped, stove testing laboratory with trained staff (see subsection below), where it tested and confirmed the baseline stoves and defined the relevant standards.<sup>10</sup>

The pilot team pioneered a contextual stove-testing protocol that combined laboratory and field-based tests with burning sequences derived from typical Javanese cooking tasks. After reviewing various laboratory and field-based testing protocols,<sup>11</sup> the pilot team found that some included conceptual errors and none took local Javanese cooking practices into account. To fill this gap, the pilot team developed a new stove testing protocol for evaluating the technical eligibility of clean stoves for the program, known as the Indonesia Clean Stove Initiative-Water Heating Test (CSI-WHT).<sup>12</sup> Its main objective was to ensure that stove testing results conducted in the Defining a new testing protocol was time and resource intensive, yet the process of developing the protocol was instructive for all stakeholders involved. Several players initially resistant to the idea came to see the value added to their product development.

<sup>&</sup>lt;sup>10</sup> Prior to the Indonesia CSI, testing protocols had not been established at the national level, and international laboratories used different testing methods.

<sup>&</sup>lt;sup>11</sup> The testing protocols reviewed included the Water Boiling Test (WBT), Adapted Water Boiling Test (AWBT), Control Cooking Test (CCT), and Kitchen Performance Test (KPT).

<sup>&</sup>lt;sup>12</sup> The CSI-WHT has made important contributions to ongoing ISO discussions and cookstoves development (https://cleancookstoves.org/ binary-data/DOCUMENT/file/100/000/87-1.pdf).

#### BOX 2.2 Integrating Local Behavioral Context into Testing Protocols

Developing a laboratory protocol test that reflected the cooking behavior of Central Java Island cooks was key to ensuring that the tests performed measured the efficiency and emissions of stoves while performing tasks relevant to future users. Data collectors made detailed field observations of female cooks, taking into consideration the frequency of each cooking task performed, cooking duration times, fuel modulations necessary to accomplish each cooking task (referred to as the operating procedure or burn cycle), and the typical cooking vessels used. Multiple cooking cycles were combined to create an average burn cycle, referred to as a technical test, which reproduced power levels and their variations. In the CSI laboratory, the burn-cycle protocol test takes approximately 63 minutes, and is repeated at least 4 times for each stove tested. Results from these assessments are not necessarily valid beyond the province of Central Java, underscoring the vast differences in the Indonesian biomass economy (YDD 2016).

Note: Other qualitative and quantitative data collection methods were used to augment the observational data.

controlled laboratory environment truly reflected the variables that depend highly on local context (e.g., fuel moisture content, operating procedures, and types of cooking vessels).<sup>13</sup> By developing a holistic, contextual technical test, outcome metrics could not only provide pertinent information regarding fuel efficiency and emissions; they could also reasonably predict in-home performance. By documenting the technical test and relevant pots and fuels, the protocol could be used by manufacturers in other countries to test stoves for the Indonesian market (Durix, Rex, and Mendizabal 2016).

#### Establishing a Stove Testing Laboratory

Stove companies' expressed interest in participating in the pilot program raised questions about testing protocols that led to the establishment of a stove testing laboratory. On hearing about the pilot program, several stove companies expressed interest in participating, presenting efficiency and emissions data from stove manufacturers. But various questions arose: What sort of testing protocol was used? How were efficiency and

Working with complementary players (bilateral donors and NGOs) helped circumvent rigidities that can sometimes hinder a larger institution, and helped the pilot bounce back faster from temporary setbacks. emissions measured? How reliable were the results? Were those who conducted the test trained and qualified to do so?

By reaching out to project partners and other donors, the vision of establishing a stove testing laboratory that would meet the needs of the pilot program was achieved. This was done in a collaborative manner, with the French Development Agency (AFD) providing funds to GERES, which funded, coordinated, and transferred equipment to set up the pilot testing laboratory. YDD, a local partner of the CSI Indonesia project, provided the land and building for the laboratory and mobilized the required staffing. The CSI project provided technical guidance and capacity building for the staff and funded the stove testing services on a per-testing basis (figure 2.4).

<sup>&</sup>lt;sup>13</sup> To account for these variables, the pilot program relied heavily on data collected by social and gender teams using participant observation methods, qualitative studies, and quantitative surveys (box 2.2).

#### FIGURE 2.4 Pilot Laboratory Testing Room (left) and Stakeholder Visits (right)



#### Setting Performance Standards

**Concurrent with development of the testing protocol, the task team worked to agree on and establish appropriate performance standards for the pilot program.** When the Indonesia CSI was launched in early 2012, no stove performance standards existed. In 2013, prior to pilot implementation, the CSI project team provided initial inputs for developing a National Standard Method on Biomass Stove Performance, recognizing that ongoing revisions and improvements would be needed to develop a fully enforceable national standard. However, performance standards were needed for the RBF pilot program, so the task team developed standards for stoves to be considered eligible for incentives.

Two stoves that predominate in the pilot region—the Keren biomass stove and the LPG stove—served as baselines at each end of the cleanliness spectrum, which allowed for tiered improvement. Both types of stoves are found throughout Central Java, often in the same home (figure 2.5). Based on test results for these two baseline stoves, minimum required performance was established for competitor stoves that would be introduced as clean stoves. This made it possible to build a tiered improvement, with incremental results. It was thought that cleaner stoves were more likely to be expensive. Thus, setting a single threshold might eliminate stoves that could offer incremental improvements or price out interested consumers. A single threshold set too high would run the risk that few or no stoves would qualify; if set too low, the incremental improvement may not be significant enough to justify the support.

After much debate, a star rating system with up to 3 thresholds (stars) per factors measured was created and included in the RBF incentives. These factors were (i) system efficiency, as measured by the overall thermal efficiency across the entire burn cycle; (ii) emissions, as measured by CO and PM<sub>2.5</sub> emissions;<sup>14</sup> and (iii) safety and durability, with minimum pass/fail criteria. Table 2.1 provides an overview of the thresholds for each star level, showing how they compare against the two baseline stoves.

To qualify as a clean stove eligible for incentives under the RBF pilot program, the candidate biomass stove (wood or pellet) had to exceed the baseline at the 1-star level. This qualifying stage is on a pass/fail basis across all factors; that is, the stove must have at least 25 percent efficiency, emit less than 12 g of CO, emit

<sup>&</sup>lt;sup>14</sup> Two emissions factors were included to give weight to the health aspects of the pilot program.

#### FIGURE 2.5 Two Kitchens in One House: Wood Keren Stove (left) and LPG Stove (right)



Transparent, understandable, and predictable requirements to qualify and receive incentives are cornerstones of good RBF standards. less than 300 mg of PM<sub>2.5</sub>, and pass both safety and durability requirements. Once the 1-star threshold is passed, incremental improvements in system efficiency or emissions performance can qualify a stove for increased incentives.

Once the star rating concept is accepted by stove designers, manufacturers, and retailers and understood by households, the specific value of each star level can be adjusted. Such adjustments may be based on learning feedback loops (if set too high or low) or over time to push

	System Efficiency	Emissions		Safety and Durability		
Threshold	Overall thermal efficiency (%)	СО (g/MJ <sub>NET</sub> )	РМ <sub>2.5</sub> (mg/MJ <sub>NET</sub> )	Safety (pass/fail)	Durability (pass/fail)	
Baseline: Keren wood stove <sup>a</sup>	16–20	7–20	400–500	Fail	Fail (3–6 months)	
1 star	> 25	< 12	< 300			
2 stars	> 30	< 10	< 200	Expert examination with preset criteria	1-year minimum	
3 stars	> 40	< 8	< 100	with preset citteria	to pass	
Baseline: Generic LPG stove	62	Negligible	Negligible	Pass	> 2 years	

#### TABLE 2.1 Star Rating System Used to Set Qualifying Stove Standards for the RBF Pilot

Note: The Keren wood stove represents the minimum against which the improvement brought by a new stove ought to be measured, while the generic LPG stove shows the maximum level that could be reached.

a. The baseline Keren stove is hand-produced by artisans, and its shape is customary rather than normative. Its quality and performance vary widely according to the materials used and the skills applied.

the industry toward cleaner products as technology and markets develop. Figure 2.6 illustrates the continuum of improvement from the Keren baseline toward increasingly cleaner stoves and the likely ceiling to be met at the LPG baseline level.

The initial rating system included a separate category for water boilers, with higher requirements for system efficiency thresholds. During the field study and household survey, it had been noted that 98 percent of households boiled water daily for drinking and/or bathing and that, among households that used both biomass and LPG stoves, biomass stoves were usually used for these tasks (except in the case of boiling small quantities of water [e.g., making coffee]). So a potential market demand was identified for a dedicated water-boiling stove, optimally designed for that purpose. Unfortunately, no designers submitted such a product during the pilot.

The presence of a potential market demand does not mean supply will step in. Setting more stringent requirements for a single-purpose water boiling stove might have been counterproductive.

#### **RESULTS-BASED INCENTIVES**

**Results-based incentives, the second building block of the RBF framework, linked the incentive level to stove performance and its disbursement to M&V results.** Once the stoves met the eligibility criteria for receiving the incentives, the key questions were how to establish the right level of incentive to attract the private sector without distorting the market and the conditions for payment to the market aggregators.





Having the flexibility to adjust incentive levels based on market feedback proved particularly important; but the trade-off was the time cost of waiting for the market response to the adjustment.

#### Setting Eligibility Incentives

The pilot's incentive levels were set to attract smaller players to the clean stoves market.<sup>15</sup> The rules for implementation were simple and clearly defined to be understood by all. Three cost categories, reflecting several performance levels, were anticipated: US\$15–30, \$30–50, and \$50+. The idea was for the incentives to be sizeable enough to attract stove suppliers, especially those new to the sector, but generally not to exceed half of stove supply costs. It was also decided that incentive levels could be adjusted based on market feedback. Since the pilot targeted efficient and clean cooking solutions, incentives were also based on measured improvements related to efficiency and emissions criteria.

