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Options for reducing costs of diesel pump irrigation systems in the Eastern Indo-Gangetic Plains

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In many parts of South Asia, electricity for groundwater pumping has been directly or indirectly subsidised by governments to support intensification of agriculture. In contrast, farmers in large portions of the Eastern Indo-Gangetic Plains (EIGP) remain largely dependent on unsubsidised diesel or petrol power for irrigation pumping. Combined with a lack of comprehensive aquifer mapping, high energy costs of pumping limit the ability of farmers to utilise available groundwater resources. This increases exposure to farm production risks, in particular drought and precipitation variability.

To date, research to address these challenges has largely focused on efforts to enhance rural electrification or introduce renewable energy-based pumping systems that remain out of reach of many poor smallholders. However, there has been comparatively little focus on understanding opportunities to improve the cost-effectiveness and performance of the thousands of existing diesel-pump irrigation systems already in use in the EIGP. Here, we present findings from a recent survey of over 432 farmer households in the mid-western Terai region of Nepal – an important area of diesel-pump irrigation in the EIGP. Our survey provides information about key socio-economic, technological and behavioral aspects of diesel pump irrigation systems currently in operation, along with quantitative evidence about their impacts on agricultural productivity and profitability.

Survey results indicate that groundwater irrigation costs vary significantly between individual farmers. Farmers faced with higher costs of groundwater access irrigate their crops less frequently, which in turn results in lower crop yields and reduced overall farm profitability. Our data indicate that pumpset fuel efficiency may be a key driver of variability in irrigation costs, with large horsepower (>5 HP) Indian-made pumpsets appearing to have significantly higher fuel consumption rates (1.10 litre/hour and $18,000) and investments costs than alternative smaller horsepower (<5 HP) Chinese-made pumpsets (0.76 litre/hr and $30,000). Despite this, the majority of farmers continue to favour Indian pumpsets due to their higher reliability and well-established

supply chains. Variability in access costs is also related to differences in capacity of farmers to invest in their own pumping systems. Pumpset rental rates in the region increase irrigation costs by a factor of 3-4 relative to the cost of fuel alone. Furthermore, rental rates typically are structured on a per-hourly basis, further exacerbating access costs for farmers with low yielding wells or whose irrigation management practices are less efficient.

Our findings highlight that opportunities exist to reduce costs of groundwater use in existing diesel irrigation systems through improved access to more energy efficient pumping systems. This would have positive near-term impacts on agricultural productivity and rural livelihoods, in particular helping farmers to more effectively buffer crops against monsoonal variability. Such near-term improvements in diesel pump irrigation systems would also play an important role in supporting agriculture in the EIGP to transition to more sustainable and clean sources of energy for irrigation pumping. However, efforts to enhance irrigation access must also occur alongside improvements to aquifer monitoring and governance of extraction, in order to minimise risks of future depletion such as observed in other parts of the IGP.