USAID | INDIA
FROM THE AMERICAN PEOPLE

Financing Agriculture Demand Side Management (Ag DSM) Projects

February 25, 2008

This document was produced by PA Government Services Inc. for review by the United States Agency for International Development.

USAID India

Financing Agriculture Demand Side Management (Ag DSM) Projects

February 25, 2008

Company Confidential

© PA Knowledge Limited 2008

Prepared for: United States Agency for International Development (USAID)

Prepared by: WENEXA II

PA Consulting Group
A-6, The Qutab Hotel & Apartments
Shaheed Jeet Singh Marg
New Delhi -110 016
Tel: +91 11 416 88773
Fax: +91 11 416 89087
www.paconsulting.com

Version: 1.0

FOREWORD

This report was produced in partial satisfaction of the deliverables under USAID / India's Water Energy Nexus Activity, Phase II (WENEXA II) project managed by its contractor, PA Government Services, Inc.

This report should be read in parallel with the *Ag DSM Concept Note* produced by the WENEXA II project. That document outlines the dimensions of the water-energy problem as it relates to agriculture and provides the conceptual underpinnings for this report. The report can be obtained on the WENEXA II website at www.waterenergynexus.org or via the DRUM Project website at www.drumindia.org.

Throughout this report we use the term Discom to refer to the electricity provider. Although the term Discom refers to the functionally unbundled distribution part of the erstwhile (bundled) State Electricity Boards (SEBs), its use in this report also refers to those utilities still operating as SEBs.

TABLE OF CONTENTS

Foreword i

Introduction 1

1. Executive Summary 1-1

2. Report Background & Objectives 2-1
- 2.1 Report Objectives 2-1
- 2.2 Implementing Ag DSM: The Case for State Governments 2-2
- 2.3 Ag DSM Project Implementation: Key Conclusions 2-4

3. Finance & Business Model Design 3-6
- 3.1 Principles, Components and Key Issues to Address 3-6
- 3.2 Key Issues in Ag DSM Project Design 3-7
- 3.3 Innovative Hybrid Solutions are Possible 3-8

4. Ag DSM Project Financing & Business Models 4-1
- 4.1 Categorizing the Financing Options 4-1
- 4.2 Model 1: Discom as Borrower 4-2
- 4.3 Model 2: ESCO as Borrower 4-7
- 4.4 Model 3: Farmer as Borrower 4-15
- 4.5 Model 4: Industrial Firm as Borrower 4-17
- 4.6 Project Risks & Risk Management 4-19
- 4.7 Summary Evaluation of the Model 1 v. Model 2 4-22

5. Project Economics & Financial Model 5-1
- 5.1 Project Scope and Capital Costs 5-1
- 5.2 Operating costs 5-3
- 5.3 Power Costs of Service Savings Calculation 5-4
- 5.4 Project Financing Plan 5-6
- 5.5 Project Cashflow and Summary Benefits 5-7
- 5.6 Carbon Values 5-9
- 5.7 ESCO as Borrower Option 5-10

6. Major Conclusions & Recommendations 6-1
- 6.1 Major Conclusions 6-1
- 6.2 Recommendations 6-2

Appendices

APPENDIX A: Sample project finance model A-1

APPENDIX B: Checklist Guide For States B-1

APPENDIX C: Info Guide C-1

APPENDIX D: DPR Outline D-1

INTRODUCTION

Today, 50% of fresh water and 35% of electricity share one thing in common — the pumping of groundwater to irrigate crops. India is now facing an historic crisis involving these two essential resources and there is an increasing awareness that decisive action must be taken soon to avert a future calamity.

The successful effort to provide water for India's Green Revolution created a dilemma. On one hand, free power enabled farmers to pump the irrigation water needed to produce the increasing agricultural output needed by India's growing population; groundwater provided a steady source of supply even when monsoons failed. On the other hand, free power is a prime cause of the profligate use of water and energy resources.

The technology and know-how to avert a crisis already exist but the motivation to implement a workable and cost-effective solution has been elusive. Low-cost power to the agricultural sector is entrenched as a public good and imbued with a sense of entitlement. Some now believe it will take a calamity to empower government to implement the unpopular and possibly harsh measures that may be required.

The apparently simple remedy is a separate mechanism to deliver subsidies that would ensure farmers receive the economic value provided by the current regime of discounted electricity tariffs. Theoretically, that would enable the introduction of cost-based tariffs to let market forces regulate electricity consumption. But this approach, while conceptually appealing, would require a heroic gesture on the part of politicians and policy makers.

The booming economy for professionals, managers and the middle class makes it extraordinarily difficult to ask farmers to bear the brunt of agricultural reform. Any idea that can be attacked as a stalking horse for the elimination of any agricultural support can be used to political advantage. Since the burden of proof for such allegations is very low, any approach involving metering is a non-starter.

But without measurement, there is no signal to indicate changing consumption trends and everyone — except perhaps the farmer himself — will be blind to the need for corrective action to a decline in the water table or some other operational factor.

Most administrative "second best" mechanisms involve complexity on a scale that may be very difficult to sustain. Private sector participation would involve significant commercial and financial risks that are daunting to all but the most intrepid.

Thus, the logical "left brain" recommendations seem to be limited to either the introduction of economic tariffs — anathema to farmers and politicians alike — or, alternatively, a stringent, possibly inflexible and potentially harsh regime of administrative load control.

WENEXA II has been searching for a workable "second best" administrative solution for over three years and we are acutely aware of the difficulties in developing a workable and sustainable solution. Nonetheless, we are "guardedly optimistic" to use the terminology of diplomacy. We believe that the key to a solution rests in

- Being realistic and candid about the problem
- Aligning the incentives among the parties, especially farmers
- Finding a solution that fits the Indian context

“The devil is in the details” is a common refrain when discussing economic models but, in this case, we believe it is more likely that deliverance will be found in the details. A close study of the models and financing mechanisms in this report will enable policy makers to decide whether the potential benefits of Ag DSM — in its broadest sense, including the holistic approach we consider essential — warrants an effort to tailor a solution for an individual state’s particular needs.

1. EXECUTIVE SUMMARY

This report presents the result of an in-depth study of the practical considerations involved in implementing Ag DSM projects, with an emphasis on creating "bankable" models. A bankable model in this context involves the creation of a business model that enables the financing of the substantial investment required with a high level of assurance that projected savings from the Ag DSM project will be achieved and sustained long enough to repay loans and provide an adequate incentive for the investor / operator to accept the risks of the undertaking. Without that, Ag DSM will not be able to deliver on its promise.

A capsule summary of the results of this study includes the following:

- Large agricultural water pumping power loads and inefficient distribution and pumping systems are squandering precious resources. Twenty five years ago, the agricultural load used 10% of electricity. Today, pumping consumes up to 40% of total electricity in some states. Meanwhile, groundwater — once considered an abundant resource — is increasingly stressed, with an ever increasing number of areas in danger of exhausting underground aquifers.

- Subsidized agricultural power tariffs provide an incentive for farmers to do the wrong thing. As noted by the Bureau of Energy Efficiency (BEE) in Developing a Demand Side Management (DSM) Roadmap for India, this "tragedy of commons" exists because farmers must pursue their individual self interest by using ever increasing amounts of a "free" common resource (i.e., power) to pump irrigation water from diminishing reservoirs as the water table continues to recede. Farmers are trapped in a vicious cycle that requires ever larger amounts of power from an increasingly strained electricity network to chase declining water tables.

- The financial losses of the electricity distribution sector have mushroomed, creating an unsustainable burden on state governments. Even though there have been some victories in improving the financial health of some utilities, overall results show insufficient improvement in the subsidy to the power sector, estimated at Rs. 40,000 crores (U.S. $10 billion) per year.

- The economics of Ag DSM are compelling. Electricity use at the pump level can be cut by 50% through the introduction of high-efficiency pumps. Critics point out (rightly) that these results have not been sustained in early pilot projects. While true, the statement is incomplete. The early failures do not mean that savings cannot be sustained. The lessons learned from pump efficiency pilots and implementation programs enable the design of business models that can work effectively on a sustained basis. The economic argument for Ag DSM would likely be even stronger if the long-term avoided cost of new generation was factored into the equation, and compelling if the social consequences of continued delay were factored into Ag DSM policies.

- A holistic approach will produce a higher probability of producing significant and sustainable savings in water and electricity. Some problems are easier to solve if they are segmented into their constituent parts and then attacking each one individually. For the water-energy nexus, the problems are linked and, thus, better

results can be achieved by finding a linked solution. For example, the introduction of drip irrigation, wherever it is appropriate, can lead to a step-function improvement in water efficiency while adding an additional 15% to electricity savings from the introduction of high-efficiency pumps.

- Farmers are central to a workable and sustainable solution. The implicit compact is between Government and farmers. Recognizing that and creating a model that provides a powerful incentive to invoke the correct behavior of farmers is much more likely to produce sustainable results.

- Investments in Ag DSM projects offer an important and timely opportunity to reduce total power consumption, improve the efficiency of ground water extraction and reduce the subsidy burden while improving service to farmers.

- Unlocking the potential of Ag DSM projects requires a bankable business model that creates benefits and incentives for all stakeholders, including State governments, utilities and farmers.

- The key to creating a viable financing mechanism is to link the project financing with the benefit stream created for the State government through reduction in the wholesale power that must be purchased by Discoms. That would allow the state subsidy to be redirected to pay for the Ag DSM program. Under optimal conditions, it would also enable a reduction in the state subsidy. At a minimum, it can promote the efficient use of two precious resources, help staunch the financial losses of the electricity distribution sector and prevent further depletion of aquifers.

- The implications of inaction are serious. Since today's crisis came into being in the past generation only, current trends may not be sustainable for more than another generation. A failure to provide sustainable water for agriculture would likely lead to crop failures and severe social impacts. Thus, inaction will allow the problem to become more serious.

- Four models (and one hybrid) are discussed in this report. Two models are ready for implementation now: the Discom as Borrower and the ESCO as Borrower models are 'good to go' with the least amount of additional study and with the fewer preliminaries than the other options. However, we would note that even these will require a considerable and concerted effort to operationalize.

  - The Farmer as Borrower model (and its hybrid, the Agricultural Collective Franchise, a variation on the Rural Power Franchise) would require a significant communication and education campaign addressed at farmers and, perhaps policy makers too, but it offers some unique advantages.