**The incentive amount was based on the star rating system** (table 2.1); incentives were calculated independently for each of the three improvement categories by thermal efficiency, CO, and  $PM_{2.5}$ . For each category, Rp. 10,000 was granted for the first star earned, Rp. 30,000 for the second, and Rp. 50,000 for the third. Since a stove needed at least one star in each category to be eligible, the minimum incentive provided for an eligible stove was Rp. 30,000 (3 times Rp. 10,000). The amounts for each star earned in each category were also cumulative. For example, if a stove earned 3 stars for efficiency, then the amount for the stove in this category was Rp. 90,000 (Rp. 10,000 for star 1 + Rp. 30,000 for star 2 + Rp. 50,000 for star 3). So the highest incentive that could be received by a qualified stove was Rp. 270,000, with a 3-star rating in each of the 3 categories.

The scoring and incentivesetting scheme was well received by the market aggregators, but was too complex to be used as a consumer outreach tool to help differentiate among the various types of clean stoves. This technically-based incentive system aimed to incentivize stove designers to reach their highest performance levels and stove distributors to carry the best-placed stoves. Having cumulative incentives within categories and independent access to incentives between categories was intentional in order to incentivize stove suppliers and distributors. To illustrate, the same stove could have a 2-star rating for CO, a 1-star rating for efficiency, and a 3-star rating for PM<sub>2.5</sub>. It was acknowledged that this type of system had gaps (e.g., despite good results, high-quality, expensive stoves could remain unaffordable or cheap stoves that tested quite well and qualified for large incentives could have unexpected effects).

#### Triggering Payment and Adjusting Incentive Levels

The conditions that triggered incentive payments were designed to increase the likelihood that an eligible stove

<sup>&</sup>lt;sup>15</sup> Given the pilot program's limited time frame and funding level, it was considered that larger players would have less interest in participating.

**would not only sell but would remain in use.** Two conditions were defined for making an incentive payment to the market aggregators that carried and sold the stoves: (i) sale of an eligible stove to a household in the pilot area and (ii) continued use of the stove by the household after a specified period. Once each of these conditions was met, payment of a portion of the total incentive for which the stove was eligible would be triggered.

## After early feedback, the program adapted its incentive system as encouragement to market aggregators willing to take on the risk of selling promising but unknown stoves in an untested market. The initially

proposed triggers for incentive payment (70 percent on sale of the stove and 30 percent for continued use) were found insufficient for risk-averse market aggregators, owing to their small size and lack of advance cash.

Two adaptations were made—modification of the payment schedule and temporary increase in incentive levels giving market aggregators the confidence to test the clean stoves market. The payment schedule was modified as follows: 50 percent for stock-building, 20 percent for sale, and 30 percent for continued household use (figure 2.7). Having the purchase and receipt of clean stoves trigger the first payment resolved the pre-financing difficulty that the smaller market aggregators faced and pushed already active ones to scale their stock-building and accelerate sales efforts. In addition, a one-off incentive was provided (50 percent of the maximum allowable incentive for a given stove provided for the first 300), which enabled smaller players to test the market. One should not underestimate the risk perception of key players faced with an unfamiliar scheme. The pilot timeline should allow sufficient time for early movers to do test runs and share feedback internally before getting back to pilot promoters.

#### FIGURE 2.7 Incentive Payment Schedule and Related Verification Steps



Defining the right results and payment triggers are key to RBF success. Too little upfront payment can make the risk too high, but too much may decrease players' incentives to meet expected results. The RBF design needs to balance the perceived risks of market players with the premiums associated with the risks. A flexible mechanism that can be adjusted if the market does not respond as expected is recommended.

#### **MONITORING AND VERIFICATION**

The M&V system, the third building block, included the number of stoves delivered and used and verification of their performance. Once the stove eligibility for incentives, expected results, and related sequencing of payments had been defined, the next challenge was how to measure these results in a transparent way to assure market aggregators of receiving swift and predictable incentive payment, while at the same time, avoiding fraud.

The task team adopted a "trust-but-verify" approach, and set up RBF verification processes that were key to mobilizing the market aggregators. The principles adopted included pre-set transparent rules, mutual independence of actors in the verification-payment chain, and automatic payment on confirmation of results. BRI (Bank Rakyat Indonesia)—a transaction-focused, professional entity—was selected as fund administrator, which reassured market aggregators and Lembaga Konsumen Yogyakarta (LKY), a consumer advocacy group, was hired as an independent third party to undertake M&V activities.

As linchpin of the process, BRI interacted with both market aggregators and the M&V team. The market aggregators were required to submit proof of clean stove delivery and detailed sales reports to BRI. Prompted by BRI, the M&V team used documentation of clean stove delivery to verify the actual stock-building, which triggered the first incentive payment.

Detailed sales reports, which verified stove purchase by households, triggered the second payment, and the stoves' continued use by households triggered the third one. Based on the results of the M&V team's findings, BRI released the incentive payment through direct deposit into the market aggregator's bank account.

**The RBF pilot design included a three-stage verification process linked to triggering the partial incentive payments.** In the first stage, the M&V team visited the market aggregators' stove warehouses and confirmed the number of stoves by brand name, model, and type. They verified that all stoves had a unique serial number and coding affixed, along with the identifying clean stove logo (box 2.3), and that the market aggregators kept appropriate records. The second stage entailed contacting the end-user households listed in the sales reports by telephone to confirm that they had bought the clean stoves from the participant market aggregators. Finally, the third stage required the M&V team to conduct a field survey and interview the end-user households listed in the sales reports to verify that they were using the purchased clean stoves.

The goal of tracking every clean stove bought and sold under the pilot program proved too costly in **practice.** While the first stage was the most straightforward, the M&V team encountered multiple problems during the second stage for a variety of reasons, including missing data, cultural or gender-related issues, and insufficient

#### BOX 2.3 Creating Brand Recognition to Promote Better Health

One of the key social marketing strategies of the RBF pilot program was to create brand recognition to promote the improvement of consumers' health. Given that stove customers may not recognize the new clean cookstove technologies in the marketplace, the pilot used a program-endorsed, clean stove logo so that these stoves could easily be identified (figure). The logo presented the clean stoves as products that promote healthy living and save energy, translated as "Tungu Sehat Hemat Energi" (TSHE) in Bahasa Indonesia. The TSHE logo was affixed to all qualified stoves to ensure that consumers could easily identify clean stoves and was printed on all pilot promotional materials to raise awareness.

Clean Stove Logo



*Note:* Design and creation of the TSHE logo resulted from an open competition among high school, vocational, and university students.

incentive-sharing, among others. The third stage was even more challenging since, in order to closely monitor progress and ensure that the market aggregators' incentive payments were not delayed, the M&V team had to make frequent field visits. But this was impractical, given the wide sales coverage area for each market aggregator (throughout Yogyakarta-Central Java and the NTT region).

#### SUPPORTING MEASURES: CAPACITY BUILDING AND AWARENESS RAISING

The three building blocks of the RBF framework were supported by the pillars of (i) institutional strengthening and capacity building and (ii) awareness-raising campaigns. From the start, the Indonesia CSI project recognized that institutionalizing clean stoves would be an important step toward providing an enabling environment and that awarenessraising campaigns should be conducted at all relevant levels to motivate both supply and demand (Zhang and Knight 2012). Requiring a verification system to double as a statistically-valid monitoring system proved too burdensome for the market aggregators and the M&V team. A verification mechanism must be easily explainable and adjustable, especially when linked directly to households, whose reaction to verification requirements cannot be anticipated.

#### Building Stakeholder Capacity

Key capacity-building elements included establishing a platform for communication, learning, and cooperation; and providing technical assistance to improve all market players' performance. The Indonesia CSI–supported Indonesia Stove Alliance (ATI), hosted by YDD, serves as a platform for information dissemination, experience sharing, and cooperation on clean stove use for governmental agencies, companies, research institutions, and local communities. ATI is now considered the main portal for those interested in obtaining information on clean biomass cooking in Indonesia. Market aggregators under the pilot program were provided technology training and support in marketing development (figure 2.8). In addition, financial support was provided to publish a stove user's



#### FIGURE 2.8 Hands-On Training of Sales Agent in Stove Technology

manual for all eligible clean stoves, which sales agents were instructed to give household stove buyers. Design of the manual, based on user feedback and interviews during the testing phase, included easy-to-understand pictures and instructions (figure 2.9). After the pilot program ended, interviews with market aggregators confirmed that the stove user's manual was quite useful in addressing household questions, saving both time and budget.

#### Conducting Social Marketing to Raise Awareness

Awareness-raising campaigns educated households about the relationship between clean cookstoves and better health. Initial studies showed that most people were unaware of the health threats linked to indoor



FIGURE 2.9 Page from the Stove User's Manual





biomass cooking smoke, but were keen on lessening soot deposits on their kitchen walls and ceilings. Education and awareness-raising campaigns emphasized that clean stoves not only emitted less smoke and soot, but also saved energy and created a healthy living space.

**Outreach activities were also implemented in collaboration with the Indonesia CSI Program Management Office (PMO).** Communication channels included newspaper and radio advertisements and radio talk shows focused on the pilot region. Their aim was to introduce the pilot program, raise consumer awareness about the dangers of indoor air pollution (IAP), and promote clean cooking solutions (figure 2.10).

It should be noted that many market aggregators had unrealistic expectations for the pilot program's awareness campaign and underestimated their own role in stimulating demand. While well-designed and implemented, the pilot awareness-raising activities fell short of many market aggregators' expectations, in large part, because they envisioned a campaign on the same scale as that of the government's Kerosene-to-LPG Conversion Program, which had been equipped with vast budgets for advertising and media coverage.

