EXECUTIVE SUMMARY

BASELINE SURVEY ON ESTIMATING SOCIOECONOMIC BENEFITS OF RENEWABLE ENERGY TECHNOLOGY (RET) SYSTEMS IN BANGLADESH

Study Team: Monzur Hossain (Team Leader), Mohammad Yunus, Nazneen Ahmed and Siban Sahana

The purpose of this study is to carry out baseline surveys on socio-economic benefits of each of the four Renewable Energy Technology (RET) systems of interest, namely- solar mini-grid, solar irrigation pump, Improved Cooking Stoves (ICS) and biogas plant to facilitate the estimate of socioeconomic benefits of the interventions. All the potential users (e.g. households and enterprises in case of solar mini-grid electricity), will be interviewed and information will be collected to make comparisons between treatment and control groups. Separate surveys were conducted for each of the 4 RETs of interest: **mini-grid, solar irrigation pump, ICS and biogas plants**. In addition, community surveys on all the 4 RETs will complement aspects that are not covered by household surveys.

Part-I: Findings from Mini-Grid Survey

The baseline survey included the survey of 3500 households (2000 in treatment and 1500 in control groups), 1246 enterprises and 91 communities (villages). In addition to socio-economic characteristics of the households, information was elaborately collected on women empowerment, energy consumption and demand pattern, willingness to connect to solar mini-grid electricity etc. For enterprises, information on various economic and financial indicators was collected.

The validity of the impact evaluation rests on the similarity of the sampled treatment and control households and enterprises prior to the start of solar mini-grid interventions. The underlying assumption is that households in control villages are, on average, similar to those in treatment villages before intervention. This then allows us to compare the two groups after the treatment to impute the effect of intervention of solar mini-grid (the treatment effect) – the logic being that the two groups would continue to be the same, on average, in the absence of any intervention. Thus, any observed difference in the post-treatment can be attributed to it.

The results present a comparison of average of households' characteristics of treatment and control villages and tests whether they are statistically the same. The statistical test used is a t-test on sample averages and a proportion test (Z test) on proportions. A statistically insignificant difference between the main characteristics across treatment and control households provides evidence that the chosen control group is similar to the treatment group and thus can serve as a valid counterfactual for the impact evaluation.

Solar mini-grid electricity may generate various benefits to the households. Some of the key findings are discussed below.

Mini-Grid Electricity vs. Solar Home Systems

Availability of electricity from solar mini-grid immediately replaces polluting kerosene lamps that provide the dimmest of lighting and/or poor substitute of solar lights by high-quality lights. Better lighting has the immediate effect of extending the waking and working hours of family members, allowing for school-going children and adults alike to study and read in the evenings. These expectations are manifested in about two-thirds to three quarters of respondent households both in the treatment and control areas. Besides, more than one third of respondent households expects that the availability of lighting through solar mini-grid will open their windows of information and news and one quarter believe that the service will be well within their affordable limits. There is also expectation about greater sense of security at nighttime, allowing for greater social interaction.

About 70% of the households and enterprises both in treatment and control areas use solar home systems (SHS). That there is prospective market for solar mini-grid is manifested in the current users' dissatisfaction with the SHS installed in their houses. About 7-8% of the respondents complained that the quality of backstopping services of the SHS providers is not satisfactory, less than 5% complained that even the promised backstopping services are not easily available, about 2-3% complained that the costs of repair and maintenance of the SHS they own is very high. In most of the cases, there are hardly any significant statistical differences between respondent households in the treatment and control areas. Considering the dissatisfaction of smaller proportion of SHS users, it is highly likely that both SHS and mini-Grid electricity will be simultaneously used. Mini-Grid may not be a perfectly substitute of SHS, rather it may play a complementary role. This issue will warrant special attention while assessing the impact of solar mini-Grid electricity. The evaluation will have to isolate the impact of SHS carefully from the one of Mini-grid for the households/enterprises that are using both sources of electricity.

Energy Usage and Demand Pattern

Households depend on firewood to meet most of their daily energy requirements. Treatment households use about 98 kg of firewood per month compared with 93 kg in the case of control

households. The second important source is animal wastes, especially cow dung; both the treatment and control households use more than 50 kg of this biomass. It appears that almost the whole amount of biomass of any type is used for cooking. About 100% of the firewood is used for cooking both in the treatment and control households. It was found that members of the treatment households collect firewood 0.83 times a week compared to 0.73 times by members of the control households (that is, 3 times a month). It was found that treatment households spend about 5.73 hours in firewood foraging compared to 4.12 hours in the case of control households and the difference is statistically significant. The same observation holds for twigs and leaves.