  - The Industrial Customer as Borrower model would require additional study, further refinement and, perhaps, the development of infrastructure to enable it. The Industrial Customer as Borrower model might not be practicable until there is experience with one of the other Ag DSM models and increased confidence in the security of the payment stream.

2. REPORT BACKGROUND & OBJECTIVES

2.1 REPORT OBJECTIVES

This Report was commissioned by USAID as part of its Water Energy Nexus Activity, Phase II (WENEXA II) program with the objective to design effective, bankable finance and business models for implementing Ag DSM projects.

Developing and implementing Ag DSM projects involves a constellation of complex issues, including entrenched power subsidies, utility finances, utility regulation, State government budgets, groundwater management, farmer behavior, political factors and more as well as coordination amongst many parties. (See Text Box 1: Key Parties).

The growing recognition of a looming agricultural power and water crisis suggest that if practical action plans can be defined, they will find a receptive audience. While the compelling economic potential of Ag DSM has been studied and known for many years, and several demonstration projects funded with grant resources, robust and commercially replicable financial and business models for implementing projects have yet to be demonstrated. USAID has identified this as the critical gap to unlock the potential of Ag DSM. This Report takes the next steps to fill this gap. The report:

- reviews lessons learned from prior Ag DSM project experience and assesses key issues that must be addressed in a successful business model design;
- provides a detailed description of several project finance and business model options, assesses the pro's and con's of each, and makes recommendations to align the commercial interests of stakeholders;
- includes an analysis of typical project economics, from the point of view of State governments, utilities, project contractors, project lenders and participating farmers with a preliminary economic assessment of two sample cases; and, finally
- provides practical guidance to State governments and outlines steps to develop Ag DSM projects (Annexes A, B & C).

2.1.1 *Central Role for State Governments*. A key starting point for this report is this: State governments must take a lead role to organize Ag DSM projects and enable financing. State governments must take the initiative, in consultation with the Discoms, the State Energy Regulatory Commission (ERC) and, most importantly, farmers as well as other parties, to develop projects. Hence, this report is addressed principally to policy makers.

In practice, the only way to develop and demonstrate viable financing and business models for implementing Ag DSM projects is by working through the details of specific project cases. Thus, this report is a work in progress, and will succeed in its objective by assisting specific State governments to develop plans to implement projects.

Key Parties. To design an effective business model, consultation is required with all parties to understand their interests, concerns, objectives & motivations.

Public entities

- State Governments, including their Finance Ministries
- State Energy Development Agencies
- State Energy Regulatory Commissions
- State Electricity Boards and power distribution companies
- Farmers & farmer organizations and community associations, including potentially local panchayats and other community organizations
- Central Government, including Ministry of Power and BEE , water resources, ministry of finance,

Commercial entities

- Farmers & farmer organizations
- Turnkey Contractor or ESCO or contract Program Manager
- Equipment vendors/suppliers
- Key sub-contractors for installation, O&M, & farmer organizing
- Project lender(s)
- Equity investors, as applicable
- Industrial or Commercial firms, as stakeholders in the power system, and which could purchase saved energy at a discount off industrial tariff under one possible business model

2.2 IMPLEMENTING AG DSM: THE CASE FOR STATE GOVERNMENTS

Recently, the Bureau of Energy Efficiency (BEE) began developing the National and State government case for a concerted, State-by-State investment program in Ag DSM projects[1].

- *Large Ag Water Pumping Power Loads and Inefficient Distribution & Pumping Systems.* India's agriculture sector consumes 30% or more of electricity units sold and represents as much as 40% of connected load. This power is used for irrigation water pumps in highly inefficient pumping systems; pumping efficiencies as low as 30% and less are common. Pump sets are frequently oversized in order to extract water from increasing depths and to withstand large voltage fluctuations and they are inefficient due to improper selection and installation, high-friction foot valves and piping and inadequate maintenance. Experience in India has demonstrated that the energy required to deliver a given amount of water can be reduced by 50% by replacing the pump set with a smaller, efficient and correctly-sized pump set and installing a low-friction foot valve and piping[2]. Farmers are unwilling to invest in these improvements because under the present tariff regime there is no financial incentive and because poor voltage conditions preclude it. On a de facto basis, agricultural power loads are managed by frequent service curtailments or, at least, by slow restoration of service whenever there is an outage. This compounds inefficiencies in the whole system to the detriment of all. For example, not knowing when water will be supplied, farmers often leave their pumps switched on; when power service is resumed, loads spike, and power quality

[1] See National Workshop on Developing Road Map for DSM in India, Section III on " Agriculture DSM" Bureau of Energy Efficiency, presented at the National Workshop on DSM, Pune, October 1-2, 2007

[2] The reduction in friction permits the downsizing of the pump sets.

fluctuations — which further harms distribution equipment and pumping equipment — causing motor burnouts and reducing motor efficiency. Undependable power service results in difficult-to-manage water supply, which reduces crop yields and farmer income and results in the excessive use of water. Power is transmitted to these rural loads long distances at low voltages, resulting in distribution losses as high as 30%. Pumping systems also have very low power factors, often less than 0.65, further aggravating distribution losses.

- *Subsidized Ag Power Tariffs.* Power tariffs for agriculture water pumping are far below the costs of service, with power tariffs averaging 30 paise (.30 Rs or < $0.01) per kWh, and often billed per pump horsepower unit, and not on the basis of metered consumption. Costs of delivering power for agricultural pumping are estimated typically in the range of Rs. 2.25 per kWh, reflecting the busbar wholesale cost of power, to Rs. 3.5 / kWh, which value would include distribution costs and distribution losses, that is, the full cost of delivering power to the point of end use. Thus, power is provided by Discoms at heavily subsidized rates and Discoms incur losses for every unit sold, reducing the incentive to improve service. Further, farmers have little incentive to conserve, given the low costs of power.

- *Discom Losses and Fiscal Impacts on State Governments.* Discom losses incurred in providing agricultural water pumping power are covered from two main sources: (a) high tariffs (much higher than the cost of service) for industrial and commercial customers — which provides an incentive for them to minimize consumption from the utility and, if possible, to self-generate; and (b) State governments provide annual appropriations to subsidize the Discoms. Discom revenues are frequently insufficient to finance operations, requiring substantial State government subsidies, which may be as high as 20% to total income. The subsidy burden and fiscal impacts on State governments are high. Total annual subsidy expenditure by State governments for Discoms to cover losses directly related to agricultural power is estimated at Rs. 40,000 Crores or approximately $10 billion[3]. In effect, Discoms are instruments of the State governments to deliver subsidies to agriculture. These subsidies continue to be justified on social and political grounds, to support farmers who feed the nation and to gain political support from this powerful constituency. These high levels of agricultural pumping power consumption, and the related subsidies, have contributed to nation's success feeding its growing population, but the current system is costly, inefficient, does not provide quality power and ultimately works against the interests of the commonweal.

- *Economics of Ag DSM Projects.* Ag DSM projects offer an attractive way to break through this vicious cycle. Ag DSM projects, typically consisting of distribution system upgrades, rectification of pump sets, measurement and control systems and, social components, can save 50% of the power required to meet a given agricultural pumping load. Analysis suggests that Ag DSM investments can pay for themselves from the savings benefit stream in roughly four years. There are an estimated 20 million bore wells in India with about half of them powered by electricity with a total connected load in the range of 35 GW. Average investment costs for replacing pump sets are generally in the range of Rs. 20,000 to Rs. 40,000 per pump set.

[3] Economic Survey, 2006-07, as quoted in BEE publication cited above, p.25.

Assuming that half of the nationwide agricultural pump inventory is replaced, the national investment need is in the range of Rs. 20,000 to Rs. 40,000 Crore or $5 to $10 billion, for pump set system replacement alone, (before accounting for needed investments in power distribution system upgrades and other project components). Nationwide power consumption for agricultural pumping power is in the range of 120 million MWh. Again, assuming that half of the pump sets are replaced, and savings of 50% in power consumption are achieved and sustained, annual power savings would equal 30 million MWh, which, at Rs. 3,000 per MWh, would be valued at Rs. 9,000 Crore, for a simple payback period of 4.4 years.[4] Properly financed, these projects can yield net savings to State governments and Discoms.

- *Interrelated Issues.* Ag DSM is a critical issue that must be addressed for the financial health of the Discoms and the power sector generally. Furthermore, Ag DSM is closely linked with the nation's groundwater crisis,[5] as the current water pumping system results in over-exploitation of this finite resource. Ag DSM and related rural power distribution system upgrades are also critical to improving power services in rural areas. Power service curtailments imposed to manage the agricultural pumping loads also affect power service to rural villages. Dependable power service facilitated by Ag DSM projects can improve the viability of rural economies. There is a growing urgency to the need for a solution to the linked problems of Discom finances, groundwater depletion and farm and rural economic development. The proper design of Ag DSM projects can accommodate these issues and capture latent synergies.

- *Condition Precedent.* A contributing factor that drives farmers to select cheap and rugged but inefficient pumps is the poor quality of electricity service in rural areas. High efficiency pumps require high quality electric service because they are more sensitive to voltage fluctuations. Thus, network upgrades must be implemented first if Ag DSM projects are to succeed. The cost of such upgrades, whether the implementation of high voltage distribution systems (HVDS) or feeder segregation, should be considered mandatory expenditures for Discoms. Otherwise, the Ag DSM projects will not be sustainable. Alternatively, the development of a rugged and cheap high-efficiency pump might provide the technological breakthrough needed to enable widespread implementation of sustainable Ag DSM projects.

- Overall, investments Ag DSM projects offer an important and timely opportunity to reduce overall power consumption, improve efficiencies of ground water extraction and reduce the subsidy burden of the states while improving service to farmers.

2.3 Ag DSM PROJECT IMPLEMENTATION: KEY CONCLUSIONS

Based on the current realities, India's Bureau of Energy Efficiency (BEE) and others have reached further conclusions about the way forward to develop and implement Ag DSM projects.[6]

---

[4] This is a simplified calculation, and requires further analysis and commercial validation in specific State applications. Fully loaded project costs, including all necessary social components of a successful investment program, may lengthen the payback period. Ag DSM project economics are discussed in Section 4.

[5] Interview with Montek Singh Ahluwalia, Deputy Chairman, Planning Commission, as reported in the Economic Times, September 25, 2007

[6] See, for example, "Agriculture Demand side management Projects: Strategic Implementation Plan" presented by BEE, Ministry of Power, New Delhi, July 10, 2007

- Unlocking the Ag DSM potential requires effective finance and business models that create benefits and incentives for all stakeholders — State governments, utilities and farmers — while engaging the private sector in project development, implementation and investment.

