# ECONOMIC ANALYSIS

## A. Economic Rationale

1. Energy efficiency potential in Tajikistan is assessed by the Ministry of Energy and Industry at 30% of current power consumption. More than 50% of the country's housing (i.e., more than 500,000 households) need some level of home improvements. The deterioration in housing conditions and their energy inefficiency is due to lack of maintenance and repair. With lack of support from the government and other commercial banks and financial institutions to finance the repair and maintenance of these houses, a handful of microfinance institutions (MFIs), such as IMON and Arvand, have started offering home improvement loans in partnership with Habitat for Humanity. The acute need for home improvement financing is demonstrated by the fact that this program has disbursed nearly 6,000 home improvement loans amounting to $8.1 million within a short period of 2 years. Nevertheless, given that nearly 500,000 houses need immediate repair, this program has only served 1.2% of the potential market size.

## B. Macroeconomic Context

2. From 2000 to 2008, Tajikistan's economy grew at an average of 8% per annum, driven primarily by world prices and demand for cotton and aluminum (Tajikistan's main export commodities).[1] Economic growth was also driven by a demand for Tajik labor in rapidly growing countries such as Russia, resulting in large remittances to Tajikistan that fueled consumption. However, this period of growth masked the build-up of weak macroeconomic and fiscal positions, including increases in external borrowing. Supply side shocks, such as steep rises in global fuel and food prices in 2007–2008, and growth in aggregate demand led to a spike in inflation and the widening of trade and current account deficits. Despite an International Monetary Fund (IMF) economic stabilization program and a temporary improvement in macroeconomic performance in 2008, Tajikistan's economy remained weak and suffered significantly from the 2008–2009 global financial crisis. In 2009, GDP growth weakened dramatically, a steep exchange rate depreciation occurred, and remittance flows dropped by 30%–50% compared to 2008 due to a recession in Russia and the consequent depreciation of the ruble. This resulted in a current account deficit of 5.9% of gross domestic product (GDP) in 2009 and a reduction in foreign direct investment and trade finance.

3. Based largely on renewed high levels of remittances, the economy rebounded in 2010, with GDP growth of 6.5%. Stronger than expected agricultural production in 2011 contributed to higher GDP growth in 2011 (7.4%) and 2012 (7.5%).[2] Inflation increased by 6.5% in 2010 and 12.5% in 2011 but moderated to 5.8% in 2012. After declining from TJS3.45 at the end of 2008 to TJS4.40 at the end of 2010, the currency stabilized and ended at TJS4.60 per US dollar at the end of 2011 and TJS4.8 at the end of 2012.

## C. Sector Context

4. Tajikistan depends on hydroelectric sources for 98% of its energy needs. In the summer, the hydroelectric power plants create a surplus of electricity. In the winter, however, there is a

[1] World Bank. April 2012. *Project Appraisal Document on a Proposed Grant to the Republic of Tajikistan for a Private Sector Competitiveness Project (Report No. 67470-TJ).* Washington, DC.
[2] ADB. 2013. *Tajikistan Economic Indicators.* Manila.

large deficit because rivers freeze and cause reservoir levels to decline. In rural areas where 73.5% of the population lives, power is supplied for 6 months for only 4–6 hours per day. As a result, rural households must rely on solid fuels (e.g., wood and coal) for essential purposes such as home energy efficiency, lighting, and cooking. Winter power cuts are also now frequent in large cities. The winter deficit causes human suffering and is also a significant impediment to economic growth and development.