Apart from biomass energy households also use non-biomass energy. Among various types of non-biomass energy, kerosene dominates in consumption. It was found that treatment households consume 0.79 liters of kerosene per month compared to 0.73 liters for control households. Besides, kerosene both the treatment and control households consume other fossil fuels such as petroleum, diesel, and LPG gas cylinder to the tune of 0.1-0.2 liters. Kerosene is by and largely used for lighting (82%) with a small portion for cooking (17%). Similar observation can be made about other fossil fuels such as petroleum, diesel, and LPG. In contrast, SHS is mostly used for lighting (78%) with another 22% for running electrical and electronic appliances.

The cooking system in both the treatment and control households is dominated by traditional biomass stove. It was found that households own about 2 cooking stoves, which are utilized for about 4 hours. Besides, a few households own and utilize traditional kerosene stove along with the biomass stoves.

Almost all of these energy products are procured from the market. Treatment households spend Tk. 59 per month compared to Tk.53 per month by control households. The difference is statistically significant. The difference mirrors in the case of SHS, where treatment households spend Tk.44 compared to Tk.47 by the control households. However, the difference in this case is not statistically significant. Besides these two types, households also spend small amounts on diesel, petroleum, and LPG cylinder, etc. Apart from the last one, the differences are not statistically significant. In aggregate, treatment households spend about Tk. 147 per month compared to Tk.122 by control households. The ensuing difference of Tk.24 between the two groups of households is statistically significant.

It is expected that solar mini-grid electricity might have strong impact on the current energy usage and demand pattern of the households and enterprises.

Willingness to Connect to Solar Mini-Grid Electricity:

The willingness to connect to solar mini-grid depends on several factors such as affordability, satisfaction levels with the current system and the anticipation of improved living conditions through increased income earning opportunities as well as facilitated means of access to information and news. Majority of the households (92-93%)and enterprises (93-96%) from both

treatment and control groups are keen to accept mini-grid services based on the availability, with the portion for enterprises being statistically significant. About three-fourth of the households and enterprises anticipate better lighting from mini-grid services for both treatment and control groups. It was found that about two-third of the households hold better opportunity for children's education and quality of living to be integral incentives for adopting the solar mini-grid, whereas enterprises were found to be more willing to accept mini-grid services for increased income generation opportunities. About 36-40% of the households were seen to be more willing to accept mini-grid services to facilitate access to information and news which was greater than that of enterprises which was found to be a meager 8-9%. Regarding affordability, one-fourth of both household and enterprises believe the mini- grid electricity will be within their affording limit, for both treatment and control groups.

It is also likely that solar mini-grid electricity might have impact on household income and expenditures, asset holdings, education outcome, women empowerment etc. on which baseline data are provided in this study.

Part-II: Survey Findings on Solar Irrigation Pump

The baseline survey was done in order to facilitate the impact evaluation on various socio-economic benefits generated by the adoption of the solar irrigation pumps to be provided by IDCOL nominated POs in some selected areas. The baseline survey included the survey of 2000 households (1200 in treatment and 800 in control groups), 111 pump owners (65 in treatment and 46 in control groups) and 36 communities (villages). In addition to socio-economic characteristics of the households, information was elaborately collected on agricultural loans and asset holdings as well as the outcomes of irrigation. For pump owners, information regarding diesel run pumps (age, capacity, amount of diesel used per day), amount of carbon dioxide emitted per litre of diesel utilised per day, as well as the costs and returns for the pumps were also estimated. Solar irrigation pumps may produce various benefits to the households. Some of the key findings are highlighted below.

Crop and Irrigation

Farmers in the treatment villages on average cultivate 2.8 plots during the Aus season, which increases to 2.99 during the Aman season and to further 3.4 during the Boro season. Farmers in the control villages cultivate slightly lower number of plots compared to treatment villages. The average size of the cultivated land hovers around one acre during the three seasons. In terms of productivity, while there is no difference between the treatment and control groups of farmers, per acre yield is about 40% higher during the Boro season compared with that during Aus or Aman seasons.

Total cost per acre varies in the range of Tk. 27-30 thousand for production of Aman between treatment and control farm households. The costs per acre increase to about Tk. 38 thousand for production of Boro and further to Tk.48-50 thousand for production of Aus. It may be noted that labor costs accounts for more than 50% of total costs during Aus and Aman seasons. However the share reduces to 38% during the Boro season. Irrigation costs range 6-7% of total costs during the Aus season, which increases marginally to 10-11% during the Aman season, but jumps to 19-21% during the Boro season.