- The key to creating a viable financing mechanism is to link the project financing with the benefit stream created for the State government through savings in purchased power and the reduction in the cost of Discom subsidies. State subsidies could be redirected to amortize investments in Ag DSM projects: a designated portion of State Government subsidies provided to the subject Discom can be pledged as a primary source of security and repayment for project debt financing. As projects are implemented and efficiency gains achieved, State governments would gain through a reduction in subsidy payments to Discoms.

- A holistic approach to Ag DSM is needed that includes power efficiency and water efficiency project benefits in addition to pump set replacements. Thus, the definition of "Ag DSM" must address: (i) pump system rectification (including piping, foot valves, and motors as well as efficient pumps), (ii) distribution system upgrades, (iii) water efficiency and drip irrigation measures, (iv) metering, load management, and load limiters, and (v) farmer social and business advisory programs to assist in improving farm productivity and incomes. The development of rural power distribution franchises — and specialized agricultural franchises controlled by farmers — possibly coupled with rural distributed generation power projects, could be incorporated into a holistic program to sustain the energy savings.

- The Central Government could support State governments in establishing the necessary framework and possibly by providing catalytic funding for project development.

3. FINANCE & BUSINESS MODEL DESIGN

3.1 PRINCIPLES, COMPONENTS AND KEY ISSUES TO ADDRESS

Design of an effective Ag DSM project finance and business model is best done in the context of a specific State. Nonetheless, some general points can be made regarding issues that must be addressed to develop projects. The components of an equitable, effective and bankable business model can be described in the context of procedures applicable to public sector entities and key issues required to achieve a successful project design can be identified.

3.1.1 Business Model Design Principles

An effective finance and business model must include the following elements.

- Identification and clear allocation of all project roles and risks, properly matched to the capacities, incentives and objectives of each party. The party assuming given risks and roles must have the technical and financial capacities to perform and manage them. The complete set of roles must cover *both* project development and implementation.

- A project development plan, outlining all steps and indicating who drives each step over the project development cycle.

- A contract structure and basic terms that meet the objectives of all key parties to the project and align their incentives. Key parties include the Discom, relevant Government agencies, the Regulator, ESCO or contractor, project lenders and investors, farmers and local communities;

- A procurement method, reflecting requirements of the Discoms, and clearly defining what the Discom will procure.

- A structure and plan to raise the necessary project financing, both debt and equity, including a credit structure and risk mitigation mechanism, to meet security and lending criteria of prospective project lenders.

- Quantification of the financial benefits for all parties, based on a thorough assessment of project economics. The financial model must reflect the finance and contract structure and allow for sensitivity analysis of key project variables.

- A plan to obtain necessary State Government and ERC approvals, the steps to get them, required documents to submit, and an approval strategy geared to State policy and law.

- Strong replication potential in the Indian context so the implementation of Ag DSM projects can be scaled up to achieve their full economic and environmental potential.

3.2 KEY ISSUES IN AG DSM PROJECT DESIGN

Based on WENEXA's experience with Ag DSM as well as the experience of prior pilot projects, we have identified several key issues that must be incorporated in the design of a viable Ag DSM business model.

3.2.1 *Provide clear benefits and incentives to farmers*. Farmer behavior is a major risk factor in Ag DSM. Engagement of and incentives for farmers are essential parts of the project. Cost/benefit analysis from the farmer point of view must be performed and their behavior anticipated. Farmers can foil projects, if only by not actively supporting it, so a marketing and social organizing plan must be included. Many types of incentives and benefits for farmers can be generated by Ag DSM projects. Foremost are improved power service, power quality, reliability, duration and dispatch. These have direct effects on water supply and hence crop yields, and on farm labor and management requirements. Improved power service can lower pump maintenance costs (in both parts and labor and reduced pumping downtime) and extend pump life. Other services for farmers can also be included.

3.2.2 *Replace pump systems not just pump sets.* The efficiency of the pumping system is a function of several factors, not only the efficiency of the motor and pump, but also the sizing of motor and pump with respect to the pumping loads, and the piping system and design and use of foot valves. A proper system should include: (i) right sizing of the pump and motor; (ii) replacement of existing suction and delivery piping with low-friction, PVC piping; and (iii) use of foot valves. New pump sets will typically replace three-phase with single phase pumps and belt drive pumps to monoblock pump sets.

3.2.3 *Incorporate rural power distribution system upgrades as an essential component of Ag DSM projects.* Discoms suffer large technical distribution losses delivering power to agricultural pumping loads. Power is transmitted over long distances at low voltages. As a result, power quality is very low; large voltage fluctuations wreck havoc on pumping equipment.

Discoms cope with the agricultural pumping load through rotating service curtailments. These feeders also supply non-agricultural customers, forcing Discoms to restrict domestic and commercial supply too. This poor service represents a loss of potential revenue from non-agricultural customers and reduces economic activity in the rural communities. High voltage distribution system (HVDS) upgrades are needed, and provide savings in reduced line losses. Without HVDS upgrades (or feeder segregation), new agricultural pumping equipment will be short-lived and ultimately ineffective. Thus, upgrades to the distribution system need to be made as a precondition to or packaged together with Ag DSM investments.

Network upgrades can also segregate agricultural feeders from rural village power service, thus improving service to rural communities and promoting economic development.

3.2.4 *Incorporate water efficiency investments and load management systems*. The amount of energy savings will be a function of quantity of water pumped. A key

concern is farmer behavior: after the new pumping system is installed, farmers may simply pump more water. Water efficiency investments such as drip irrigation should be implemented in conjunction with the Ag DSM project where feasible. Water efficiency projects bring their own benefits to farmers in terms of improved delivery of water to the crops and increased crop yields, and will help assure the energy savings targeted by the project. With water efficiency measures, farmers may decide to irrigate more acreage, but can do so without increasing water quantity pumped. To further manage the risk that farmers will increase water quantity pumped, a load management system could be included in the project design.

3.2.5 *Provide Incentives for the Discoms*. Under the current system, reduced Discom losses would result in reduced State subsidies and reduced allocation of available power. The Discoms, in effect, are instruments of the State to deliver the subsidized power to the agricultural sector, passing through the losses to the State as a middleman. The Discoms has a central role to play to develop and manage the Ag DSM projects, (even in the ESCO as Borrower model). In order to motivate the Discoms to undertake projects, some portion of the net project benefits can be allowed to remain with the Discom.

3.2.6 *Include a payment security mechanism for a Discom's payment obligations*. A major concern for lenders and project developers relates to the creditworthiness of Discoms. A payment security mechanism can be designed and included in the project structure to address this issue directly and mobilize lenders. This is a necessary component of a policy framework to open this market and create a replicable business model.

3.2.7 *Measure & verify energy savings*. An energy savings measurement and verification (M&V) protocol is essential to include in the project, to document results and take corrective actions as needed. In some business models and contract structures, measured savings may directly determine the amount of payments. Even if not, savings should be measured to confirm project results.

3.2.8 *Consider rural power distribution franchises as a means to sustain savings*. As part of planning an Ag DSM project, Discoms should consider a long-term plan for rural power service generally: how rural power is organized, delivered, priced and managed. In this context, the framework for Ag DSM is offered by the Electricity Act of 2003, which provides for development of rural power distribution franchises, which can be sponsored by several types of organizations. Development of distribution franchises can create the community basis and incentives to sustain Ag DSM project efficiencies over time. Implementing Ag DSM projects can be a practical strategy for institutional reform of the rural power system. Ag DSM projects can create the benefits and trust needed to open the way for reform.

3.3 INNOVATIVE HYBRID SOLUTIONS ARE POSSIBLE

We believe a solution is possible, if not easy to define and perhaps less easy to implement. These include the options outlined in this report, all of which have their own pros and cons. The business and financing models discussed herein should not be viewed as inflexible but rather as "types" that can be tailored to suit the conditions of a particular state or region. They could also be combined with other concepts, for example the franchise, to take advantage of potential synergies.

One alternative involves the creation of agricultural franchises composed of farmers who would, collectively, have a greater measure of control over their own destinies in terms of power. A melding of the Energy Service Company (ESCO) concept, discussed in this report, and the Franchise concept, discussed widely elsewhere and embodied in the Government of India's Eleventh Plan, would provide one unique feature: farmers would benefit directly from energy efficiency improvements in agricultural pumping.

A simple variation of a "cap and trade" type of system might then be developed to create a local electricity trading market wherein an agricultural franchisee — essentially a farmers collective — could sell back to the Discom the electricity it "saves" by being more efficient. Such a trading system would allocate a specific amount of energy supply (based on actual historical consumption) to a properly constituted agricultural franchise, to be supplied by its local Discom. Then, the collective could either (a) use power as it did in the past, or (b) implement a scheme to reduce the energy intensity of its pumping activities and sell the unused portion of its allotment back to the Discom at a stipulated price. Thus, farmers could benefit directly from energy savings.

Another potential advantage would be that the program could be made voluntary. Up to now, most Ag DSM models involve a top-down approach. Many assume farmer behaviors will be supportive either because they are already receiving a benefit or because the cost to repair pumps would decline by Rs. 2,000 – Rs. 3,000 per year. One lesson learned by the WENEXA II project is that farmers are the key to success so they need to be the centerpiece of a solution. A workable solution must include an incentive for farmers in exchange for their correct behaviors — but behaviors that will serve the interests of society as well as their own interests.

Under an agricultural (rural distribution) franchise, no metering would not have to be installed beyond bulk metering at the feeder level or at the transformer level and farmers would be responsible to organize operating rules for their own collective. The creation of an agricultural franchise controlled by a farmers' collective could be entirely voluntary on the part of farmers. Giving farmers control will be a powerful advantage, we believe. Any given group of farmers could chose to implement the concept or stay with the existing regime. After an initial trial period, farmers could elect to disband without significant barriers to exit if they were not satisfied with the results. In fact, they could pursue a 'de facto' abandonment of the efficiency improvements by not selling any saved power back to the local Discom and continue to use it as in the past. Several advantages of this approach are that it would:

- Give farmers control of the operation of farmers' collective franchises and align the economic incentives of the governed and the government. This would create a positive way to provide tangible benefits to farmers while creating political capital.
- Allow the concept to be rolled out incrementally as agricultural franchisees come forward and are deemed qualified against pre-established standards
    - Volunteers are likely to be more committed to finding a way to make the system work and to making the many small adaptations that may be needed to sustain good results than an army of conscripts with no incentive
- After the basic agricultural franchise concept is established, it could provide a foundation to create a rural power trading regime. India's advanced IT and telecommunications technology could enable the sector to leapfrog into a vastly changed dynamic for rural electrification.