A note of caution: Local expectations might be raised beyond what program promotors can offer due to prior, seemingly unrelated projects.



## SECTION 3 ADAPTING TO FIELD REALITIES: PILOT IMPLEMENTATION

mplementing the pilot program required many adjustments, highlighting the challenges of simultaneously introducing new concepts, methods, and technologies within a limited timeframe. The program's flexibility, which allowed for making important course corrections in response to field-based realities, was key to stimulating local innovation in stove design and technology, motivating private-sector investment, and incentivizing market aggregators to develop their household markets for clean cooking.

## **CALL FOR STOVE TECHNOLOGIES AND TEST RESULTS**

**Two calls for clean stove technologies resulted in 15 stoves passing the eligibility test for the RBF incentives.** In February 2014 and April 2015, the Indonesian government announced calls for clean stove technologies for testing at the pilot laboratory. Of the 50 stove technologies submitted from more than 20 national and international companies, 20 were rejected as not having clear design specifications or were considered prototypes not ready for market. The remaining 30 were tested throughout the full burn cycle representative of a typical Central Java cooking session. Of those, 15 stoves—8 from international companies and 7 that were locally designed—passed the eligibility test for the RBF incentives, meeting minimum efficiency, emissions, and safety and durability requirements (figure 3.1).

All eligible stoves had large emissions improvements but lagged in efficiency. All 15 stoves achieved a 3-star rating for PM<sub>2.5</sub> reduction and most had CO improvements. But most lagged in efficiency, with no appreciable difference between international and Indonesian models. Overall, pellet stoves were more efficient and cleaner, confirming that processed fuels are cleaner burning.<sup>16</sup>

Of the 15 eligible clean stoves, the market aggregators, who were mostly smaller players, finally settled on carrying 7 Indonesian technologies for resale, one of which was not producible at scale and was dropped. A key aspect of the pilot program was giving market aggregators choice, based on a range of stove options. Initially, it was anticipated that larger medium-sized businesses would participate. These players had national or multi-province capability and interest in carrying more expensive (often international) stoves. But the Although submissions without clear design specifications and prototypes had to be rejected due to time and budget constraints, this was a good opportunity to help these designers refine and broaden their product offerings.

pilot's limited coverage area, budget, and timeline proved dissuasive to larger companies. It became necessary to adjust the pilot focus to accommodate the technical assistance needs of smaller businesses (box 3.1).

A total of 10 diverse market aggregators—including 8 that were new to the clean stove business and 5 women-led businesses—participated in the pilot. One group comprised several internationally-backed local

<sup>&</sup>lt;sup>16</sup> Given the limited timeline of the pilot program, the stoves with the highest fuel efficiencies and emissions reductions could not be made available due to their expense (international stoves) or production issues (Indonesian stoves).



FIGURE 3.1 Emissions and Efficiency Comparisons of Eligible National and International Clean Stoves

The emission-efficiency findings ran counter to the notion that international stoves are more expensive because of their vast superiority, while the emissions results showed the value of having flexible criteria over time; that is, since all of the eligible stoves met the highest PM<sub>2.5</sub> criteria, the scale in future iterations could be adjusted upward toward increasingly cleaner stoves. entitles. Ditana Energy Solutions, a subsidiary of a Norwegianbased private-sector company and among the first pilot participants, already invested in the clean stove wholesale and retail business. Yayasan Kopernik, a small-to-medium-sized NGO, also had extensive experience selling clean stoves to rural households. Ivy Kickstarter, another similarly sized NGO, had an established relationship with a microfinance institution (MFI), and was able to offer, accept, and sell stoves to rural consumers who borrowed money to purchase them. All three players relied on developing their own networks of sales agents and sub-agents for selling directly to rural households. A second group consisted of small, private-sector entities with extensive experience in the household cooking sector aiming to diversify their businesses (e.g., creating a pellet market for households). A third group comprised small private businesses and individuals with good access to their target communities (Appendix C) (box 3.2).

### **INNOVATIVE BUSINESS MODELS**

The pilot promoted grassroots innovation in business **models.** Due to their diverse business experience and size, the

market aggregators created their own business models, which were often dictated by whether they could negotiate terms of payment for stove procurement from the producers, terms of payment they expected from stove buyers, and

#### BOX 3.1 Deciding on Which Clean Stoves to Carry: International or Locally Produced?

During the design phase of the RBF pilot, it was envisioned that both international and Indonesian clean stoves would be made available and disseminated during implementation. The program made significant efforts to facilitate business arrangements between qualified stove manufacturers outside the country with potential market aggregators. A few international stove manufacturers expressed interest in using the RBF pilot to test the Indonesia market, but were unprepared to set up a local office or joint venture to directly participate during the limited pilot period. For their part, the market aggregators, who were mainly small businesses, perceived that they lacked the financial resources required to handle complex importation processes under existing laws and regulations, that the final market prices would be unaffordable for the local market especially compared to locally-produced qualified stoves—and that after-sales service could be unreliable. Information Poster Showing the Stoves Carried by Market Aggregators



*Note:* The Sri-kandi stove, shown in the poster, was dropped from the pilot because it could not be produced at scale.

In the end, the market aggregators decided on 7 locally-produced, qualified clean stoves. Of these, 4 (Prime Pellet, Prime Firewood, UB Pellet and UB Firewood) had long records of design and redesign, based on user feedback through various government-sponsored, improved stove dissemination programs; 2 (Keren Super 2 and Amarta) were developed with support of the Indonesia CSI project, while 1 (Sri-kandi), although promising, could not be produced at sufficient scale within the pilot timeframe.

#### **BOX 3.2** Market Aggregator Highlights

Ditana Energy Solutions was the first mover and by far the largest market aggregator in the RBF pilot program. Ditana is its own stove manufacturer and sole distributor of the Prime cookstove brand in Indonesia, with a well-established distribution network. Ditana used the pilot program to accelerate its stove production and testing. Two Prime cookstoves (Prime Square Firewood and Prime Square Grandular/Pellet) were tested and approved for sale. More than 3,700 units were sold to households in the pilot region, which initially focused on Central Java and later shifted to NTT. Ditana sold its stoves at full price plus margin for sales agents and relied on the RBF funds to establish its sales network and reduce transport costs.

**Yayasan Kopernik** aims to bring energy-efficient technologies to people living in "last-mile" parts of Indonesia through opening income-earning opportunities for women. Under the RBF pilot, Kopernik expanded clean stove







#### BOX 3.2 Market Aggregator Highlights (Continued)

sales in Yogyakarta-Central Java, relying on local community development networks to train women as sales agents. The women received the clean stoves on consignment and earned margin on every stove sold. In NTT—where there are no LPG subsidies for cooking—Kopernik's market for clean stoves is quite large. The RBF incentives reduced the cost of the clean stoves and helped reach more people in remote rural areas.

**Amarta Stove and Pellet** 



**CV Agro Jawa Dwipa**, a pellet production facility with prior experience selling biomass pellets to cooperative and micro food businesses, hoped to expand into the household sector under the RBF pilot program. The company developed its own pellet stove, which was tested and found eligible under the RBF pilot. It reorganized its sales force network to sell its biomass pellets and the cookstove under the Amarta brand. The manufacturer's suggested retail price for the Amarta stove is among the lowest of all eligible clean stoves sold under the pilot program. The company plans to continue selling eligible pellet-based clean stoves to households, cooperatives, and small industries in Central Java.

**CV Dian Handicrafts**, a woman-owned business that produces handicraft products, purchased eligible clean stoves from producers in Yogyakarta and sold them directly to consumers using female sales staff and outside women sales agents. The owner negotiated favorable terms of payment with CV Agro Jawa Dwipa for its Amarta brand. Agro Jawa Dwipa accepted a 30 percent deposit to

start production, with the balance paid after Dian Handicrafts received the first RBF incentive for the order. Dian Handicrafts passed along the favorable terms of payment to household consumers, who could make installment payments decided on by the sales agents. The owner/operator reported that most consumers fully paid for the stoves in 5–10 installments.

**CV Kedung Artha**, a small stove business, is owned by a man who also manages a pellet production factory in Central Java. He used his access to the local pellet market and distribution network and the RBF pilot program to expand his clean stove business, especially for pellet-based clean stoves. Under the pilot, CV Kedung Artha sold UB (firewood and pellet) and Prime (firewood and pellet) stoves. To reduce risk of non-payment, sales agents were required to pay CV Kedung Artha in full on delivery of the stoves. With each stove sold, the company provided the consumer 1 kg of wood pellets free of charge. The owner plans to continue selling clean stoves and hopes to set up his own pellet factory.

**CV CITO 13** is a small business, whose owner decided to produce and distribute the Keren Super 2 under the RBF pilot once design specifications were made publicly available. He outsourced production to artisans (to make ceramic linings and assemble final products), metal sheet workers (to make metal sheet covers), and a small metal plant (to make steel grates); supplied these contractors all raw materials (except the steel grates); and monitored quality assurance and control at each step of the production process. The stove was sold through independent sales agents, other market aggregators, and direct company sales. The owner said the RBF incentives and social marketing support helped him to expand his clean stove business.

**CV BEDOG** is a small trading business in agricultural products for export and the domestic market. The owner joined the RBF pilot program to diversify into the clean cookstove business. He used outside sales agents, mainly vegetable farmers, who were required to pay in full on delivery of the stoves before direct Keren Super 2 for Sale



#### BOX 3.2 Market Aggregator Highlights (Continued)

resale to rural and peri-urban household customers in Yogyakarta-Central Java. Most of the clean stoves (Keren Super 2, UB Pellet, and UB Firewood) were sold following RBF pilot–supported cooking demonstrations and promotional activities. The owner's decision to continue in the clean stove business will depend on whether the wholesale price can be lowered.