Gross returns per acre vary in the range of Tk. 88-99 thousand for production of Aus between treatment and control farm households. The gross returns per acre falls to about Tk. 41-46 thousand for production of Aman but rise to Tk.53-55 thousand for production of Boro. It may be noted that main product accounts for about 95% of gross returns. Given the ranges of total costs mentioned before, the corresponding net returns ranges between Tk. 43-55 thousand during the Aus season, falls to Tk. 15-23 thousand during the Aman season, and to Tk. 18-20 thousand during the Boro season.

Almost all of the areas cultivated have access to facilities either from ground or surface water irrigation. Both the treatment and control farmers availed the irrigation facilities whenever it is available except for the Aman season. The dominant mode of irrigation is diesel driven pumps which covers more than 90% of the irrigated areas across the three seasons. While farmers spend about 6-8 days in irrigating crops during Aus and Aman seasons, the frequency increases to 22 days during the Boro season. Almost all of those farmers who used irrigation water reported to have received it in adequate amount. Half of the farmers in the treatment group and about one third in the control group owns irrigation pumps.

Findings from Pump Owners on Irrigation

All pump owners were males with 78.31% owning one pump in the treatment areas and 73.02% in control areas. None of them owned more than 4 pumps. Irrigation business was reported to not be the pump owner's main source of income, with only 9.64% and 6.35% of the respondents in treatment and control areas reporting irrigation to be their main source of income.

Pumps owned by the respondents were found to be 0 to 15 years old. In terms of capacity, the pumps were categorized into four groups: 1-5 Horse Power (HP), 6-10 HP, 11-15 HP and 15+ HP. Depending on the pump life and the capacity of the pumps, average quantity of land that could be irrigated in one season, was estimated to vary from 93 decimals to 770 decimals in treatment areas and 76.67 decimals to 620.56 decimals in control areas. Pumps with similar HP may differ in terms of their output (average quantity of irrigated land per season) depending on age of the pump. The performance is not systematic. Thus, the output appears to depend much on how the pumps are used by their owners. Depending on the capacity of pumps, the average number of irrigation days in a season varies between 9 to 48.75 days in treatment areas and 10.20 to 46.67 days in control areas. It is noted that for both treatment and control areas the

pumps having a capacity of 11-15 HP have high irrigation days, though a clear conclusion (regarding the relation between HP of pumps and irrigation days) cannot be drawn.

Carbon Dioxide Emissions Due to Diesel Consumption

The carbon dioxide emissions from the irrigation pumps were assessed from the amount of diesel utilised per day using standard conversion rates. It is estimated one litre of diesel fuel burnt to release 2.68 kilograms of carbon dioxide into the atmosphere. Pumps with higher capacity consume relatively higher amount of diesel and therefore emit higher amount of carbon dioxide. Also pumps with similar capacity but older aged consume more diesel than younger aged pumps.

It has been estimated that diesel pumps produce from lowest 13 kg to highest 53 kg of carbon dioxide per day of irrigation activity. It is expected that if diesel pumps are replaced by environment friendly solar irrigation pumps, carbon dioxide (CO_2) emissions would decrease significantly.

Irrigation Costs and Returns

The implementation of solar irrigation pumps instead of diesel pumps can contribute towards minimising irrigation costs. From the reported data of the baseline survey, the findings depicted that out of total costs for running shallow tube wells (that are comprised of labour and diesel purchase), diesel cost was estimated to be about 66% which is much higher than labour costs for both treatment and control areas. While the labour and diesel costs have an equal share (around 45% each) in total costs of running deep shallow tubewell per season in the treatment areas, in control areas the diesel cost have a higher share (57.66%) than the share of labour cost (30.73%). It is noted that cost and income, both are higher for shallow tubewell than those in deep shallow tubewell in both areas. From the findings, it can be inferred that the replacement of diesel pumps with solar pumps will lead to a drastic decline in pump running costs for both shallow tube wells and deep shallow tube wells. The rate of return (profit as % of total income) was reportedly higher for deep shallow tube wells. In both areas, the rate of return is higher for irrigation with deep shallow tube wells than that of shallow tube wells.

Village Characteristics

Regarding available irrigation facilities of the villages, more than 95% of the arable lands in both categories of villages were found to be under irrigation facilities with a statistically insignificant difference. Almost 64% of the pumps in the treatment villages and 59% pumps of the control villages are run by diesel (however, household survey revealed higher percentage). The survey also found that, both in terms of cost per hour or cost of irrigating per decimal of land per season, the cost of irrigation water was higher for control villages. However, these differences were not statistically different from zero.