- This will require the segregation of feeders but that, or implementation of HVDS, is a mandatory cost of upgrading the distribution network

- Create a platform to reform increasingly dysfunctional agricultural tariffs by, for example, allowing agricultural franchisees to buy additional power above their baseline entitlement — or to change consumption patterns during the day, week or season — in exchange for predetermined charges approved by regulators

This idea is but one possible application of the business models and financing options in this report. The results of a study by WENEXA II's energy efficiency financing specialist provide building blocks that could be combined in different ways. In fact, the co-existence of different models and regimes is entirely possible. Different operating realities that are shaped by different ground realities and different cultures in different states may warrant the implementation of several different models in the same state.

4. Ag DSM PROJECT FINANCING & BUSINESS MODELS

4.1 CATEGORIZING THE FINANCING OPTIONS

With the above-noted background points in mind, a range of financing and business models can be identified and evaluated against the criteria for a successful design.

A portion of the Ag DSM project financing will come as debt, repaid over time from the stream of project benefits. The balance of financing will come as equity or capital contributions made upfront from one or more of the several parties, including perhaps from a State Government in the form of a capital grant. The best way to categorize the range of financing options is to begin with the question: "Who is borrower for the project loans?" There are a limited set of candidates; they are:

- *the Discom*, which would borrow directly to fund the project, and contract out certain aspects of the project works and implementation;
- *an ESCO (energy services company) or project contractor, which has a contract with the Discom to finance and implement the project; the ESCO would borrow the project debt and repay it from project revenues;*
- *the farmers, individually or through a collective organization, and / or*
- *high tariff industrial customers who would sponsor projects and borrow to fund them in exchange for a contractual right to purchase a portion of the saved energy at a discount* off their high industrial power tariff.

The State Government itself is unlikely to be the borrower, but will play a key role in enabling the project debt financing. The lender could be a Development Finance Institution (DFI), e.g., chartered nationally such as the Rural Electrification Corporation (REC), Power Finance Corporation (PF), the India Renewable Energy Development Agency (IREDA) or the Infrastructure Development Finance Corp. (IDFC), or by a State institution such as Maharashtra Energy Conservation Fund or one of the Energy Development Agencies, or perhaps internationally such as Asian Development Bank (ADB) or International Finance Corporation (IFC), part of the World Bank Group — or by a specialized financial institution like National Bank for Agricultural and Rural Development (NABARD). However, it will be essential that the project design includes satisfactory credit and security provisions no matter what the source of funding.

It would also be possible to combine certain aspects of these options or to develop hybrids. For each of the major options, a diagram depicts the main elements of the contract and financial structure, namely: (i) the parties to the transaction, (ii) their contractual relationships, and (iii) the flow of funds between them.

4.1.1 *Initial Assessment of Options*. Nominally, the two strongest options appear to be: 1) Discom as Borrower, and 2) ESCO as Borrower. Discoms can be borrowers of project finance, as they are for transmission and distribution system upgrades and other capital projects. This may be the simplest structure, and quite suitable for many Discoms for financing Ag DSM projects. The Discom

could outsource some or all aspects of the project, even contracting with a turnkey contractor to implement the entire project.

Some States and Discoms and others have indicated a preference for the ESCO model, believing this can best achieve an effective distribution of project roles and responsibilities. The ESCO as Borrower has certain advantages, including:

- private sector financing and the turnkey implementation capacities of private contractors could be mobilized;
- the project could be implemented on a performance contract basis;
- the ESCO could outsource main components of project implementation;
- the Discom would not have to take new debt onto its balance sheet.

The State Government must stand behind the payment obligations of the Discom to the ESCO, funded from savings, so that the ESCO can mobilize project finance against the payments due under the Discom / ESCO contract.

Organizing industrial firms to be project sponsors has interesting potential, as it places project initiative with large established firms motivated to obtain cheaper and more reliable power. With the right incentives, these capabilities could be enlisted to help achieve the goals of Ag DSM. However, this will require considerable effort to develop and implement so, despite its appeal, it is likely to be a second or third generation option.

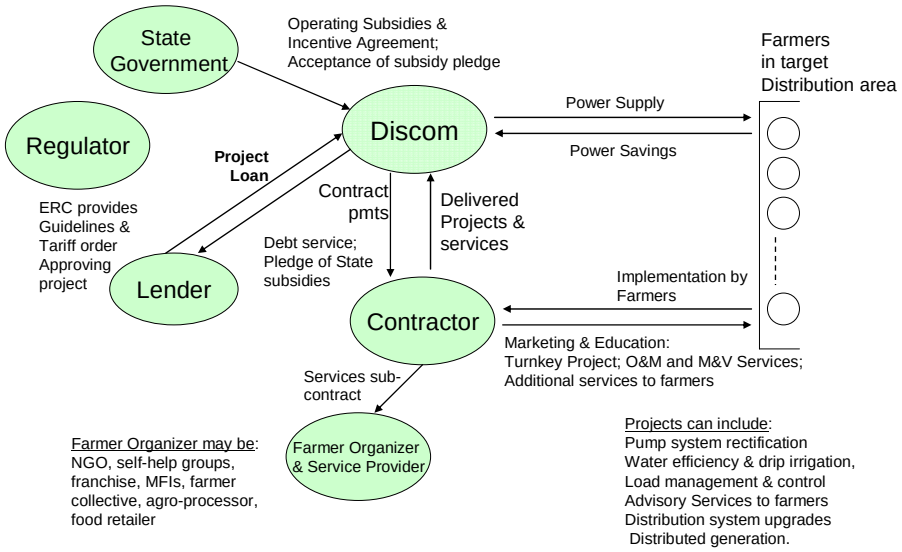
These initial comments are intended to frame the basic options. First, the Discom as Borrower option will be elaborated and will serve as the platform to detail the components of a complete Ag DSM project business model. Next, the other options are described in lesser detail and by reference to the Discom as Borrower model. The choice and design of an appropriate project finance and contract structure must be made with reference to the ground realities of each State. As suggested previously, there appears to be reasonable scope to develop hybrids. The descriptions below are intended to approach this topic functionally to provide the concepts and tools needed to evaluate alternative models and financing approaches.

4.2 MODEL 1: DISCOM AS BORROWER

The Discom as Borrower option is depicted in Diagram 1 and contains the following main elements.

4.2.1 *Project Initiation & Development*. Here, the Discom should initiate the project. If the State Government does not fully support the Discom's initiative it will not move forward so a clear expression of support from Government will be essential. The diagram below depicts the transaction at financial closing but does not indicate all the project development steps required to get there. These are outlined in Annex A, and include: (i) defining the project and conducting a feasibility study; (ii) developing a financing plan, including payment security mechanism and Government support commitments, (iii) designing the preferred contract structure, (iv) obtaining regulatory (ERC) and governmental approvals, (iv) preparing a Detailed Project Report (DPR) to serve as the project implementation plan and decision document, and (vi) conducting procurement and implementation.

Model 1: Discom as Borrower



4.2.2 *Project Implementing Contracts.* In the course of project development, the Discom will decide (i) the scope of the project, and (ii) how to implement it. These decisions will inform the preparation of the procurement document or "Request for Proposal" (RFP). The Discom can procure a range of works and services associated with the project. These services include: project design and engineering, project development and management, specification and procurement of equipment, turnkey installation, project financing, system maintenance and operation, equipment repair and replacement, and savings measurement and verification. The Discom must decide which of these functions it will perform itself and which it will contract out. Furthermore, these services could be procured separately or as a package.

Regarding construction and installation of the project, the Discom must decide what type of construction contract is preferred for the project, i.e.:

- What will be the role of the contractor in determining the final project design and specifications?
- Would a "turnkey" construction contract be preferred?
- Would the Discom prefer to develop the project specifications, then procure one contract for the equipment purchase and another for installation and with the Discom (or an engineering consultant) acting as project manager?

Regarding maintenance and operations services for the installed systems, the Discom should assess the capacities of its own works department to maintain the systems:

- What maintenance responsibilities will the Discom retain?
- Which maintenance responsibilities would be appropriate for farmer to perform?
- What maintenance responsibilities might be outsourced?
- Would an equipment supplier or contractor provide an extended warranty, taking financial responsibility for repair and replacement of installed equipment for the term of a services contract?
- How will risk of loss and damage to equipment be handled?

In general, a turnkey contractor offers the Discom contractual assurance that the works will be installed properly. The RFP can include performance-based specifications, and the contractor could assume responsibility for selection of final equipment and systems, subject to Discom approvals. The contractor could assume full responsibility for everything from installation through commissioning. The contractor could also provide extended warranties on the equipment and assume responsibility for repair and replacement through a specified contract term. The equipment would likely be owned by the Discom, so insurance should be the responsibility of the Discom. At the end of the debt term, the Discom can transfer ownership of the equipment to farmers. The Discom's decisions on what project functions to outsource versus performing itself will depend on its preferences regarding project risks and risk management.

4.2.3 *Project Financing*. The project would be financed with a combination of debt and the Discom's equity. A portion of the Discom's equity contribution could come in the form of a capital grant from the State government. The Discom's equity contribution will typically be 10-30% of the project cost. This could be a significant amount for a Discom to fund and may be an important factor in determining the preferred financing structure. With debt at 70-90% of the total project cost, adequate security must be structured with the lender.

4.2.4 *Payment Security Mechanism and Multi-Year Budget and Tariff Agreement.* The recommended approach to financing Ag DSM projects is to allow a Discom to assign a portion of its State subsidy as security for the Discom's payment obligations to the lender. By pledging its subsidy, the Discom would agree that the State Government would pay the Discom's subsidy (or a specified portion of it) to a Trust & Retention Account (TRA) held by a trustee (e.g., a bank) on behalf of the Lender and the Discom. These funds would be distributed according to the terms of the project loan agreement, with priority given to project debt service.

Implementing Ag DSM projects will reduce the Discom's losses on power delivered to the agricultural sector. These losses are covered by State government annual subsidy payments. The amount of this subsidy is calculated annually and incorporated into the Discom and State government budgets, and used also as the basis for a tariff order approved annually by the State ERC. This is the budget system defined in the Electricity Act 2003 (EA03), although States may vary in their adherence to it.