**CV Karya Wahana Sentosa (KWAS)**, a furniture-making company, used its core-business contacts to sell the Amarta stove under the RBF pilot program and establish a pellet supply chain for Amarta stove buyers. To ensure a steady pellet supply for stove buyers, CV KWAS made arrangements for the heads of coconut cooperatives in several villages to serve as the main distributors of pellets from CV Agro Jawa Dwipa, the manufacturer.

**Ivy Kickstartyer** is a social enterprise aimed at combining entrepreneurship, women's empowerment, technology, and nature to change the daily lives of women in remote areas of Indonesia. Ivy cooperates with microfinance institutions (MFIs) and low-income banking organizations to establish end-user distribution channels for water filters, solar products, and now clean cookstoves--the newest of its product line, offered under the CSI project. Ivy used the CSI's RBF incentive to lower the introductory price of clean stoves, cover the perceived risk of non-repayment (on a new product line) from the MFI, offset transport costs, and provide training. The Prime Wood clean stove became one of Ivy's best-selling products in Central Java. The organization continues to sell clean stoves and plans to introduce additional stoves to broaden its product offerings.

the level of risk they were willing to accept. Innovations included extending manufacturer credit to consumers through installment payments, partnering with MFIs to offer consumer credit, offering bundling discounts for stoves/fuels, and partnering with cooperatives as fuel (pellet) distributors (box 3.2).

### **MAKING COURSE CORRECTIONS**

The pilot team made important adjustments to help market aggregators overcome key barriers to expanding their clean stove markets, which proved critical to the program's success. Within the pilot's 2-year timeframe, it was difficult to identify which business model works better; over a longer implementation period, the pros and cons of each model may have become clearer.

#### ADJUSTING THE PAYMENT SCHEDULE

The incentives payment schedule was modified after field investigations confirmed that most stove manufacturers and suppliers required full upfront payment. Because the market aggregators lacked enough upfront cash to purchase a sufficient number of clean stoves, they could not expand their markets. Adjusting the timing and amount of incentive paid to ensure market aggregators could meet their upfront investment costs had a positive outcome. The market aggregators immediately ordered more stoves from the manufacturers and suppliers, built up their inventories, and sold more stoves (Section 2).

Shifting a portion of the risk away from market aggregators was needed to get the pilot moving. It was understood that the burden could be shifted back once they were confident with their clean stoves and markets.

#### **OPENING THE PILOT TO A NEW PROVINCE**

The task team agreed to extend the pilot area to NTT Province in response to market aggregators' identification of geographical areas with better chances of creating a sustainable business. By mid-April 2016, several market aggregators indicated that sales in Central Java were not progressing as originally planned, due, in part, to competition from LPG and because some of their stoves were a better fit for a drier climate (e.g., where non-wood byproducts could be burned in a pellet stove). The task team agreed to extend the pilot area to NTT Province, where three of the market aggregators used their RBF incentives to set up distribution chains.

#### SUPPORTING ELIGIBILITY OF NEW DESIGNS

To help the market aggregators get started, the pilot team had to adjust its eligibility principle of "marketready only" in order to provide direct support for design development. On the first round of testing, some market aggregators decided not to carry certain qualified, locally-produced clean stoves because producers could not agree on a wholesale price acceptable to the market aggregators. In other cases, qualified stove producers had limited production capacity and could not meet anticipated demand. Also, none of the qualified international stoves could be made available during the pilot program.

The pilot laboratory supported the redesign and development of two new types of locally-produced stoves that were tested as eligible for the program. One important function of the pilot lab was to provide stove designers and developers feedback on the technical performance of their stoves. The lab was strengthened to support the redesign and development of the Keren Super 2 stove and the Amarta, which eventually tested as eligible clean stoves.

#### Keren Super 2: Artisanal Stove Improving from the Baseline

**CSI partner GERES was motivated to develop a clean stove that would be easily accepted by users, affordable to low-income households, and increase the choices of clean cookstoves.** GERES used its prior Cambodian experience and AFD funding to support the design and development of a clean stove based on the Keren, the pilot area's most widely used, traditional firewood stove. The improved stove, called the Keren Super 2, was similar to the Keren in appearance, production process, and operational procedures, but had significant design improvements. Technical support was provided to local artisans to produce the Keren Super 2 (figure 3.2).

Although the Keren Super 2 had the lowest performance rating among the qualified clean stoves, it had the highest rating in overall user satisfaction. The Keren Super 2 received a 1-star rating for efficiency, a 1-star rating for CO emissions, and a 3-star rating for PM<sub>2.5</sub> emissions, which was the lowest performance rating among the eligible clean stoves. But it received the highest rating in user satisfaction because it could be used in a similar way as the baseline Keren. Among household users, 67 percent were satisfied and 12 percent were very satisfied with the



FIGURE 3.2 Keren Super 2 Production (left) and Potential Buyer Examination (right)

Keren Super 2. This stove also had the lowest retail price and lowest incentive payments.<sup>17</sup> User satisfaction with the Keren Super 2 compared favorably against both the Prime Firewood and UB Firewood stoves, which had higher performance ratings.

#### Amarta: Market Aggregator-Designed Pellet Stove

**Agro Jawa Dwipa decided to design and produce its own pellet-based, low-cost improved cookstove.** This market aggregator backed off its initial plan to sell an existing pellet stove because its price was thought to be too high. Since the company's core business is sale of pellets for the household market, it believed a relatively low-cost pellet stove would provide a larger market base for its pellet sales. With 3-star ratings in CO and PM<sub>2.5</sub> and a 1-star rating in efficiency, this pellet-based improved stove, called the Amarta, qualified to be sold under CSI pilot program (figure 3.3). However 88 percent of households rated the stove as difficult to use, highlighting the need for customer feedback (box 3.3).

#### **INCREASING STOVE DEMONSTRATIONS AND TRAINING**

**Clean biomass cookstoves are a new technology, requiring cooking demonstrations and training in order for buyers to gain familiarity with their use.** All clean stove designs and models require cooks to make some adjustments or behavior changes. For example, to reduce heat using a traditional stove, the cook can simply remove the desired amount of firewood from the combustion chamber. But using a clean stove technology requires that the cook close the air vent door to reduce air flow into the combustion chamber.

<sup>&</sup>lt;sup>17</sup> The GERES team took special care to maintain construction costs at a level comparable to the baseline Keren stove.



#### FIGURE 3.3 Amarta Production Chain (left) and Stove and Pellet Stocks (right)

Participant observations designed to understand how qualified clean stoves were used by women in selected villages confirmed that the new technologies were more difficult to use. The higher the performance standards, the more behavior changes that were required. For example, the clean stoves were harder to ignite and fuel management was more difficult than for stoves with lower performance ratings. Based on these observations, it was concluded that buyers (and potential buyers) would benefit from cooking demonstrations to better understand how the stoves differed from traditional stoves and how best to use them.

**Cooking demonstrations, often combined with women's health check-ups, became an integral part of clean stove promotion.** In partnership with the market aggregators, the market facilitator coordinated 7–10 cooking demonstrations in selected communities of the Yogyakarta-Central Java pilot area (figure 3.4). Demonstration activities focused on preparing an entire meal of dishes typical of the community. Given that women account for the vast majority of household cooks in the pilot region (Appendix A), cooking demonstrations were conducted by women who had extensive experience using various clean stove technologies and were knowledgeable about indoor air pollution (boxes 3.4 and 3.5).

#### **BOX 3.3** Importance of Customer Feedback in Developing a Clean Stove Market

Clean stove design and development takes time, requiring iterative customer feedback loops so that the design can be refined to meet users' needs and expectations and thus gain their acceptance. At the time the RBF pilot program was getting under way, developers of the UB and Prime stoves (both pellet and firewood) had already gone through several iterations to better meet users' needs and expectations.

By contrast, developers of the Keren Super 2 and Amarta did not have an opportunity to test their newly designed stoves before the pilot program began. In fact, the pilot program served as their first test for user acceptance. The Keren Super 2 design was rated favorably mainly because of its similarity to the widely used Keren stove. But the Amarta, which is based on a more radical design that uses pellets as fuel, was rated as "difficult to use" by a large majority of households. Clearly, developers of the Amarta stove will require several more design and modification iterations based on customer feedback.

#### FIGURE 3.4 Stove Demonstration Combined with Women's Health Check-Up



#### BOX 3.4 Need for Ongoing Awareness Raising to Increase Uptake

Awareness-raising and educational campaigns on the health risks of indoor air pollution linked to the use of traditional biomass cooking stoves should not end with the RBF pilot program. Households that purchased the clean stoves under the RBF pilot program will need time to adjust to using the new stove technologies. Given that most households in the pilot area use various types of stoves for different purposes (e.g., cooking food or boiling water), it would be unrealistic to expect all purchasers of the clean stoves to immediately begin using them on a regular basis. Ensuring that polluting, traditional biomass stoves are replaced by clean cookstoves will require ongoing promotional activities.

#### BOX 3.5 Stories of Clean Stove Users: Fueling a Better Future

Savings for Children's Education. Yeni Paga lives with her husband and three children in Kupang, the capital city of NTT Province. To earn extra family income, she runs a home-based business selling snacks, including fried and steamed food. Before learning about the Prime Wood clean stove at a cooking demonstration supported by the RBF pilot program, Yeni used a kerosene stove to meet most daily cooking needs and kept a traditional biomass stove behind the house to cook for special occasions. She spent Rp. 160,000 per month on kerosene and regularly



acquired wood from a relative at Rp. 1,000 per bundle. After she started using the Prime Wood stove, which she purchased in cash for Rp. 450,000, Yeni found she needed only 30 bundles of wood per month. She still kept her kerosene stove, but was able to cut her monthly kerosene fuel expenditure in half. She is saving the extra money, about Rp. 50,000 per month, for her children's education. Yeni is quite happy with her new stove and expects that many more neighbors and relatives will purchase clean stoves if the prices can be lowered.