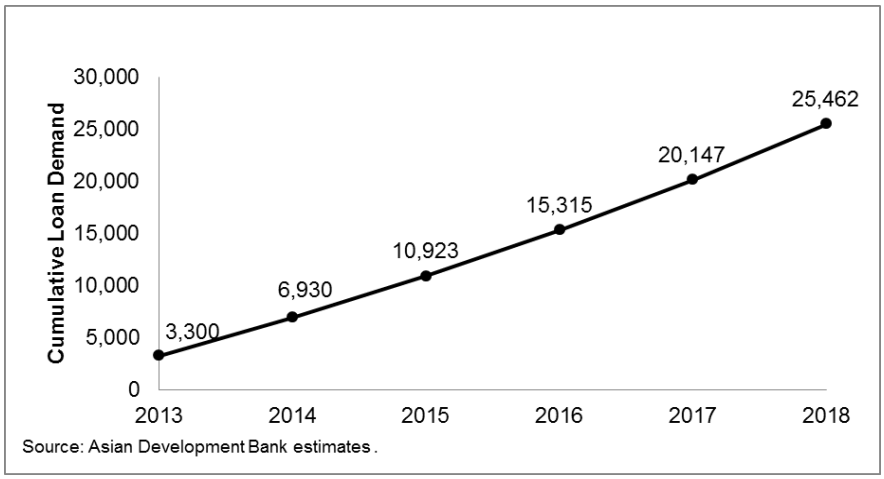
5. Achieving demand-side energy efficiency is the simplest way to improve the country's winter energy situation. Improving the energy efficiency of households in low-income and rural areas can bring significant warmth and comfort to people living there while also reducing the strain on the country's overextended power system. The lack of access to finance is one of the biggest barriers to improving household energy efficiency; MFIs, with their outreach and double bottom-line (social and financial) business models, are best suited to remove this barrier.

6. The microfinance sector in Tajikistan is well developed, with 125 licensed MFIs and two microfinance banks as of 31 March 2013. The sector provides affordable credit to a large segment of the population, with 142,059 borrowers at the end of 2012—a 49% increase from the end of 2009—and a total loan portfolio of $233 million. MFIs have a low average loan size ($1,440) and serve low income and vulnerable groups, including 5.6% of the population living below the poverty line. Seventeen percent of borrowers from deposit-taking MFIs live below the poverty line, and 20% are from vulnerable groups.[3]

## D. Demand Analysis

7. The Habitat for Humanity home improvement loan program with MFIs IMON and Arvand has seen a demand of 6,000 home improvement loans in 2 years. Assuming (i) that 3,000 of these loans were disbursed in 2012 and (ii) a conservative demand growth rate of 10% every year, it is estimated that there will be demand for at least 25,000 new loans for home improvement and energy efficiency during the project implementation period from 2013 to 2018 (Figure 1).

**Figure 1: Projected Demand for Home Improvement Loans**




[3] Erika Buerkle. 2010. *Access to Finance and Impact of Microloans.* Dushanbe.

## E. Project Economic Analysis

8. The economic analysis of this project has been carried out in accordance with ADB's *Guidelines for the Economic Analysis of Projects*.[4] The project will provide a grant of $10 million to the Government of Tajikistan, which in turn will create a credit line of $8.8 million to MFIs for on-lending to households for energy efficiency improvements in their homes. The remaining $1.2 million will be used for the project's administrative purposes. The project's economic benefit is derived from savings in household energy costs due to energy efficiency measures and also from lending activity of MFIs. However, this analysis has been conducted only on the benefits that arise from savings in household energy costs. The energy efficiency solutions that will be available for households to purchase, known as smart green energy solutions (SGES), will include solutions for (i) energy efficient heating and thermal insulation such as double-glazed windows, doors, roof and wall insulation, and solar water heaters; (ii) energy efficient cooking stoves; and (iii) energy efficient lighting such as solar home solutions and light-emitting diode (LED) lights.

## F. Valuation of Project Costs

9. Project costs computed at constant 2013 prices include capital costs for acquiring SGES and costs for operation and maintenance. The project has three main categories of SGES solutions: (1) energy efficient heating and thermal insulation solutions, (2) energy efficient cooking stoves, and (3) energy efficient lighting such as solar home solutions and light-emitting diode (LED) lights. The capital cost per household, excluding interest, is estimated at TJS5,700 for category 1 (cost of energy efficient windows, doors, thermal insulation, and solar water heaters bundled together), TJS1,000 for category 2, and TJS2,400 for category 3. Operation and maintenance costs for these solutions during their useful life (10 years from installation) have also been factored in.

10. Capital and operation and maintenance costs are adjusted to reflect the economic resource cost of project inputs in terms of the domestic price numéraire**.**[5] Costs are allocated into traded goods, non-traded goods, labor, and transfer payments (taxes and duties) and adjusted by the appropriate conversion factors for Tajikistan. Traded goods and services are multiplied by the shadow exchange rate factor of 1.02.[6] Labor costs are multiplied by the shadow wage rate factor of 0.8, which reflects unemployment in the country. Transfer payments and physical contingencies are excluded from the economic analysis.