A multi-year budget agreement will ensure the payment security mechanism is effective and, thus, should be considered a necessity. The ERC must approve such an arrangement but Section 65 of EA03 stipulates that the State shall pay its agreed annual subsidy in advance and in such manner as the ERC may direct. While we recognize that implementation of EA03 is still patchy, this provision — if backed by political will and managerial willingness — would enable the type of revenue pledge contemplated herein. Precedents exist of Discoms pledging revenues to meet payment obligations to vendors, power suppliers, and lenders. In fact, this mechanism is commonly used as security for borrowings from the Power Finance Corporation, for example. The term of these commitments must be the same as the term of the project loan, which will typically be in the range of seven to ten years.

4.2.5 *State / Discom Incentive Agreement*. Implementing Ag DSM projects will create savings for the Discom by (i) reducing below-cost power sales to the agricultural sector, and (ii) reducing distribution losses. In order to incentivize Discoms, some portion of the net project benefits could be allowed to remain with the company. This could be affected by a Project Incentive Agreement between the

State and the Discom whereby a defined portion of the net subsidy would be retained by the Discom. This also would be part of a multi-year agreement and subject to approval by the ERC as part of a tariff order. The agreement could specify that any net funds accruing to the Discom could be specified to be used for specific purposes only.

Another reinforcing incentive is that a Discom may be able to sell saved energy to its high tariff customers. Each State must engage in consultations with their respective to develop and agree an effective incentive mechanism. Because Ag DSM project economics are strong, we are confident there is scope to create "win-win" benefits for all parties.

4.2.6 *Farmer Agreement & Participation*. The geographic areas, distribution feeders and farmers targeted for participation in the project would be selected by the Discom in consultation with various stakeholders and consultants. Data will be gathered and field research conducted to support this decision as part of a project feasibility study.

Participating farmers will enter into an agreement with the Discom, the Contractor, or perhaps a local entity responsible for organizing farmer participation. The farmer agreement is anticipated to define the equipment and services to be delivered to the farmer and formalize farmers' reciprocal commitments and responsibilities. This agreement must be simple, to the point, and in local language. The Discom / Contractor will install the new pump system and have certain warranty responsibilities to assure its working operation. Farmer commitments and responsibilities may include: (i) certain operations and maintenance responsibilities for installed equipment; (ii) implementation of water efficiency measures, such as drip irrigation; (iii) access to the equipment and sharing of information about equipment performance. The equipment could be owned by the Discom and transferred to the farmer at the end of the agreement term. Critical concerns for farmers are hours of availability of service and hours of service schedule could be worked out as part of the project.

It may not be feasible for a Discom to get an up-front capital contribution from the farmers to share in the costs of the new pump system. Convincing farmers to participate in a project may be difficult, but it will be essential. This model assumes farmers will not make any up-front financial contribution to the pump system rectification although there is some evidence that suggests farmers may be willing to invest in water efficiency measures.

Farmers can foil projects, if only by inaction, and farmer behavior is a major risk factor in Ag DSM projects. A project's overall performance will be determined by the performance of individual pump sets. Good results must be sustained in order to achieve total estimated savings. Thus, farmers must be engaged during project preparation with incentives for farmers incorporated into the project design.

A primary motivation for farmers is to gain improved power service, power quality, reliability, duration and dispatch. These have direct effects on water supply and hence crop yields. Improved power service can lower pump maintenance costs (in parts and labor as well as reduced pumping downtime) and extend pump life. As water tables have declined, the use of submersible pumps has grown; replacement of a broken pump becomes a costly and lengthy task, with negative impacts on water availability and crop yields. Farmers have generally responded well to adopting drip irrigation systems, which, by making

more efficient use of water, deliver water more effectively to crops and, thus, increases yields.

Further, the project could include certain additional services to the farmers and farm communities. Additional services to farmers could include advice on crop selection, cropping methods, crop storage to reduce waste losses, and also possible commercial linkages to crop markets. The scope of these services could be crafted during project development and may evolve over time. Taken together, these components can increase farmer net income.

Organizing farmers involves a community process that will take considerable effort, both during project development and operations. The Discom or its Contractor will likely need to sub-contract with a specialized organization competent in agriculture and farmer / community organizing to deliver farmer services. Such an organization could be a self-help group, a local non-governmental organization, a farmers' collective, a farm service organization or business which has relationships with multiple farmers such as a micro-finance organization, agro-processor or major food retailer. The project should make an allowance for these costs in the project budget.[1]

Typical Required Agreements & Documents

Development, implementation and financial closing for a project require many documents, including the following.

- Project feasibility studies, cost / benefit analysis and an analysis of project economics with baseline data
- Project Development Plan: from the Discom and State Government points of view, providing the information needed for State / Discom decisions
- Directives from Government, incl. Tariff Order from the ERC and a Multi-year Budget Incentive Agreement between the Discom & State
- Procurement documents, RFP for Discom to procure a Contractor / ESCO
- Project Contract between the Discom and Contractor/ESCO
- Revenue Pledge & Assignment Agreement, between Government, Discom, ESCO and its lender
- Farmer Agreement (either with Discom or ESCO)
- Project financing documents, including, potentially a debt placement memorandum, Loan Agreement and related Escrow Agreement or Trust & Retention Account Agreement

4.3 MODEL 2: ESCO AS BORROWER

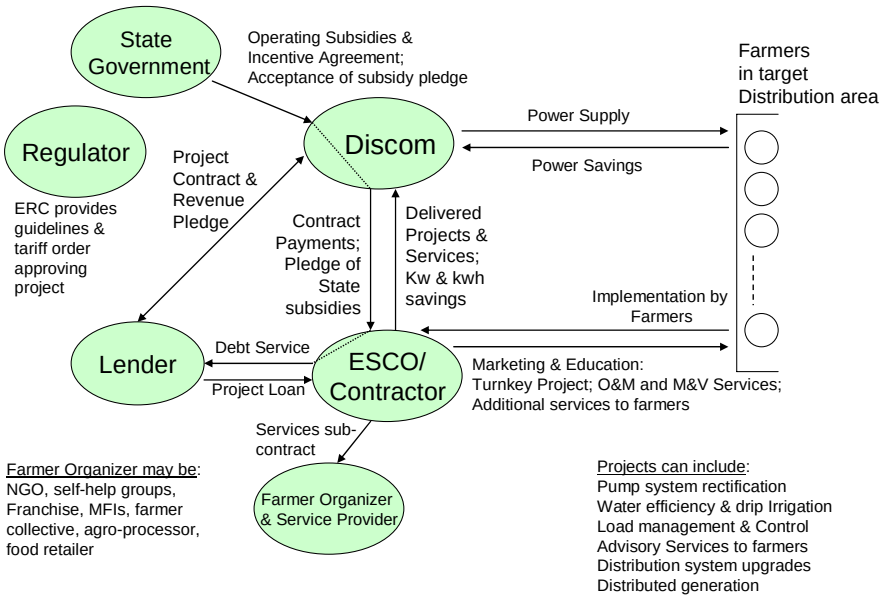
The ESCO as Borrower option is shown in Diagram 2. The basic project functions in the same manner as the model for the Discom as Borrower so there are many common elements. The fundamental difference is that, in this model, the Discom will outsource the responsibility for results. In exchange, it will offer the ESCO — whether a private entrepreneur, an agricultural collective franchise or a major corporate — enough savings to enable the creation of a bankable deal and to provide incentives commensurate with the operating and business risks. As we shall see, the State / Discom will likely be required to put a boundary on uncontrollable risks, at least until the concept is proven and ESCOs and their lenders are willing to accept an unconstrained set of risks.

4.3.1 *Project Initiation & Development*. After receiving a formal expression of support from the State, the Discom will initiate the project according to public procurement procedures. The Discom can conduct a preliminary project feasibility study and finalize the project scope and contract structure for the ESCO, develop a DPR and obtain necessary approvals (e.g. from the ERC) before procurement of an ESCO.

4.3.2 *Procurement of ESCO Project Contract.* The Discom conducts the procurement of an ESCO to implement and finance the project. The ESCO usually combines turnkey project engineering, equipment procurement, installation and commissioning, as well as management and operations services. It will also be responsible to obtain financing under an agreement, termed the Ag DSM "Project Contract" in Model 2.

Precedents exist for Discom procurements for ESCO performance contracts, e.g., for capacitor installation programs. The procurement process for 'early movers' should be flexible and interactive in view of the inexperience with performance contracting in the sector. That would allow development of better contract terms and an effective M&V protocol. Draft versions of the contract and M&V protocol should be issued to bidders during the tendering process so they can suggest modifications.

Model 2: "ESCO" as Borrower



4.3.3 *Discom / ESCO Contract*. There are analogies in other ESCO energy services agreements that provide significant precedents for the Discom / ESCO Project Contract that can be used to craft a project agreement. Major components of the Project Contract include:

- Project Scope, both capital and services. The investment plan will be defined, as in any public works contract, detailing the project components, specifications, locations, system integration and commissioning and acceptance testing requirements. Services will include operations and maintenance of the installed systems, and services to be provided to farmers. The division of operations and maintenance responsibilities will be specified.

- Contract Payment Formula. The Contract will specify the formula to determine the amount an ESCO will be paid categorized as (i) fixed payments, based on the agreed value of investment and services delivered by the ESCO, and (ii) variable payments, based on savings, for which there are several methods of calculation.

- Warranty provisions, performance standards and guarantees will address the efficiency of installed equipment. The ESCO may guarantee a minimum level of savings and agree to financial remedies or liquidated damages if the savings are below target. Financial backing for guarantee commitments may be needed.

- Project Equipment Ownership & Disposition. An ESCO typically owns the equipment with a provision to transfer it to the Discom or the farmer at the end of the term. Purchase options can be negotiated and a schedule of stipulated value is often included for this and insurance purposes. Responsibilities for equipment insurance, repair, and responsibility for loss and damage are allocated. The contract term, termination provision, default and remedies are also addressed. Further, the ESCO must be allowed to assign or pledge Contract payments and equipment assets for financing purposes.

4.3.4 *Discom Payment Obligation.* From a financing perspective, the heart of the Project Contract is the Discom's payment obligation. Critical aspects are: (i) the formula for determining how much the Discom will pay the ESCO, including related measurement and verification methods; and (ii) the security backing the payment obligation.