**Starting a New Business**. Ibu Nurjanah long dreamed of starting a business selling "Lontong Sayur" (banana leaf–wrapped rice cakes served with meat and vegetables in coconut milk). But making 20 pieces of Lontong using her traditional Keren biomass stove would require spending Rp. 10,000 on wood fuel, which she could not afford. One day she visited her daughter, who had just purchased a Keren Super 2 following a cooking demonstration at a neighbor's house. After observing the stove's performance, Ibu asked her daughter to buy one for her, which cost Rp. 150,000. Once Ibu started using the Keren Super 2, she found that only half the amount of wood was needed. Also, she did not have to tend the fire like before. The new stove's fuel and time-saving features made it possible for Ibu to finally start her food business.

Saving Time and Fuel. Erna Henu and her family live in Oebufu, NTT Province, where they raise livestock and have a poultry business. Each day, Erna cooks the family meals using a kerosene stove and uses a traditional threestone fire for boiling drinking water and cooking cattle feed. One day her husband, who is in the furniture-making business, brought home a Prime Wood clean stove that he purchased at an RBF pilot–supported stove demonstration held at a community health center. He observed that the clean stove functioned much like his family's current kerosene stove, but did not require continuous tending—a duty that he shared with his wife. He also considered that



#### BOX 3.5 Stories of Clean Stove Users (Continued)

the wood waste from his furniture business could be used as fuel for the new stove. Encouraged by her husband, Erna gradually learned how to start the fire using the new stove. Now she uses the Prime Wood stove for boiling water and cooking cattle feed every morning and afternoon. She values the clean stove for its convenience, fuel savings, and time saved from faster cooking.



From Kerosene Supplier to Clean Stove Promoter. Before Kanisius Maruli first learned about the clean stoves from an ad in a Kupang newspaper, he was a local supplier of kerosene stoves. Production of kerosene stoves has slowed owing the Kerosene-to-LPG Conversion Program, and many producers from Java have stopped making them. So when Kanisius heard about a clean wood stove that could burn like a kerosene stove, he became interested and met with the RBF pilot market aggregator to learn about the clean stoves and what his responsibility would be as a

sales agent. The market aggregator used a cash-and-carry system for selling the Prime Wood clean stoves, with a minimum bulk purchase of 50. Kanisius got started with his first 50 units, which he sold for cash at Rp. 400,000 each. He conducted demonstrations in and around Kupang (at markets, schools, women's artisan groups, and other community groups) and recruited sub-agents to widen his sales coverage. Within a year, he had sold more than 150 units, but had difficulty obtaining more after the market aggregator's office in Kupang closed down. He is convinced that sales will accelerate as more people learn about the clean stoves and their benefits.

**Satisfied Customer of the Keren Super 2**. Ibu Tami lives with her husband, a farm laborer, and two young children in the remote village of Bleder. She cooks mainly on the family's traditional Keren biomass stove since she and her husband can collect wood fuel and agricultural waste for free from the surrounding local environment. Although she has an LPG stove, she uses it only occasionally, given the fuel's high cost (Rp. 24,000 for 3 kg). When Ibu participated in a demonstration of the Keren Super 2 stove at the home of the sub-village head, she observed that the clean stove, which looked much like her traditional Keren stove, had sturdy, aluminum casing and performed better. Also, the cost was affordable, at Rp. 150,000, which could be paid for in several installments. Ibu is satisfied with her fuel-saving stove, especially now that many households are selling their biomass fuels to palm sugar industries.







## LEARNING HOW THE MARKET RESPONDS

The course corrections described above were critical to the subsequent pick-up in stove deliveries and resulting incentive payments to the market aggregators. By December 2015, little disbursement had been made, owing, in part, to delays in identifying the market aggregators, as well as finalizing tests and the list of eligible stoves. Disbursements picked up only after the modified incentives payment schedule was put in place and understood by the market aggregators and when a wide variety of locally-produced clean stoves became available. Another large increase in incentive payments was linked to opening the NTT Province to sales eligibility. The payment flow illustrates the response of market aggregators to new incentives and course corrections, the lag between action and reaction, and the cyclical nature of the stove business (i.e., waiting to fully sell original stock before restocking) (figure 3.5). The last rush to stock stoves, paid in January 2017, indicates that market aggregators had sufficient confidence in their stoves' ability to sell. Had the RBF pilot funding been larger and sustained over a longer period of time, it is quite likely that market expansion would have continued.



## SECTION 4 LESSONS LEARNED

he Indonesia CSI pilot program demonstrates that market-based RBF incentives can attract the private sector and stimulate local innovation. The RBF fund provided incentives to attract private investment in the clean stove sector together with technical assistance to strengthen institutions, build capacity, and raise awareness.

### WHAT WAS LEARNED?

The pilot's core value is that it provided a unifying framework for all key elements to develop the clean stove sector—policy, institutional, technology, standards/testing, private-sector support, demand stimulation, and closing of the affordability gap—and sent clear signals to market aggregators regarding performance and results the program would like to see. Aligning all of the necessary interventions toward performance-based targets and results avoided piecemeal or fragmented interventions, which characterized past stoves programs.

Having performance-based incentives with enough flexibility for market aggregators to make local innovations was also important. In such countries as Indonesia, providing market aggregators the space to develop incremental solutions (e.g., upgraded cooking technologies and new business models) can make the move toward higher performance levels more sustainable. Lessons from the design and implementation of the Indonesia RBF pilot, summarized below, will be of interest to other countries considering applying this mechanism to promote the development of their clean stoves markets.

## **KEY LESSONS**

- Stove testing that reflects local cooking practices and associated technical criteria are critical for developing a clean stoves market. Robust, locally-relevant testing is especially important where local circumstances (e.g., wood moisture content, cooking practices, and fuel preparation) can vary significantly. Only a robust, locally-customizable testing protocol can provide stove developers feedback on what types of local adaptation may be required to make a stove relevant to a given geographic market. To adhere to this principle, the social and gender team collected field data using various methods (e.g., participant observations, focus group discussions, and informant and expert interviews, as well as survey data). These findings were shared with experts to develop the CSI-WHT stove-testing protocol.
- During the project design phase, it is good practice to conduct qualitative and quantitative studies to gain a deeper understanding of the target population's cooking behavior and practices (e.g., how people cook, who cooks, and what types of stoves are used for different purposes). Inputs from the social and gender team were critical to developing the stove testing protocol. Integrating social and anthropological field data into laboratory performance-testing methods ensures that the results are reasonably reflective of local usage (Appendix A).

- It takes time for the private sector—especially risk-averse SMEs—to respond to market incentives. During the first-year of pilot implementation, transactions were quite limited because the market aggregators were still familiarizing themselves with the RBF mechanism and market. Also, the small size of the RBF fund was unable to attract large-scale investors and enterprises. So the participant market aggregators comprised smalland medium-sized enterprises (SMEs), including individual businesses, who are extremely risk-averse to making their own upfront investments. The 2-year implementation period for the pilot was insufficient for the market aggregators to fully respond to the incentives; it is suggested that the design of future programs build in a longer implementation period.
- Having a professional fund manager matters for helping build market confidence and making transactions flow smoothly. Selecting BRI (Bank Rakyat Indonesia), a professional transaction-oriented entity, as the pilot fund manager helped to reassure both market aggregators and the independent, third-party monitoring and verification (M&V) team.
- **Product design and quality improvement require iterations based on consumer feedback.** The pilot program tested two new stove designs for eligibility and provided market aggregators opportunities for testing and collecting consumer feedback on them. Market response and post-pilot consumer feedback on the stoves' performance and quality were mixed. For better sales, these stoves must be further improved. This experience also shows the beauty of the market mechanism, which eventually screens out lesser products.
- Awareness-raising activities and live demonstrations are key to raising sales. In post-pilot interviews, market aggregators said that awareness raising and live demonstrations were invaluable for increasing their sales, confirming that demand stimulation is an integral part of any clean cooking program. To be convinced to purchase the new stoves, households needed to see that the stoves improved their cooking experience.
- *Effective promotion requires thorough market research prior to program implementation.* The qualitative studies conducted in Central Java and Sumba Island, NTT—including participant observations, expert interviews, and focus group discussions with households—and quantitative household market surveys conducted in Central Java by the social and gender team were critical to gaining a better understanding of how best to promote and market the pilot program (Appendix A).
- Third-party verification must strike the right balance between simplicity/cost and precision/risk. The
  centralized M&V approach adopted by the RBF pilot program had several advantages, but was impractical and too
  costly for a scaled-up national program. It allowed the M&V team to closely monitor sales to market aggregators
  and households, monitor development of the clean stoves market, and discourage fraudulent claims. But a
  decentralized approach would likely have been simpler and less expensive to plan and implement (e.g., it could
  rely on local community leaders and organizations where the clean stoves were sold to conduct M&V activities).
  That said, it is important that the M&V team maintain a database system that tracks all RBF incentives distributed
  to the market aggregators, given the need to account for all subsidy distributions and deter fraudulent claims.
- The RBF design must be flexible and adjustable to reflect changing market conditions. The Indonesia pilot experience confirms that the program management team must closely monitor the effectiveness of the RBF incentives and, based on feedback from market aggregators, make adjustments or redesign the program as needed. An assessment during the early stage of implementation revealed that market aggregators were unwilling or unable to take on financial risk. For the first year of the pilot, the clean stove inventories for sale were quite low and, in turn, so were household sales. To help market aggregators overcome the perceived financial risk and accelerate sales, a third stage of incentives was added to the design for stove stocking, with a one-off bonus for the first 300 stoves in stock. As a result of the added incentive, more market aggregators started investing in the sector.