From the above analysis it can be seen that for almost all of the indicators concerned, the treatment and control villages are at a comparable level. Though different villages have a different number or percentage of amenities or they vary across other features considered in the survey but on average the differences are not significant. The baseline indicators are expected to provide a good basis for follow up study later on solar irrigation pump intervention.

PART-III: Survey Findings on Improved Cooking Stoves

The baseline survey of 3000 households (2000 in treatment and 1000 in control groups) was conducted in 128 communities (villages). In addition to socio-economic characteristics of the households, information was elaborately collected on women empowerment, kitchen characteristics, willingness to purchase the improved cooking stove etc.

The validity of the impact evaluation rests on the similarity of the sampled treatment and control households and enterprises prior to the start of improved cooking stove interventions. The underlying assumption is that households in control villages are, on average, similar to those in treatment villages before intervention. This then allows us to compare the two groups after the treatment to impute the effect of intervention of improved cooking stove (the treatment effect) – the logic being that the two groups would continue to be the same, on average, in the absence of any intervention. Thus, any observed difference in the post-treatment can be attributed to it.

The results present a comparison of average of households' characteristics of treatment and control villages and tests whether they are statistically the same. The statistical test used is a t-test on sample averages and a proportion test (Z test) on proportions. A statistically insignificant difference between the main characteristics across treatment and control households provides evidence that the chosen control group is similar to the treatment group and thus can serve as a valid counterfactual for the impact evaluation. The implementation of the domestic biogas plant may generate various benefits to the households. Some of the key findings are discussed below.

Kitchen Characteristics

Improved cooking stoves (ICS) that burn firewood and biomass fuels, reduces concentration of suspended particulate matter during the active burning period as well as during the smouldering phase. ICS also offers reductions in indoor air pollution compared to the traditional stove. Further, a marked reduction in emission concentration can be achieved as a result of transition from biomass fuels such as firewood to fossil fuels such as charcoal and natural gas.

It is established that the total emissions per unit of delivered energy were substantially greater from burning the solid fuels than from burning the liquid or gaseous fuels, due to lower thermal and combustion efficiencies for solid-fuel/stove combinations. The level and extent of pollution also depends on the location, area, ventilation of the kitchen, as well as the kind of stoves used and the types of fuel burned.

It may be noted that more than three fifths of the treatment and control households have a separate room of the main house as their cooking area with no significant differences. The cooking areas for the treatment and control households were found to be 56 and 72 square feet respectively. Maximum of the respondents in both treatment and control households used CI for constructing the walls (15-16%) and roofs (52-54%) of the kitchen. More than one fourth of the respondents in the control households had a significantly higher access to a ventilation route in the cooking area (such as a chimney or a gap) in comparison to treatment households. Almost all of the respondents in both treatment and control areas use a self-built, traditional mud stove (3 or 5 stone) with the portion of time spent making stoves being significantly greater in the control households (301 minutes) in comparison to the treatment households (240 minutes). Despite most of the respondents in both treatment and control households possessing a main stove, only a meagre 2-5 per cent of the households had a chimney for the stove with significant differences. The control households were reported to use about 90 per cent of their total fuel for the stoves, which was significantly greater than the treatment household's usage at 87 per cent. The greatest exposure and hence, the most risk prone towards catching smoke related illnesses is usually by the main cook, which was seen to be for almost all of the respondents in both treatment and control households. The total exposure to stoves by household members was seen to be significantly higher in the control households at 228 minutes in comparison to the treatment households at 221 minutes, with the maximum amount of time spent during times of lunch.

Smoke related health issues

Indoor air pollution from kitchens poses a significant health problem to a large section of the rural population. Higher health risks are attributed to two factors: higher pollutant concentrations in cooking spaces, and longer times spent indoors. It is usually claimed by different quarters that indoor air pollution from solid fuel use in Bangladesh is responsible for a large number of premature deaths annually. More than half of the respondents in both treatment and control households reported to be ill in the last one month, with the dominant categories of health issues being respiratory (coughing and breathing problems), eye irritation and chest pains. About 44-46 per cent for both households took treatment/medical advice for their health issues and the total monthly cost for treatment is higher in the control group at Tk. 1035.19 than the treatment group at Tk. 632.29, with the difference being significant.. Further impact evaluation can be conducted on the selected areas to reduce these smoke-related health issues.