4.3.5 *Measurement & Verification*. M&V is necessary to confirm that the estimated benefits are being realized. Continuous feedback also enables the ESCO to make adjustments, as needed, to ensure savings are sustained. Other DSM programs have successfully defined commercially acceptable M&V protocols.

Baseline energy consumption patterns must be established prior to project implementation. This can be done as part of the project feasibility studies. If metering equipment can be installed at the feeder and individual pump levels, it would be able to monitor power consumption accurately.

Otherwise, the contract between the Discom and ESCO would have to be modified to move away from variable, performance-based payments.

An important consideration for M&V is the tradeoff between cost and accuracy. The purpose of M&V is not to determine a project's exact energy savings but rather to estimate them with sufficient accuracy to enable a viable project agreement between the contracting parties. The level of accuracy necessary for this project should be determined through negotiations between the Discom and the ESCO Contractor.

Table 4.3.5, below, outlines three alternative M&V protocols for Ag DSM projects along with their respective advantages and disadvantages.

Table 4.3.5: Alternative Measurement and Verification Protocols

Protocol	Advantages	Disadvantages
1. Stipulated savings, with periodic sampling of pump sets	• Low cost	• Less accurate • Rules out variable payments
2. Measured savings for all feeders and a sample of pump sets	• More accurate • Permits variable payments	• Higher cost • Requires extrapolation of savings and adjustment for other variables • May increase resistance among farmers due to meters at pump sets
3. Measured savings for all feeders and pump sets	• Most accurate • Permits fully variable payments based on measured savings	• Higher cost • May require adjustment for uncontrollable variables if used to determine payments to the ESCO • Highest risk of resistance from farmers

A key question regarding M&V, affecting the financeability of the project, concerns the project contract payment formula, i.e., will the real-time measured savings be the way payments to the ESCO are determined? In answering this question, two competing concerns must be balanced. First, is the concern of the ESCO and its project lender: *some risk factors that affect kWh savings performance are outside the control of the ESCO*. The second concern is that the Discom and State Government are basing their project economics on estimated savings, and want to make payments from the savings benefit stream.

Risk factors outside the ESCO's control include farmer behavior, the amount of land under irrigation, cropping patterns, water table declines (potentially affected by adjacent farmers), weather and rainfall. All these factors can affect the quantity of water pumped and the head, which will cause energy loads to vary, even if the technical performance of the ESCO's installed systems perform as specified. Variations in power quality can also affect pump performance, useful life and maintenance and replacement costs. ESCOs and their lenders may not be able to accept full exposure to such uncontrollable risks.

For this reason, from the point of view of the ESCO and its lender, a stipulated savings M&V protocol may be appropriate. This would involve metering of a sample of feeders and pump sets before and after the project in order to estimate savings on a per-pump set and per-feeder basis. This information would then be used to stipulate savings for the entire project area. Periodic sampling of pump set efficiencies during the course of the contract period would be important to account for any deterioration of savings and to confirm that the ESCO is meeting its warranty obligations. Even if a stipulated savings methodology is used to determine payments to the ESCO, the Discom can implement a measured savings system for all feeders and pump sets to gather the most accurate information.

Additional solutions to balance these concerns can be developed and tested. Two steps are recommended. First is to *address the risks functionally with a good project design and management plan* by incorporating into the project design the lessons learned on Ag DSM projects to date. This would include incentives for farmers and upgrade of the distribution system, as well as water efficiency investments and load management systems.

The second is to design the project economics so that the actual savings required to satisfy the parties' basic project economic objectives is less than estimated savings. Ag DSM energy efficiency investment projects should be designed so that their economic viability is tested on the basis of savings in the range of 85-90% of the target. Thus, there is a margin of safety of 10-15%, i.e. the parties will still meet minimum financial objectives if actual savings are less than the estimate by 10-15% of projected savings.

Contractually, ESCOs must stand behind technical performance and specific efficiency of the systems and equipment they install. These are key values in the M&V savings calculation. Other values in the savings equation, i.e., energy loads can be estimated using baseline data and then stipulated in the project contract. In this way, the ESCO is not exposed to uncontrollable risks, but does assume responsibility for system efficiency. The Discom and State Government would, in effect, assume the uncontrollable risks. If the ESCO is paid based on the agreed value of its capital investment and delivered services, this formulation can produce equitable results.

4.3.6 *The Agricultural Franchise Concept*. Anecdotal evidence suggests that farmers are willing to pay more for power if the quality of service is improved. If farmers experience improved power service as a result of the project, they may be willing to shift to a regime that includes provision for tariffs at higher rates, perhaps for increased supply above a subsidized baseline allotment. On the other hand, if farmers perceive the project as a "Trojan horse" to enable the introduction of metered tariffs, they may rebel and block the scheme. Avoiding such an outcome will require that the project design and development process involves farmers in a step wise approach that demonstrates service improvements first to build trust and confidence.

Another means to achieve tariff reform, and build the social capital necessary to accomplish it, would be through the establishment of agricultural distribution franchises. These are envisioned in the Electricity Act 2003 (Part II, Section 5) and could be undertaken by Panchayat institutions local businesses, cooperatives or non-

governmental organizations. Several models of franchises are possible and franchise functions could evolve over time.[3]

A basic function of a franchise is to perform metering, billing and collection functions. One possible option would be for an agricultural collective variation of the rural distribution franchise to operate as an ESCO with an allotment of free power it could either use or sell back some portion of saved energy for a profit. This model would give the franchisee strong incentives to reduce theft and pilferage and would create a collective interest in improving power distribution efficiency.

This is a variation of the "Own Your Transformer" (OYT) program adapted for an agricultural feeder, where a community group takes ownership of a transformer and assumes responsibility for distributing power downstream of that point. The Discom provides a single bill to the community group for power delivered to this point, and the franchisee assumes responsibility for billing and collection. Bangalore Electricity Supply Company is actively promoting an OYT scheme.

Development of rural power or agricultural distribution franchises could become a means to organize farmers, give the community a stake in creating an efficient system and align farmer incentives with the interests of the project. Organization and capacity building of franchises and investment in their operations could be an aim of the Ag DSM project incorporated as part of an ESCO's package of services. The local franchise organization could earn an increasing equity stake in the franchise as the ESCO investment is retired. Such an approach would sustain project performance and savings, and create an institutional framework to continue improvement and reinvestment in Ag DSM after the initial project term is completed.

4.3.7 *Payment Security Mechanism and Incentives for the Discom.* In the ESCO as Borrower case (as with the Discom as Borrower), the State Government would enter a multi-year budget and incentive agreement with the Discom, as approved by the ERC. A Revenue Pledge is coupled with this, i.e., the Discom pledges its subsidy from the State as security for its payment obligations to the ESCO. It further directs the State Government to make its payments to a Trust & Retention Account held with a trustee on behalf of the ESCO. Then, as a condition of the ESCO's project loan, the subsidy is assigned for the benefit of the Lender to make project debt service payments. Remaining funds after payment of debt service obligations to the Lender would be distributed according to the terms of the various contracts, according to a project finance waterfall methodology.

4.3.8 *Project Financing.* The ESCO would be responsible to mobilize project financing, including equity and debt. For debt, the transaction structure must be designed to satisfy the lender's security requirements. Other factors lenders will weight heavily in their decision to provide financing will include the:

- terms of the project contract (especially the payment formula),
- project economics and financing plan,
- technical feasibility study,
- ESCO's financial strength and capacity to deliver.

The loan will be on the balance sheet of the ESCO, or a single purpose project company owned or controlled by the ESCO, not the Discom or other parties.[4] The burden of due diligence for the lender is relatively high as the lender must perform a "project finance" type appraisal for this kind of loan. Recourse to the ESCO, or its parent company sponsors, could also be negotiated as part of the loan structuring. The ESCO will also need to provide certain equity financing, typically 20-30% of total investment costs. The ability of candidates to provide adequate project equity must be an evaluation criterion in the Discom's procurement process.

4.3.9 *Farmer Agreement.* Participating farmers will enter into an agreement with the ESCO, covering the terms as described above. Furthermore, the project could include certain additional services to farmers and farm communities to provide incentives to participate. The ESCO will likely need to contract with a specialized entity to assist in organizing and delivering services to farmers.

4.3.10 *Creating a Viable Business Proposition for the ESCO.* The project must be designed to create an attractive business proposition for the ESCO, and as a result, a bankable risk in the eyes of lenders. The roles, risks and responsibilities the ESCO is asked to assume must be within its technical and financial capacities. The costs associated with proposing on and developing a project must also be reasonable and manageable. Key concerns of ESCOs in evaluating an Ag DSM project opportunity include the following.

- *Risk allocation, technical performance responsibilities and Contract payment formula*. Typically, the ESCO can assume: engineering, equipment procurement, logistics, installation, commissioning, operations, maintenance, and certain technical performance responsibilities for installed equipment and systems. ESCOs can also sub-contract to deliver services to farmers. There are certain risks ESCOs cannot control and will be reluctant to assume. These include: farmer behavior, variations in energy loads (e.g., weather, rainfall, or declining water tables), and power quality delivered by the utility. If payments to an ESCO are subject to these uncontrollable risk variables, then it may not be able to raise financing for the project. A project contract payment formula that is based on the agreed value of the ESCO's delivered capital investment and services will be most acceptable. Performance can be defined based on specific efficiency of installed measures, of the water pumps, and the ESCO can provide an extended warranty to continue to meet this specification. This

[4] However, as part of a financing package, capital contributions can be provided by other parties in the form of capital contributions, grants and cost sharing. Farmers could also finance the implementation of certain water efficiency projects.

contract method has been used in other ESCO / Utility DSM contracts in India, e.g., for power factor correction.

- *Payment security mechanism.* ESCOs and their lenders will be concerned with the creditworthiness of the Discom and the likelihood that it will make timely and full payment in accordance with the contract for the full duration of the agreement. For some ESCOs, untimely payments by a Discom could force it to fail to make timely loan repayments and possibly lead to an event of default. A payment security mechanism can be designed to satisfy these concerns. This system can be vetted with prospective lenders, including the DFIs, and interested lenders could then be referred to ESCOs.