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#### The Efficient, Clean Cooking and Heating Community of Practice

https://collaboration.worldbank.org/groups/clean-cooking-and-heating-solutions

#### Indonesia Stove Alliance

http://www.tungkuindonesia.org/en/index.html

#### Social-Gender Support to Indonesia Clean Stove Initiative

https://www.astae.net/social-gender-support-to-indonesia-CSI



APPENDIX A MARKET RESEARCH AND PROMOTIONAL ACTIVITIES his Appendix summarizes the many lessons learned from implementing the market research and promotional activities under the Indonesia RBF pilot program. These lessons resulted from the collection and interpretation of baseline data, ongoing evaluation of strategies, and post-pilot evaluation of data collection. These activities were largely carried out with the guidance of market facilitators, who conducted education and awareness campaigns, implemented promotional and marketing activities, and directly supported market aggregators in their individual efforts to conduct such campaigns in local communities.

## **MARKET RESEARCH ACTIVITIES**

**Effective promotion and marketing required thorough market research.** Prior to pilot implementation, the social and gender team conducted qualitative studies (i.e., participant observations, expert interviews and focus group discussions with households in Central Java and Sumba Island) and quantitative household market surveys in Central Java to understand how to best promote and market the pilot program (ASTAE 2015a). During pilot implementation, data were collected and adaptations were made based on data review and feedback. At the close of the program, the team conducted quantitative and qualitative surveys among households who bought the clean stoves under the pilot program and conducted interviews with the manager/owner market aggregators.

Findings from early market research efforts clarified that the pilot program should focus promotional and marketing activities in three areas. First, the baseline pilot data showed a clear need to raise awareness and educate consumers. Second, a variety of promotional strategies would be needed to introduce those stoves that passed the designated stove-testing laboratory's requirements for emissions, efficiency, and safety. Third, promotional and marketing strategies would need to be linked to awareness and educational campaigns for market aggregators to convince consumers to buy the clean stoves.

The main objectives of promotional and marketing activities were as follows (ASTAE 2015b):

- Raise awareness and educate consumers about the health risks linked to indoor air pollution (IAP) resulting from the burning of biomass fuels using traditional cookstoves.
- Introduce the new clean cookstoves as a solution for IAP and focus promotion and marketing activities on all clean stoves rather than specific ones.
- Present the clean stoves as having better value than the existing traditional biomass cookstoves, given that they promote a healthy living environment and save fuel.
- Ensure that consumers can correctly identify the pilot-endorsed clean stoves by affixing a CSI logo to these products (box 2.3).
- Conduct cooking demonstrations to ensure that household buyers or potential buyers of the clean stoves know how to properly use them.

## **UNDERSTANDING THE TARGET POPULATION**

Knowing the profile of potential customers allowed the team to develop appropriate educational, promotional, and marketing materials and recognize where more efforts needed to focus. Several key data were gleaned from a market survey conducted among peri-urban households outside Yogyakarta prior to the start of the pilot. Based on the survey results, the team recognized that firewood remains one of the most important fuels for cooking even though Java is one of the world's most densely populated areas, with an average of more than 2,600 people per square mile.

Detailed information on the gender of cooks and the relationship between preferred fuel use and demographic data of cooks and households provided important insights into how to design the educational, promotional, and marketing materials. The data revealed that 96 percent of household cooks are women. While some cooks used only biomass, others used both biomass and LPG. Among the dual-fuel users, the reasons for using two fuel types varied. Some mainly used biomass for cooking, supplementing it with LPG. Others did the reverse. Still others primarily used LPG for cooking and biomass for boiling water. The age of cooks was associated with preferred fuel use. Among older cooks, who were accustomed to traditional cooking methods, biomass cookstoves and fuels were more popular, whereas younger cooks preferred more convenient, modern fuels (LPG). The average age of female cooks using biomass only was 48 years, compared to 45 years for dual-fuel users, and 41 years for LPG-only users. The educational status of the cooks also varied by fuel use. Only 21 percent of single-fuel (biomass) users had completed high school, compared to 32 percent of dual-fuel (LPG and biomass) users.

Given the association of fuel use and average monthly household income, the team expected that dual-fuel using households might be better able to afford the higher-priced clean biomass cookstoves. Single-fuel (biomass) using households were poorer than dual-fuel (LPG and biomass) households, with average monthly incomes of about Rp. 1.4 million and 2.0 million, respectively. The survey data also revealed that 78 percent of households that used biomass only collected it from the surrounding environment, while the remaining 12 percent collected and purchased it.

Knowing how fuel is collected and prepared at the household level is important to understanding whether a stove design will be accepted by the consumer. For the vast majority of households that use firewood for cooking, the fuel must be collected and prepared. The survey results showed that the responsibility for collecting biomass fuel is shared equally among males and females; both adult males and females spend an average of about one hour per week collecting firewood. Interestingly, most households that collect biomass fuels do not consider the time spent on this task as a significant burden, suggesting that biomass fuels remain readily available in the survey area.

While male and female household members spend about the same amount of time collecting firewood, preparing the firewood for use depends mainly on the size of the wood. For larger-sized wood pieces, 56 percent of households rely on males to chop the wood; 19 percent rely on adult females, 15 percent rely on both adult males and females, and the remaining 11 percent have no need to prepare firewood. For preparation of smaller-sized wood pieces, 38 percent of the households surveyed rely on adult males, and 36 percent rely on adult females; another 20 percent rely on both adult males and females, while the remaining 6 percent have no need for chopping small-sized pieces of firewood. This information was pertinent, given that higher-performing clean cookstoves require that wood be prepared in a uniform size for complete combustion. Based on the current division of labor in the pilot area, preparing wood for the higher-performing clean cookstoves would likely mean more work for female household members. Indeed, results from the

post-pilot survey showed that "spending time chopping firewood into small pieces" was a common complaint among users of UB and Prime firewood stoves.

**Given that men and women may make a joint decision to purchase stoves, promotional and marketing campaigns should focus on both women and men as potential buyers.** The market survey revealed that women generally decide on stove replacements. The decision to purchase a new stove is often made independently if the stove is inexpensive (e.g., the popular Keren and Anglo stoves). Apparently, Rp. 50,000 is the threshold for women making an independent stove purchase decision. However, for more expensive stoves in a range of Rp. 50,000–200,000 (e.g., a fixed stove made of brick and cement), the decision to purchase is more likely made jointly. Survey data also revealed that households in the pilot area are generally conservative financially and reluctant to create debt for the family. Buying an appliance on credit requires a joint decision in most cases (ASTAE 2015a). Given these survey findings and the pricing of some of the clean stoves, the pilot team and market aggregators agreed that men need to be included in the promotional and marketing strategies.

## **UNDERSTANDING THE STOVE MARKET ENVIRONMENT**

Knowing what stoves were sold in the current market assisted the team in understanding the products the new stoves would be competing against and how to position the new stoves. Understanding who the competitors are is fundamental in any retail business. Baseline qualitative and market survey methods identified four types of traditional biomass cookstoves currently being sold and used by consumers targeted by the pilot program for replacement with eligible clean stoves. The Keren stove accounts for 63 percent of market share, followed by the one and two pothole fixed stove, at about 31 percent; stoves made of stone comprise about 7 percent of market share, while three/five stone stoves account for only 4 percent.

The Keren is an inexpensive stove (costing about US\$1), lasting an average of only 16 months. Households that own and use the Keren have an average monthly income of Rp. 2.264 million, which is Rp. 0.411 million less than that of households that use other types of stoves. However, the average family size and total number of family members eating meals in the household are the same for both Keren users and nonusers, at 4 persons per household. The one and two pothole fixed stove, the second most popular stove, is self-built (fixed), using a combination of mud, brick, and cement as the main materials. Stoves made of stone, which last for decades, involve a labor-intensive process of removing stone from mountains, cutting it into pieces, and carving it into the stove shape (ASTAE 2013).

Strategic marketing messages were designed and developed to compete with these inexpensive traditional biomass cookstoves. The purpose was to raise potential customers' awareness and convince them that the pilot program's endorsed clean stoves have a better value, particularly since they provide for a healthy cooking environment that saves fuel.

**Participant observation, interview, and survey data allowed the pilot staff to understand how women interacted with the stoves.** These data were shared with designers and developers so they could modify and improve their product designs. At least one stove manufacturer used the information collected by the social and gender team, along with laboratory testing results, and directly involved women in the redesign and redevelopment of the Keren Super 2.

## SOCIAL MARKETING CAMPAIGNS FOR RAISING AWARENESS

Messaging for the social marketing campaign sought to depict the CSI-endorsed stoves as having better value than the traditional biomass stoves in use. Raising awareness of the target population required focusing on how IAP linked to traditional stove use causes health-related illnesses. Health information was linked to strategic messages that identified clean stoves as the key solution to IAP. Baseline data confirmed that, although households were keen to lessen soot deposits on their kitchen walls and ceilings and from pots and pans, they did not correlate soot deposits with the health-related risks of IAP. Only 8 percent of the households surveyed perceived that switching to LPG would improve their cooking environment. These findings confirmed the need for campaigns to help consumers understand the health-related risks of IAP caused by the inefficient burning of biomass fuels using traditional cookstoves, emphasizing that clean cookstoves offered a solution that created a healthy living space, saved energy, and emitted less smoke and soot.