Women Empowerment

The ICS are expected to reduce cooking time (including collection of fire wood). If such an improvement on time use is achieved by the introduction of ICS, then that will extend positive impacts on overall time use of women as women still are responsible for cooking and most of the household works. Moreover it is expected that installing ICS in a household may extend positive impact on various indicators of women empowerment as result of improvement of women's life because of reduction of cooking time and availability of more time for other things including time for visiting relatives, going for shopping etc.

Majority of the women were seen to possess land and jewellery, with women in the treatment households having a significantly larger portion than the control households. Regarding the women's freedom in mobility, decision making in household social and economic affairs as well as personal autonomy, almost all the treatment and control households showed joint decision making.

An estimated more than one tenth of the women in the treatment and control households could visit their parental homes; go shopping, go to the banks as well as go outside the village (within the city); on their own. More than one tenth of the respondents in both households can purchase household and personal items (clothes, jewellery etc.) as well as children's clothing and food items on their own. Most of the differences were found to be significant. It is to be noted that regarding voting for the elections, almost half of the women in both treatment and control households could take decisions on their own. More than four fifths of the women in both

households believe that both genders must have equal opportunities in all affairs, that a women's income increases the respect earned from her family and community as well as makes her hopeful about the future. Regarding the clear division of chores between men and women as well as the belief that a woman's income would lead to a control of her life, more than half of the women for both households believed so. About 31-33% of the women were seen to engage in some form of IGA in the respective treatment and control households, where almost all of them were involved in IGAs at home. More than three fifths of the women in the respective treatment and control households were engaged in poultry rearing. The years engaged in work by both treatment and control households was estimated at about 8-8.5 years with significant differences. The monthly net earnings from engaging in various IGAs were estimated at Tk. 712 and Tk. 393 for the respective treatment and control households with significant differences.

Willingness to purchase

A total of three packages were offered that ranged from Tk. 300-500 (Package 1) being the cheapest to Tk. 1800-2400 (Package3) having the highest selling price.

It may be noted that the willingness to buy at cash payment hovered around 36% and 9% in the treatment households across the packages compared with 34% and 10% in the control households. The results are worse in the case of willingness to buy at installments. While willingness to buy at installments hovered around 2% and 25% in the treatment households, it dropped down to 0% and 13% in the control households. Except for cash payment of Package-2 and installment payment of Packages-2 and 3, the differences are not statistically significant.

More than half (56%) of the treatment households who are not willing to buy, reported that they cannot afford to buy the plant at the offered price. The same opinion was expressed by 39% of control households. While only 4% of the treatment households are satisfied with their current cooking arrangements, it increases to one quarter in the case of control households. Roughly, similar shares of treatment and control households do not see any benefit of switching from traditional stoves to ICS. As the potential consumers are quite price sensitive, the POs would need to rethink about their planned pricing mechanisms of different packages.

PART-IV: Findings on Biogas Plant

The baseline survey was done in order to facilitate the impact evaluation on the socio-economic benefits generated by the domestic bio-gas plant to be provided by IDCOL nominated POs in some selected areas.

The baseline survey of 1500 households (1000 in treatment and 500 in control groups) was conducted in 61 communities (villages). In addition to socio-economic characteristics of the households, information was elaborately collected on women empowerment, kitchen characteristics, willingness to purchase the domestic biogas plant etc.

The results present a comparison of average of households' characteristics of treatment and control villages and tests whether they are statistically the same. The statistical test used is a t-test on sample averages and a proportion test (Z test) on proportions. A statistically insignificant difference between the main characteristics across treatment and control households provides evidence that the chosen control group is similar to the treatment group and thus can serve as a valid counterfactual for the impact evaluation. The implementation of the domestic biogas plant may generate various benefits to the households. Some of the key findings are discussed below.

Kitchen Characteristics

Nearly all of Bangladesh's rural residents and a shrinking fraction of urban residents use solid fuels (biomass and coal) for household cooking. It is established that the total emissions per unit of delivered energy were substantially greater from burning the solid fuels than from burning the liquid or gaseous fuels, due to lower thermal and combustion efficiencies for solid-fuel/stove combinations. The level and extent of pollution also depends on the location, area, ventilation of the kitchen, as well as the kind of stoves used and the types of fuel burned.