- *Project development time, costs and risks.* An ESCO will not earn anything until the project contract is executed and the investments are made. The costs and risks involved in a proposal to develop a project (i.e., to get to the point of project contract execution) are a potential deterrent to an ESCO. Discoms should be well-prepared and collect sufficient and high-quality field data to qualify a project, structure the proposed terms of the project contract in a fair and realistic way, lay the complete groundwork for gaining necessary approvals and decisions for a project, and reflect this preliminary data in the request for proposal (RFP) documents in clear language. This will convey a sense of professionalism and decisiveness to prospective ESCO contractors to instill the confidence to invest the time and expense to develop a project development proposal. Initial RFPs and project contracts should contain flexibility for negotiation. Once experience is gained, the Discom could consider developing a "Standard Offer" contract to shorten the project development cycle and reduce risk.

- *Project size.* We believe there is a correlation between project size and its profitability. Our estimate is that a minimum commercial scale pilot project will be in the range of Rs. 20-40 Crore investment ($5-10 million) and Rs. 100+ Crore ($25+ million) for replication scale projects. This amount of funding can be readily obtained; the key issue will be the structure of the deal and management. If distribution system upgrades are included in the project, this size could be reached easily. As experience is gained, larger projects could be developed. Larger project sizes will serve to recruit interest from larger contracting firms capable of acting as ESCOs.

Definition of an ESCO in India for Ag DSM.

The ESCO concept has been promoted in India and the term "ESCO" has acquired certain a common usage, yet it requires elaboration. For the purposes of this report, the term "ESCO" designates a *turnkey project contractor* offering engineering, project development, project management, equipment procurement, installation, and logistics and operational management. In the ESCO as Borrower model, the ESCO is also responsible for mobilizing finance. In the Discom as Borrower and Industrial Firm as Borrower models and possibly under the agricultural collective franchise approach, ESCOs could be contracted

to provide turnkey project implementation.

In the course of our research, the question was rightly raised: are there any ESCOs in India capable of undertaking Ag DSM projects? If the ESCO as Borrower model is chosen, will the ESCO have the financial capacity to mobilize necessary project financing, including debt and equity?

Research indicates that there are a limited number of firms in India identified as "ESCOs" such as DSCL Energy Services, Asian Electronics, Saket Projects, ElPro, Tata Honeywell, Johnson Controls India, and others.[5] These firms have financed projects on the strength of their balance sheets, though the numbers of projects are growing relatively slowly. The limited number of self-proclaimed ESCOs gives the impression that the ESCO industry *per se* does not yet exist in India in a vibrant way. While this conclusion is valid, there are *many* firms with the strong balance sheets and proven competencies in turnkey project development, engineering, equipment supply, installation and project implementation who are active in the power and infrastructure sectors, e.g., Subash Projects and Torrent, and including firms such Reliance, Tata, and L&T. Some smaller engineering and project management firms may also be interested, including 3CE and Saha Sprague (Bangalore) with specialized interest in DSM, rural power distribution and Ag DSM projects.

There is also strong interest in Ag DSM among manufacturers of pump sets and power distribution equipment, including Bharat Heavy Electricals, Kirloskar, Crompton Greaves, Vijay Electricals and others. The Indian Pump Manufacturers Association has over 100 members and is actively pursuing the development of Ag DSM business, including standards, labeling and branding of efficient pump sets. And while they may not be interested in expanding into the ESCO business, they are 'complementors' in the terminology of game theory who can become vital allies of firms that opt to become ESCOs.

The constraint on development of an ESCO industry may be as much on the demand side as the supply side of the industry. Recruiting capable well-capitalized companies to undertake Ag DSM projects on an ESCO basis is one of the developmental challenges which this Report addresses. Organizing effective demand for ESCO services for well structured projects, that is, with bankable business models, could give rise to an industry response. The thesis of this report is that the ability to attract substantial private sector players will require a minimum threshold deal size and a bankable business model that is scalable. The creation of those conditions could spark the creation of a viable ESCO business in India.

The social components and rural logistics of Ag DSM projects pose special challenges. A prime ESCO contractor will need to assemble teams including equipment manufacturers, after-sale service companies / networks to handle the rural logistics of agricultural pumping installations, expertise in rural power distribution and franchising, and NGOs to deliver programs to farmers.

[5] See Indian Council for Promotion of Energy Efficiency Business website www.iceeb.org for a list of self-identified ESCO companies in India.

4.4 MODEL 3: FARMER AS BORROWER

4.4.1 *Farmer as borrower*. The basic mechanism is depicted in Diagram 3 and would work as follows.

- First, the Discom would conduct a tender to qualify energy efficient pump and motor models and suppliers that meet the target energy efficiency and Bureau of Indian Standards (BIS) standards. Other specifications of efficient pumping systems would also be defined, e.g., concerning foot valves and piping.

- To motivate farmers and make projects economically attractive, a rebate or capital subsidy could be provided to the farmer to defray a part of the costs. Rebate or capital subsidy programs have been used extensively in utility DSM programs internationally for lighting, appliances, motors, compressors, power factor correction and other equipment that creates system benefits for the utility. The concept has also been used successfully in India, e.g., by the Government of Karnataka to provide a subsidy for drip irrigation. The utility would market the program to the target end-users and collect the data farmers need to apply for the subsidy. The subsidy itself would be approved prior to installation, but with payment made after completion of installation and verification of the new system.

- A farmer would procure the pump from one of the certified vendors and pay full cost up front, including installation and all ancillary charges. Pump vendor can provide turnkey installation.

- The eligibility standards for farmers must be defined. The pump system must be within the defined project area, and of the size and nature specified by the utility. Typically, farmers must be regularized customers and current on payment obligations to the utility.

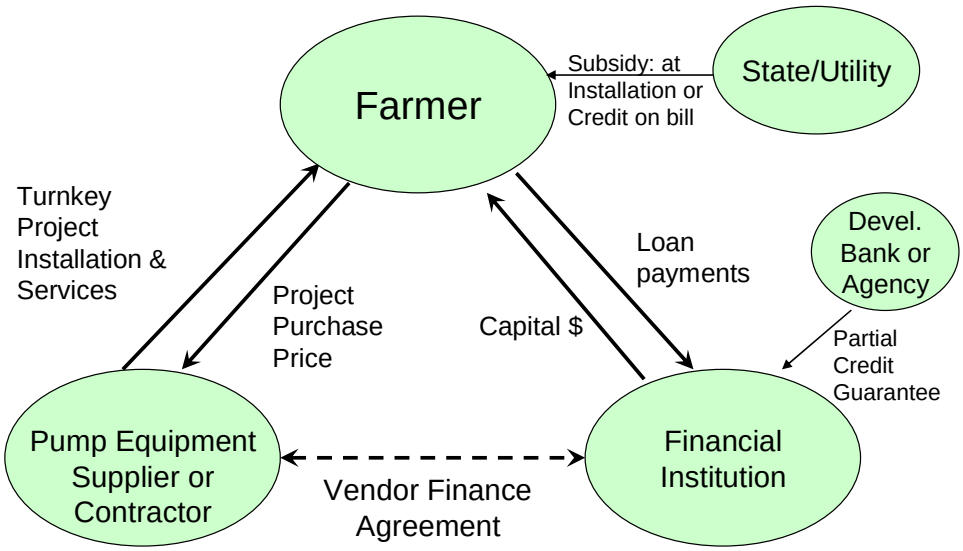
- Variations on the subsidy payment formula can be used to provide an incentive for continued efficient pump performance. Instead of paying the subsidy in full at commissioning of the new pump set, the subsidy could be paid over time (with interest), based on continued efficient performance of the pump set.

- In the Model 3 diagram, financing is offered to farmers from participating lender(s). To assure that many farmers gain access to financing, a partial credit guarantee program can be included to share in farmer credit risk and motivate lenders to make the pump system loans. The Discom should allow the farmers to assign their subsidy payments to lenders or suppliers, with appropriate documentation.

- The documentation required for a subsidy program typically includes:
  - standard offer and marketing literature;
  - qualification of equipment types by specification;

- qualification of vendors and installers;
- an application form for the subsidy;
- baseline and commissioning procedures;
- a subsidy agreement with the farmer for the approved applications; and,
- documents to assign subsidy payments to an equipment supplier/lender.

Model 3: Farmer as Borrower



4.4.2 *Farmer as Borrower: Program Design Issues*. There are several issues with this model.

- *Will farmers have financial incentive to participate?* What are economics from farmer point-of-view? Significant benefits to farmers exist where farmers are paying a sufficiently high price for their power. Cost / benefit analysis from the farmer point-of-view must be conducted to size the appropriate amount of subsidy to provide an incentive to implement a pump system rectification project. In other rebate programs, utilities often launch the program with a high subsidy amount (as a percentage of the cost of the targeted type of energy efficient equipment) under a limited-time offer. Then, as experience is gained with the market response, the amount of the subsidy can be reduced.

- *How will farmers finance their investment?* A complementary program will be needed to offer financing to farmers so they can make instalment payments, perhaps according to their agricultural cycle instead of monthly. If the subsidy is paid after commissioning or over time, the farmers will need financing to bridge the gap.

- *Will the farmers be deemed sufficiently creditworthy by lenders?* Banks could be recruited to participate, perhaps in collaboration with pump manufacturers. If loans for energy efficient agricultural pumps qualify as "green financing" and rural lending, they could help a participating bank meet its preferential sector loan targets.

- *What if the energy efficient pump fails and a farmer replaces it with an inefficient pump?* Will the subsidy continue? How will energy savings be sustained? Will water efficiency investments be included? Provisions addressing all these matters can be included in the program.

- As with other project models, the utility must determine how to market and manage this program. It could, for example, choose to contract out program management and other functions. A budget for the utility subsidy must be established, the source of funding identified, and necessary approvals from State government and the ERC obtained.

The Farmer as Borrower model is fundamentally different from the other models. It relies on the individual motivations and decisions of the many individual farmers to undertake pump system rectification. What kind of market response will there be — especially in the absence of cost-based tariffs — and what kind of results will be achieved? How will program be marketed and will the cost of each "sale" be prohibitive? How much subsidy can be given before it negates the value of the savings achieved?

Elements of the "farmer as borrower" model can be incorporated into other business models (see Section 3.3, Innovative Hybrid Solutions are Possible). Additionally, vendor finance programs could be set up to help farmers acquire water efficiency and drip irrigation investments.

4.5 MODEL 4: INDUSTRIAL FIRM AS BORROWER

The Industrial Firm as Borrower option is depicted in Diagram 4. Industrial companies have strong incentives to self-generate power in order to improve the reliability of their service and lower costs and this creates a risk that the Discom would lose its most profitable customers. This model offers an innovative approach which harnesses the motivations of industry to obtain more reliable and cheaper power to the task of developing Ag DSM projects.