The program implemented a widespread social communication and marketing campaign supported by the government. In collaboration with the Indonesia CSI Program Management Office (PMO) within the Directorate of Bioenergy of the Ministry of Energy and Mineral Resources (MEMR), education and outreach support was provided in the form of newspaper advertisements and local radio talk shows that focused on the pilot region. The objectives of these communication activities were threefold: introduce the pilot program, raise household consumers' awareness and educate them on the health risks linked to IAP, and promote clean cooking solutions. Over a 6-month period (May–October 2015), 8 talk show episodes covered a wide range of topics related to the CSI pilot program, IAP, clean cookstoves, and healthy/clean cooking solutions. In each episode, the host discussed relevant topics with invited guests who were experts in various fields. During July–August 2016, newspaper ads were run in 6 newspapers with circulation in the Yogyakarta Special Region, Central Java, and NTT.<sup>18</sup> Radio advertisements, broadcast on 6 stations with coverage in the three regions, ran for 12 days in November 2016. Televised advertising was not included, given the limited budget of the Directorate of Bioenergy. During post-pilot interviews, several market aggregators noted that many household members in rural areas do not read newspapers on a regular basis and believed that TV ads would have reached a wider audience. Moreover, TV ads would allow consumers to see the clean stoves, rather than just hear about them on the radio.

Market aggregators found the training, marketing support, and promotional materials provided by the market facilitators very useful. Sales agents were trained in how to use the various types of clean stove technologies and present them to potential consumers. Training included sharing key market information so the market aggregators could segment the market to effectively target potential customers. After receiving permission from clean stove manufacturers, the pilot program provided financial support to design and print a user's manual for all pilot-eligible clean stoves. The user's manual included illustrated, easy-to-understand instructions. Sales agents were instructed to give stove purchasers a copy of the user's manual.

The pilot program also financed the design and printing of posters, leaflets, and banners, as well as a short audio, which were used to promote clean cookstoves and clean cooking solutions. The market aggregators each received 1,000 free posters, 500 of which were designed to promote the pilot program and clean cooking solutions and the

<sup>&</sup>lt;sup>18</sup> Radar Jogja (DIY) on July 24, Tribun Jateng (Central Java) on July 6 and 27, Tribun Jogja (DIY) on July 31, Jateng Pos (Central Java) on August 3, Pos Kupang (NTT) on August 3 and 13, and Timor Express (NTT) on August 6 and 11.

other 500 to promote his or her own clean stove brand/model. Each market aggregator also received 10 banners and 1,000 leaflets for promoting his or her clean stove brand/model. The promotional materials were not only professionally designed and visually convincing. By covering the production and printing costs, the program helped to alleviate the market aggregators' financial burden since small orders are relatively expensive. Post-pilot interviews with the market aggregators confirmed the usefulness of the user's manual and promotional materials.

**One effective social marketing approach was to create brand recognition to help users distinguish clean from traditional cookstoves.** Since the clean cookstove technologies may not be recognizable to consumers in the marketplace, the pilot program designed a program-endorsed, clean stove logo, which was affixed to all piloteligible stoves (so that consumers could easily identify them) and printed on all promotional materials.<sup>19</sup> The CSI logo presented these stove products as ones that promote healthy living and save energy, captured by the simple slogan "Tungu Sehat Hemat Energi" (TSHE) in Bahasa Indonesia (box 2.3).

The logo's design and development was part of an open competition among high school, vocational, and university students. More than 50 students submitted a total of 73 logos, 57 posters, 28 short films, and 13 video clips focused on ways to inform the public about the dangers of IAP caused by biomass stoves and clean stove solutions. The students successfully demonstrated their ability to communicate the concept through visual media and short film.<sup>20</sup> The logo design that was awarded first place was selected as the pilot program logo (box 2.3). Inviting students to participate in the competition also provided a venue for educating the younger generation about the issue. The competition was held in Yogyakarta city, Central Java's largest city and home to many nationally recognized high schools, vocational training centers, and colleges/universities.

## **CONSUMER EXPECTATIONS AND ACCEPTANCE**

**Consumer feedback collected before and after sales underscores the importance of collecting data to better understand consumer expectations and acceptance.** Surveys of clean-stove users conducted before the CSI pilot program started revealed 10 stove design features that 90 percent of the respondents considered "important" or "very important." Approximately 30–40 percent of those surveyed believed a stove that uses less fuel, reaches high heat levels and cooks fast, is durable, and ignites quickly as "very important" features, while the other 60 percent considered these features as "important." Other design features considered "important" or "very important" by 80–90 percent and about 10 percent of respondents, respectively, were ease of operation and convenience, ability to easily add or remove fuel, ability to promptly increase or reduce heat, less emitted smoke, ability to use any type of biomass fuel (e.g., firewood, coconut shells, and twigs), and ability to burn firewood of various diameters and lengths. Unfortunately, users' high expectations for the stoves made it difficult for clean stove designers and developers to come up with the perfect model that most users would easily accept, even if the stoves met performance standards and received good star ratings (table A.1). For example, more users said they were satisfied with the Keren Super 2 than with the UB and Prime pellet stoves. The most common complaints with the higher-performance, more expensive

<sup>&</sup>lt;sup>19</sup> Without the logo, it would have been quite difficult for consumers to correctly identify which stoves were pilot-eligible, given that stoves come in various shapes and designs and that a market aggregator might only promote one of many clean stoves.

<sup>&</sup>lt;sup>20</sup> See https://www.youtube.com/watch?v=1BhmdzjvUs1; https://www.youtube.com/watch?v=JD8xaQwmBgs

Factor	Keren Super 2	Prime Square Firewood	UB Firewood	UB Pellet	Amarta	Prime Square Pellet		
Efficiency	*	*	*	*	*	**		
CO (g/MJ <sub>NET</sub> )	*	* * *	**	* * *	***	***		
PM <sub>2.5</sub> (g/MJ <sub>NET</sub> )	* * *	* * *	* * *	* * *	* * *	* * *		
Total incentive (Rp.)	110,000	190,000	140,000	190,000	190,000	220,000		

### **TABLE A.1** Star Ratings and Incentives for the Pilot-Eligible Clean Stoves Sold

Source: Durix 2017.

pellet stoves were that they were hard to ignite; required cutting firewood into small pieces, which was inconvenient; could not accommodate all types of biomass; and had a fuel door that was too small for easily adding or removing fuels. Consumers were more responsive to the lower-performance, less expensive Keren Super 2, whose design consisted of a simple modification of the familiar Keren stove.

A post-pilot survey of confirmed clean stove users, conducted in Central Java and Yogyakarta, provided useful feedback, including the prices households paid for the stoves. The results showed that the average price paid for the Prime Square and UB stoves ranged from Rp. 274,000 (UB Pellet) to Rp. 350,000 (Prime Square Firewood), compared to Rp. 59,000 and Rp. 140,000 for the Amarta and Keren Super 2, respectively.

Men and women were equally important clean stove buyers; however, women tended to buy lower-priced stoves while male buyers purchased more of the higher-priced pellet stoves. The pilot program's monitoring and verification (M&V) report for the second and third verification revealed that women and men comprised 54 percent and 46 percent of stove buyers (2,220 in all), respectively. Analysis by stove type showed that women tended to buy lower-priced, pilot-eligible clean stoves, accounting for 80 percent of Keren Super 2 buyers and 77 percent of Amarta pellet stove buyers. Male buyers accounted for 89 percent of the Prime Square Pellet stoves purchased and also dominated the UB Pellet stove market, accounting for 68 percent of sales. Male buyers also accounted for more than half of the market for the retail-priced Prime Square Firewood and UB Firewood stoves (figure A.1).



#### FIGURE A.1 Eligible Clean Stove Purchases by Gender

These results confirm findings from the market survey and research conducted prior to the pilot program that showed women can independently make decisions to buy a stove up to a certain threshold. For poorer households, the threshold for women's independent decision-making to purchase a stove is about Rp. 50,000, with joint decision-making more likely as the stove cost increases (Rp. 50,000–200,000). Household income is another key factor. For stoves costing Rp. 50,000, 48 percent of households in the lowest income quintile reported that women would likely decide on their own to make a purchase; this proportion increases to 72 percent for households in the highest income quintile (ASTAE 2015a). Thus, as household incomes rise, so does women's decision-making power to make a purchase.



## APPENDIX B STAKEHOLDER RESPONSIBILITIES AND FUNDING SUPPORT

his Appendix summarizes the supervisory and implementation support provided for the RBF pilot program, as well as funding experience and lessons learned (figure B.1).





## **RULES DEFINITION AND SUPERVISION**

The **Directorate of Bioenergy** is the counterpart government agency for the Indonesia Clean Stove Initiative (CSI). It oversees pilot program implementation and is responsible for issuing, maintaining, and updating lists of clean cookstoves qualified for sale under the pilot program.

The **Project Management Office (PMO)** under the Directorate of Bioenergy, is responsible for overall management and implementation of the joint CSI program. Under the pilot incentives program, the office is responsible for: (i) issuing, maintaining, and updating the qualifying list of clean stoves to be sold in the market and (ii) overseeing and providing opinion on the pre-screening of market aggregators by the market facilitators.

The **World Bank** jointly manages the Indonesia CSI with the counterpart government agency, providing overall technical and non-technical support for pilot program implementation and funding support.

**GERES** (*Groupe Energies Renouvelables, Environnement et Solidarités*) is a partner NGO supporting implementation of the Indonesia CSI, with funding from the French Development Agency (AFD). The GERES team provides technical support for the pilot stove testing center, capacity building for key market players, and monitoring and verification (M&V) of stoves eligible for incentives.

## **IMPLEMENTATION SUPPORT**

The **Indonesia Alliance for Clean Cookstoves (ATI)** is a network and platform for knowledge and experience sharing, partnership, and cooperation regarding the use of clean stoves in Indonesia for government agencies, the private sector, community organizations, research institutions, universities, and individuals. Contracted through the Indonesia CSI project, the ATI secretariat office is currently hosted in Yayasan Dian Desa (YDD) to support implementation of the pilot program, particularly with respect to communication, learning, and promotion of cooperation among key stakeholders.