## G. Valuation of Project Benefits

11. The data for estimating the economic benefits of the subprojects is based on the results of an ADB survey on household energy expenditure in rural areas in Tajikistan conducted in

[4] ADB. 1997. *Guidelines for the Economic Analysis of Projects*. Manila.

[5] For goods and services imported into a country, border prices (cost at the country's border) of these goods and services need to be adjusted to reflect their domestic prices within the country by using shadow exchange rate factor (footnote 6). These domestic prices are known as domestic price numéraire, which serve as base costs against which project benefits (which are also domestically generated) are compared.

[6] The shadow exchange rate factor was estimated using the formulae: Standard Conversion Factor (SCF) = (Total Trade)/(Total Trade + Net Taxes) and the shadow exchange rate factor = 1/SCF. ADB. 2004. *Technical Note 11, Shadow Exchange Rates for Project Economic Analysis: Toward Improving Practice at the Asian Development Bank*. Manila.

April–May 2012.[7] The benefits of SGES in terms of cost savings due to reduced energy consumption are estimated based on field trials and energy saving performance monitoring by the Warm Comfort program of GIZ in Tajikistan. Based on these data, it is estimated that annual household cost savings will average TJS538 for category 1 SGES solutions (for heating and insulation), TJS713 for category 2 SGES (for cooking), and TJS199 for category 3 SGES (for lighting). These estimated benefits have been converted to economic prices.

## H. Results of Economic Cost-Benefit Analysis

12. The costs and benefits associated with the 3 components are aggregated to determine the economic internal rate of return (EIRR) of the project. It is conservatively estimated that microloans will be extended to 4,500 households in Tajikistan for the purchase and installation of SGES under this project. Households will have the choice of purchasing only those SGES solutions that they need, and they will also have the choice of selecting a solution provider. These households can also borrow the total amount in a single loan cycle or in 2 to 3 loan cycles. It is assumed that each of these installed solutions will generate tangible economic and environmental benefits for 10 years, which means that SGES solutions installed for example in 2014 would generate tangible benefits until 2023, while SGES solutions installed in 2018 would generate benefits until 2027. Thus, the economic and environmental benefits under this project are estimated for a total of 15 years (2013 to 2027).

13. The costs and benefits from each of these units are aggregated and the resulting EIRR is computed as shown in Table 1. The project's EIRR is estimated to be 16%. The project's economic net present value is calculated as TJS2.94 million.

14. The project also creates environmental benefits by reducing carbon dioxide ($CO_2$) emissions; these benefits have not been captured in the economic cost-benefit analysis. Without the installation of SGES for energy efficiency improvements under this project, households would continue to consume energy inefficiently from fossil fuels such as kerosene, wood, coal, manure, gas, diesel, and gasoline.[8]

15. The project also creates social benefits that are not captured in the economic cost-benefit analysis. Heating and insulation solutions make people's homes warm and comfortable and provide better living conditions in winter months. Energy efficient cooking stoves reduce indoor air pollution, thereby improving people's health. Solar and lighting solutions provide better illumination, longer study hours for children, and less smoke and fire hazards.

## I. Sensitivity Analysis

16. A sensitivity analysis of the project's EIRR was undertaken with respect to key assumptions. As shown in Table 2, (i) a 10% increase in investment cost would decrease the EIRR by 3%, (ii) a 10% decrease in benefits would decrease the EIRR by 4%, and (iii) including the estimated value of the environmental benefit using current spot carbon (Certified Emission Reduction) prices would increase the EIRR by 1%.

[7] Five hundred sixty households in on-grid and off-grid areas spread across 15 districts of Tajikistan were surveyed. The households' annual expenditures for fuel (kerosene, diesel, gasoline, propane, wood, coal, manure, and candles) for lighting, home energy efficiency, and cooking needs averaged $200.

[8] Using average carbon emissions reductions for similar SGES solutions in other developing countries with similar rural energy consumption patterns (using $CO_2$ emission reduction data from similar projects that have been registered under the United Nations Framework Convention on Climate Change [UNFCCC]), an estimated total of 142,211 tons of $CO_2$ emissions would be avoided over 15 years.