It may be noted that more than three fourths of the treatment households have a separate cooking area which is fully enclosed by walls and roof which is significantly greater in comparison to the half of the control households. With significant differences, the area for the respective treatment and control households were found to be 77 and 84 square feet. Maximum of the respondents in both treatment and control households used CI for constructing the walls (18-22%) and roofs (50-58%) of the kitchen. About half of the respondents in the control households had a significantly higher access to a ventilation route in the cooking area (such as a chimney or a gap) in comparison to the estimated one-fifths in the treatment households. Almost all of the respondents in both treatment and control areas use a self-built, traditional mud

stove (3 or 5 stone) with the portion of time spent making stoves being significantly greater in the treatment households (218 minutes) in comparison to the control households (300 minutes).

Despite most of the respondents in both treatment and control households possessing a main stove, only a meagre 4-8 per cent of the households had a chimney for the stove with significant differences. The control households were reported to use more than four fifths of their total fuel for the stoves, which was significantly greater than the treatment household's usage. The greatest exposure and hence, the most risk prone towards catching smoke related illnesses is usually by the main cook, which was seen to be for almost all of the respondents in both treatment and control households. The total exposure to stoves by household members was seen to be significantly higher in the treatment households at 264 minutes in comparison to the control households at 235 minutes, with the maximum amount of time spent during times of breakfast.

Smoke related health issues

Indoor air pollution from kitchens poses a significant health problem to a large section of the rural population. Higher health risks are attributed to two factors: higher pollutant concentrations in cooking spaces, and longer times spent indoors. It is usually claimed by different quarters that indoor air pollution from solid fuel use in Bangladesh is responsible for a large number of premature deaths annually. About three fifths of the respondents in both treatment and control households reported to be ill in the last one month, with the dominant categories of health issues being respiratory (coughing and breathing problems), eye irritation and chest pains. About three fifths for both households took treatment/medical advice for their health issues which totally amounted to Tk. 623 and Tk.764 in the respective treatment and control households. Further impact evaluation can be conducted on the selected areas to assess if bio-gas plant could reduce these smoke-related health issues.

Women Empowerment

Since women are normally responsible for food preparation and cooking, they are also more prone to being affected by the intervention of the biogas plant. It is expected that installing a biogas plant in a household may entail a positive effect on various indicators of women empowerment. This happens due to the reduction of cooking time leading to the availability of extra time which can be utilized for other activities such as visiting relatives, going for shopping etc.

Majority of the women were seen to possess land and jewellery, with women in the treatment households having a significantly larger portion than the control households. Regarding the women's freedom in mobility, decision making in household social and economic affairs as well as personal autonomy, almost all of the women in treatment and control households take joint decisions. More than one fifth of the women in the treatment and control households could visit their parental homes; take decisions regarding her children's healthcare as well as purchase household and personal items (clothes, jewellery etc.) on their own. More than one tenth of the women in both the treatment and control households could go to banks/ microfinance branches and take decisions regarding their children's education. It is to be noted that regarding voting for the elections, about half of the women in both treatment and control households could take decisions on their own. More than four fifths of the women in both households believe that both genders must have equal opportunities in all affairs, that a women's income increases the respect earned from her family and community as well as makes her hopeful about the future. Regarding the clear division of chores between men and women as well as the belief that a woman's income would lead to a control of her life, a little less than half of the women for both households believed so. About 38-51% of the women were seen to engage in some form of IGA in the respective treatment and control households, where almost all of them were involved in IGAs at home. More than three fourths of the women in the respective treatment and control households were engaged in poultry rearing. The years engaged in work by both treatment and control households was estimated at about 8-9 years with significant differences. The monthly net earnings from engaging in various IGAs were estimated at Tk. 458 and Tk. 529 for the respective treatment and control households.

Willingness to purchase

A total of six packages were offered that ranged from Tk. 22,000 (Package 1) being the cheapest to Tk. 52,000 (Package 6) having the highest selling price.

It may be noted that willingness to buy at cash payments hovered around 4.3% and 7.8% in the treatment households across different packages compared with the 2.4% and 6% in the control households. The results are not better in the case of willingness to buy at instalments. While willingness to buy at an instalment hovered around 7.86% and 12.31% in the treatment households, it dropped down to 2.96% and 8.89% in the control households. Except for instalment payment of package-1 and cash payment of package-2 the differences are statistically significant.

About half of those who are not willing to buy reported that they cannot afford to buy the plant at the offered price. Another 46% of the treatment households and more than one third of the control households reported that they are satisfied with the current cooking arrangement. The difference is not significant in the first case, but it is significant in the second case. As the potential consumers are quite price sensitive, the POs would need to rethink about their planned pricing mechanisms of different packages.