**Pilot program stove testing centers** are organizations designated to provide stove testing services to submitted stoves in response to calls for stove technologies under pilot programs. In the case of the Indonesia CSI RBF pilot program, YDD's stove testing laboratory, located in Yogyakarta (with technical support from GERES and international experts), has served as the designated stove testing center. It follows the published pilot program test and evaluation method to test and rate the eligibility of stoves for the program. It submits test results of eligible stoves to the PMO and recommends ratings for eligible ones.

**Market facilitators**, appointed by the World Bank, are responsible for engaging and helping potential market aggregators to participate in the pilot incentives program and carrying out the pre-screening of market aggregators. The market facilitators also provide business and review support to the program and selected market aggregators. Under the RBF pilot program, two market facilitators were appointed: Apex Consulting Group and YDD (Appendix A).

## FUNDING EXPERIENCE AND LESSONS

#### **INCENTIVES**

While RBF incentives for the sale of stoves would most likely be funded by the Government of Indonesia in a future scale-up phase, doing so at the pilot stage had to be abandoned. During the pilot stage, which was small in scale by definition, the burden of attempting to adapt the prevailing administrative and regulatory rules to fit RBF disbursement requirements was deemed too high. At the same time, using World Bank–executed funding would have been too complex, defeating the purpose of showing it could be done by Indonesian entities. Also, private-sector players had indicated that they would worry about delay risks if the financial handling of the incentives were done by the government.

In response, the task team proposed that BRI (PT Bank Rakyat Indonesia), a publicly-owned local development bank, to serve as both recipient and administrator of the grant to be distributed as incentives for the sale of stoves. The government would remain the main partner and beneficiary of the pilot work, but would not be the formal recipient of the incentives-related part of the grant.<sup>21</sup> This experience shows that identifying formal recipients and related mechanisms can be a trial-and-error process, with unexpected administrative roadblocks, even when all parties initially agree on the conceptual framework. Thus, flexibility is paramount at the pilot stage, but the trade-off is slippage of the original implementation schedule.

#### TECHNICAL ASSISTANCE

Given the innovative nature of the Indonesia CSI pilot program, grant funding for technical assistance to complement the incentives funding was accessed from ASTAE and the Energy Sector Management Program (ESMAP). These funding sources were added to the Australian DFAT-AusAid funding, which was used mainly during the first phase of the CSI project. Having multiple funding sources enabled a comprehensive design and implementation of pilot activities, but had significant transaction costs (e.g., in terms of proposals, administration, and reporting) and became unwieldy as the slow progress of the pilot started to conflict with respective closing dates.

Beyond grant funding, the French Development Agency (AFD) (*Agence Française de Développement*), an external partner without contractual ties to the World Bank, played a key role in pilot implementation. In close collaboration with the World Bank, AFD separately funded the involvement of GERES, which had significant experience in clean stove dissemination in Cambodia and was interested in Indonesia. This proved quite useful, not only because each partner had complementary rules on disbursements and could therefore handle aspects that the other could not, but also because each had different viewpoints on the tasks involved, which broadened the collective understanding of the process. It also enabled a clear delineation of tasks that were necessary to the RBF process, avoiding conflict of interest (e.g., ensuring that the M&V team and the payer of incentives reported to different authorities).

The technical assistance needs of a pilot program can be high and difficult to identify in advance. Having a significant budget earmarked ahead of time for a long period, possibly subject to milestone progress, would have been preferable; but the ability to access different sources of funds as issues arose was integral to the ability to implement the pilot successfully.

<sup>&</sup>lt;sup>21</sup> This recipient-executed grant was provided by the World Bank–led Asia Sustainable and Alternative Energy Program (ASTAE).



## APPENDIX C MARKET AGGREGATORS AND SALES DISTRIBUTION

his appendix describes the market aggregators that participated in the RBF pilot program (table C.1) and highlights sales-distribution results, including gender-related issues.

## **HIGHLIGHTS OF SALES DISTRIBUTION**

By the end of the pilot program, a total of US\$100,000 in RBF funds had been disbursed to the 10 participating market aggregators, for a total of 9,738 eligible stoves. Stove distribution was nearly evenly divided between the two pilot areas, at 51 percent (Yogykarta-Central Java) and 49 percent (NTT). However, it was found that demand

TABLE C.1 Summ	ary Description of Mar	ket Aggregators	
Market Aggregator	Business Description	Prior Business Experience	Gender of Owner or Manager
Internationally-based	d local entities experienced	in clean stove business or related products	
Ditana Energy Solutions	Small/medium-sized private business	Subsidary focused on clean stove wholesale and retail business	Female
Yayasan Kopernik	Small/medium-sized NGO	Has extensive experience selling rural households clean cookstoves, solar lights, water filters, and other innovative products	Female
lvy Kickstarter	Small/medium-sized NGO	Has experience selling rural consumers water filters, solar home systems, and solar lanterns	Female
Private-sector player	s experienced in the fuel b	usiness	
CV CITO 13	Small private business	Licensed LPG distributor outside Yogyakarta	Male
CV Kedung Artha	Small individual business	Manages a pellet production facility; interested in creating household pellets market	Male
CV Agro Jawa Dwipa	Small private business	Has experience selling pellets to cooperatives and food-producing microbusinesses	Male
Players new to the st	ove business with good ac	ccess to target communities	
Dian Handicrafts	Small individual business	Produces handicrafts for local and foreign tourists, relying on women handicraft makers in rural and peri-urban communities	Female
CV BEDOG	Small private business	Has a network of sales agents sourcing agri- business products from rural farmers for its core business	Male
Pancaran Sinar Berkah	Small private business	Supplies coconut byproducts to produce and sell environmentally-friendly coconut-based products	Female
CV Karya Wahana Sentosa (KWAS)	Small private business	Manufactures furniture for domestic market; has reputation for being sustainable furniture producer	Male

Note: The pilot team's grouping of market aggregators was based on analysis of their business experience, business profiles, and interviews with managers or key operators.

	Yogyakarta-Central Java		East Nu				
Market Aggregator	Wood stoves (no.)	Pellet stoves (no.)	% of all stoves	Wood stoves (no.)	Pellet stoves (no.)	% of all stoves	Total stoves (no.)
Ditana Energy Solutions	1,157	95	37	2,022	120	63	3,394
Yayasan Kopernik	250	0	10	1,998	304	90	2,552
lvy Kickstarter	600	0	100	0	0	0	600
CV CITO 13	700	0	100	0	0	0	700
CV Kedung Artha	50	250	100	0	0	0	300
CV Agro Jawa Dwipa	0	472	58	340	0	42	812
Dian Handycrafts	0	300	100	0	0	0	300
CV BEDOG	114	316	100	0	0	0	430
Pancaran Sinar Berkah	150	200	100	0	0	0	350
CV Karya Wahana Sentosa (KWAS)	0	300	100	0	0	0	300
All (no.)	3,021	1,933	51	4,360	424	49	9,738
All (%)	31	20	n/a	45	4	n/a	100

#### TABLE C.2 Market Aggregators' Sales Distribution by Region and Stove Fuel Type

was greater in NTT, probably because the Kerosene-to-LPG Conversion Program does not cover that province and because some areas have access to candlenuts, which can be used to fuel pellet stoves.<sup>22,23</sup> Ditana Energy Solutions and Yayasan Kopernik, the two largest market aggregators, focused mainly on the NTT region; Agro Jawa Dwipa divided its sales efforts between Yogyakarta-Central Java and NTT, while the other 7 market aggregators focused on Yogyakarta-Central Java only (table C.2).

**Ditana Energy Solutions and Yayasan Kopernik focused on selling Prime and UB stoves.** Of the 3,394 stoves sold by Ditana Energy Solutions, 94 percent were Prime Firewood, while the remaining 6 percent were Prime Pellet. In the case of Yayasan Kopernik, 78 percent of the 2,552 stoves sold were UB Firewood and the other 22 percent were Prime Firewood and UB Pellet.

<sup>&</sup>lt;sup>22</sup> The candlenut tree (*Aleurites moluccanus*), which is native to the Indo-Malaya region, is grown widely in NTT Province. Dry candlenut shells can be used as a substitute for pellets in Prime and UB pellet stoves.

<sup>&</sup>lt;sup>23</sup> Ditana Energy Solutions and Yayasan Kopernik sold a combined 424 pellet stoves in the NTT region.

## **GENDER AND STOVE SALES**

**During post-pilot interviews, market aggregators reported that they did not believe the gender of sales agents influenced stove sales.** The market aggregators said they did not give preferential treatment to hiring male or female sales agents. In the cases of Dian Handicrafts and CV Karya Wahana Sentosa (KWAS), the sales agents on staff accustomed to selling stoves were primarily female; however, the manager of Dian Handicrafts said that what matters most is the delivery of a sales agent's stove presentation to the potential consumer. Market aggregators said, however, that female sales agents were at a disadvantage in selling stoves in rural areas, where motorcycles are the main mode of transportation; they noted that women have a difficult time managing bulky stoves while maneuvering motorcycles through the countryside and are more prone to accidents.

Male and female sales agents performed equally well under the pilot program; however, female sales agents were more likely to sell stoves to female customers. Of all the pilot-eligible clean stoves sold by female sales agents, 65 percent were to female customers. By contrast, the proportions sold to male and female customers were about equal for male sales agents, at 51 percent and 49 percent, respectively (Figure C.1). This result may confirm that women tend to relate better to women and are therefore likely to target female customers (Appendix A).



**Female sales agents tended to sell more lower-priced stoves compared to male sales agents.** Of all the piloteligible clean stoves sold by female sales agents, the Amarta and Keren Super 2 accounted for 39 percent, compared to 29 percent for male sales agents. In terms of fuel technology, 69 percent of the stoves sold by female agents were firewood, while 31 percent were pellet stoves. For male sales agents, there was little difference in the proportions of pellet (53 percent) and firewood (47 percent) stoves sold.