## Table 1: Economic Cost-Benefit Analysis

| Year | Capital Cost - Heating & Thermal Insulation | O&M Cost - Heating & Thermal Insulation | Capital Cost - Cooking | O&M Cost - Cooking | Capital Cost - Solar & Lighting | O&M Cost - Solar & Lighting | Total Costs | Benefits - Heating & Thermal Insulation | Benefits - Cooking | Benefits - Lighting | Total Benefits | Overall Project Net Benefit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TJS | | TJS | | TJS | | TJS | TJS | TJS | TJS | TJS | TJS |
| 2013 | 1,095,255 | 0 | 192,150 | 0 | 461,160 | 0 | 1,748,565 | 120,687 | 159,944 | 44,641 | 325,271 | -1,423,294 |
| 2014 | 4,381,020 | 6,732 | 768,600 | 3,366 | 1,844,640 | 0 | 7,004,358 | 603,434 | 799,719 | 223,203 | 1,626,356 | -5,378,002 |
| 2015 | 5,476,275 | 33,660 | 960,750 | 16,830 | 2,305,800 | 0 | 8,793,315 | 1,206,869 | 1,599,437 | 446,407 | 3,252,713 | -5,540,603 |
| 2016 | 5,476,275 | 67,320 | 960,750 | 33,660 | 2,305,800 | 25,245 | 8,869,050 | 1,810,303 | 2,399,156 | 669,610 | 4,879,069 | -3,989,981 |
| 2017 | 4,381,020 | 100,980 | 768,600 | 50,490 | 1,844,640 | 100,980 | 7,246,710 | 2,293,050 | 3,038,931 | 848,173 | 6,180,154 | -1,066,556 |
| 2018 | 1,095,255 | 127,908 | 192,150 | 63,954 | 461,160 | 126,225 | 2,066,652 | 2,413,737 | 3,198,875 | 892,814 | 6,505,425 | 4,438,773 |
| 2019 | 0 | 134,640 | 0 | 67,320 | 0 | 151,470 | 353,430 | 2,413,737 | 3,198,875 | 892,814 | 6,505,425 | 6,151,995 |
| 2020 | 0 | 134,640 | 0 | 67,320 | 0 | 201,960 | 403,920 | 2,413,737 | 3,198,875 | 892,814 | 6,505,425 | 6,101,505 |
| 2021 | 0 | 134,640 | 0 | 67,320 | 0 | 151,470 | 353,430 | 2,413,737 | 3,198,875 | 892,814 | 6,505,425 | 6,151,995 |
| 2022 | 0 | 134,640 | 0 | 67,320 | 0 | 151,470 | 353,430 | 2,413,737 | 3,198,875 | 892,814 | 6,505,425 | 6,151,995 |
| 2023 | 0 | 127,908 | 0 | 63,954 | 0 | 201,960 | 393,822 | 2,293,050 | 3,038,931 | 848,173 | 6,180,154 | 5,786,332 |
| 2024 | 0 | 100,980 | 0 | 50,490 | 0 | 151,470 | 302,940 | 1,810,303 | 2,399,156 | 669,610 | 4,879,069 | 4,576,129 |
| 2025 | 0 | 67,320 | 0 | 33,660 | 0 | 126,225 | 227,205 | 1,206,869 | 1,599,437 | 446,407 | 3,252,713 | 3,025,508 |
| 2026 | 0 | 33,660 | 0 | 16,830 | 0 | 100,980 | 151,470 | 603,434 | 799,719 | 223,203 | 1,626,356 | 1,474,886 |
| 2027 | 0 | 6,732 | 0 | 3,366 | 0 | 25,245 | 35,343 | 120,687 | 159,944 | 44,641 | 325,271 | 289,928 |
| | | | | | | | | | | | ENPV | 2,938,656 |
| | | | | | | | | | | | EIRR | 16% |

TJS = Tajik somoni, O&M = operation and maintenance, ENPV = economic net present value, EIRR = economic internal rate of return.
Source: Asian Development Bank estimates.

## Table 2: Sensitivity Analysis

| Sensitivity Analysis | EIRR |
|---|---|
| Base EIRR | 16% |
| (i) 10% increase in investment cost | 13% |
| (ii) 10% decrease in benefits | 12% |
| (iii) Base + Carbon Benefits | 17% |

Source: Asian Development Bank estimates.