The central concept is to create a means for industrial customers to purchase a portion of the energy saved by an Ag DSM project. The industrial company would enter into a "Saved Energy Purchase Contract" with the Discom under which the Discom would sell a defined portion of the saved energy to the corporate. The amount could be sized as a portion of the actual saved power, both in energy and capacity terms. That would ensure a net benefit to the Discom.

The price for saved energy would be a discount from the current industrial tariff, with the difference representing savings to the industrial customer, which savings would be used to pay for the Ag DSM project. The economics of the deal would have to be tested to confirm that the expected savings are adequate to pay for the Ag DSM program and reward the corporate with a sufficient quantity of cheaper power to make it worth the effort and risk to pursue. Importantly, the Discom must commit to priority dispatch to the industrial customer for delivery of saved energy. Since the industrial customer must be

confident of this commitment, there is a potential role for trading companies, e.g. PTC (the erstwhile Power Trading Corporation) to intermediate this relationship and create confidence in this market arrangement.

The industry would sponsor the project, and could contract with an ESCO to implement, with many terms similar to those in the ESCO as Borrower model. The industry would be responsible for mobilizing the project financing.

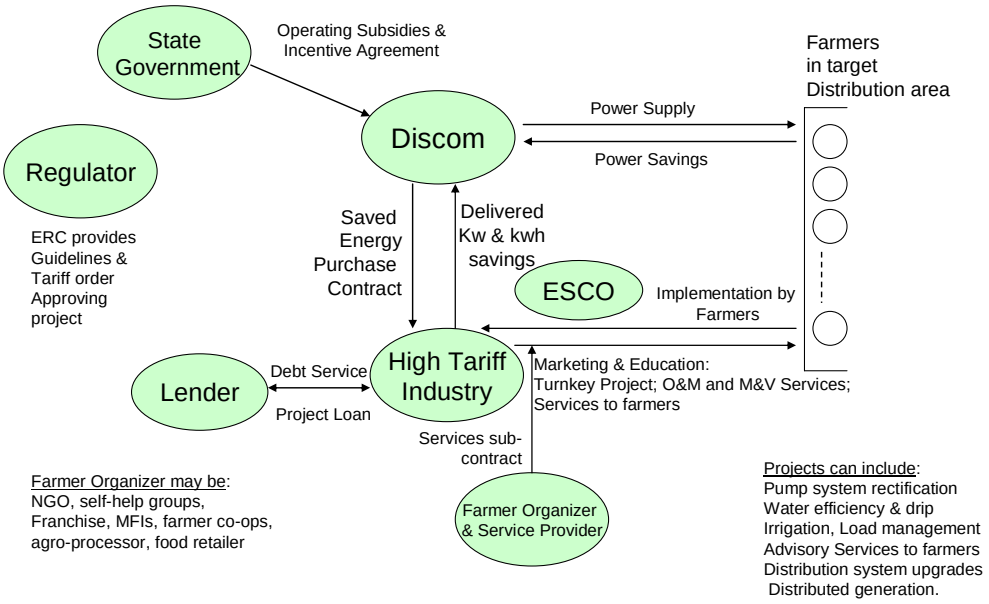
Hybrid arrangements could be developed too. An ESCO could initiate projects under Saved Energy Purchase Contracts, and then contract with industries or power brokers to purchase the saved energy. PTC has expressed interest in this business model, and might enter into a Saved Energy Purchase contract with the Discom directly, and then contract with ESCOs to implement projects. It would sell the saved energy to industrial customers and profit by the difference between (a) the cost of achieving the energy savings via the Ag DSM projects, versus (b) the sale price of saved energy.

The advantage of this approach is that is would create a market dynamic for development of Ag DSM projects. It also capitalizes on an industrial company's motivation to reduce its power cost by making Ag DSM investments. It also operationalizes the principle that saved energy can be valued at a discount from a high industrial tariff, which would greatly improve Ag DSM project economics.

The approach also utilizes ESCO turnkey capacities. A Discom could promote this market by establishing a standard offer Saved Energy Purchase Contract. Once the principle is established, the Discom could conduct procurements for this type of contract, allowing firms to compete on the highest price for the purchase of saved energy.

Implementing this approach will require greater experience with Ag DSM energy savings M&V methodologies than currently exists. There must be high confidence amongst all parties in achieving and verifying the estimated savings. ERC approvals will also be required. After more experience with Ag DSM is gained and know-how increases, this type of Saved Energy Purchase Contract approach can be explored further.

Model 4: HT Industry as Borrower



4.6 PROJECT RISKS & RISK MANAGEMENT

Risk planning, including the identification, evaluation and allocation of risks will be required whichever option is used. Likewise, each model will need a plan to mitigate and manage its unique project risks. As a general statement, risks should be assumed by the party with the best capacities to manage that risk. The only party capable of handling uncontrollable risks is the State or, perhaps, the Discom as its agent. A Discom may choose the ESCO option to reduce the risks it must manage directly, but it still must conduct risk planning as part of its project development process. Even if a Discom has another party assume certain risks, it still will be indirectly exposed to that risk, and should confirm that the risk management plan and capacities of the ESCO or other contract party are sound.

Main categories of risk are project development, construction, equipment / system operations and performance, financial and contractual, and political / regulatory risks. These are summarized below, along with risk mitigation options.

4.6.1 Project Development Risks

Project Development Risks	**Mitigation Strategies**
Expense of project development	• Budget and obtain commitment in advance for adequate funds for project development. • Undertake step-wise project development; begin with a thorough feasibility study; a project's economic benefits will drive development and provide momentum to obtain approvals and participation. • Seek help from BEE, government agencies and development agencies to cover a portion of project development costs.
Farmer resistance thwarts project	• Define early on how the project will benefit farmers. Employ effective community and farmer organizers (NGOs) to educate farmers on project benefits. • Deliver a consistent message on benefits to farmers. • Phase-in project implement so benefits to initial farmers convince other farmers.
Failure to gain political and regulatory decisions approving project	• Present a well documented case, including economic analysis, risk assessment and rate impact to explain why the net potential benefits warrant moving forward • Conduct workshops for stakeholders to inform and coordinate the Government and ERC decision processes, identify key points of concern for their respective decisions and provide the information needed for an affirmative decision.

4.6.2 Construction Risks

Construction risks	Mitigation Strategies
Completing the project • on time, • on budget, • according to specifications.	• Use turnkey contracting methods with normal commercial protections • Include contract provisions with respect to construction schedule, fixed prices, complete equipment specifications, and commissioning and acceptance testing procedures. • Organize project installation in phases. • Include change order provisions in the contract to allow for variations between actual field conditions vs. estimated conditions. • Include bonus/penalty provisions for early / late completion, with bonus and penalty amounts geared to energy savings opportunity costs and construction period interest costs. • Require contractors to provide construction performance bonds • Qualify contractor and equipment suppliers with respect to all skills and capacities, including financial. Select contractor based on ability to meet Ag DSM project challenges.

4.6.3 *Equipment / System Operations & Performance Risks*. Operations period and performance risks can affect project operations costs and savings benefits.

Equipment/System Operations & Performance Risks	Mitigation Strategies
Project equipment performs at lower than intended efficiency levels	• Include and enforce energy efficiency specifications as well as commissioning & acceptance testing protocols in the installation of the contract • Use of (extended) warranties in installation and service contracts • Provide budget for equipment replacement • Plan and budget for some deterioration in equipment performance • Allocate responsibilities & budget for equipment maintenance • Institute M&V system to track equipment performance and energy use and respond with remedial action as needed
Variable/low power quality damages new pump sets	• Power distribution system upgrades and / or conversions to HVDS as a precondition of the pump system rectification
Measurement & Verification risks	• Develop solid baseline through field surveys in project develop. • Design adequate M&V system to monitor consumption • Use M&V results to take corrective actions

Farmer Behavior Risks	Mitigation Strategies
Snap back" behavior, i.e., the improved pump system is used to pump more water to expand acreage under irrigation, etc.	• Include water efficiency measures in the project • Provide ongoing advice to farmers on cropping • Give farmers improved power service with scheduled hours as an incentive • Implement a load management and control system
Farmer replaces pump set with old / inefficient pump set	• Have contractor assume pump set operations • Develop local power distribution franchise

Other uncontrollable risks affecting energy loads	Mitigation Strategies
Water table declines, rainfall, weather: all affecting water quantity pumped and head and hence energy loads	• Design project economics with a sufficient margin of safety so that if / when these risks manifest, the project will still generate net benefits

4.6.4 Financial, Credit and Contractual Risks

Financial, Credit & Contractual Risks	Mitigation Strategies
Discom payment risk; this is a major concern of potential ESCOs	• Institute payment security mechanism based on multi-year budget/tariff order • Design project with strong net financial benefits to Discom & State
Parties fail to honor contractual commitments	• Use normal commercial methods, i.e. proper contract provisions, contractor qualification, payment terms and security provisions etc. Standard contracts can be developed.
Interest rate risk: change in interest rates increase borrowing costs	• Use fixed rate debt structures

4.6.5 Political and Regulatory Risks

Political & Regulatory Risks	Mitigation Strategies
During project development	• Policy coordination among concerned State agencies, ERC and Discom

	• Strong policy framework promoted by States, Central Government, BEE, CERC possibly with project development in-kind and financial support • Design project economics for "win-win" benefits for all parties, especially farmers
During project operations	• Use contractual provisions that are realistic and can be met by concerned parties • Perform M&V to confirm savings • Consider developing agricultural power franchises under the provisions of EA03 to sustain incentives and savings

4.7 SUMMARY EVALUATION OF THE MODEL 1 V. MODEL 2

Both the Discom as Borrower model and the ESCO as Borrower model are viable options. The main differences between these two models are summarized below.

Table : Discom as Borrower vs. ESCO as Borrower

Issue	Model 1: Discom as Borrower	Model 2: ESCO as Borrower
Balance Sheet Impact on Discom	Debt is on the Discom balance sheet; for utilities facing limits on their borrowing capacity this could be a barrier.	Project debt is "off-balance sheet" of the utility, preserving the Discom's borrowing capacity
Discom Own Funds Contribution	Discom capital contribution of 10-30% of total project costs typically required. A portion could come from State Government capital grant.	Utility can contribute "0" funds up-front; or some utility capital contribution (or State grant) could be incorporated in the financing plan.
Lender Requirements & Due Diligence Burden	Payment security mechanism backing project debt required. Lender's primary appraisal is on credit of Utility and State and the payment security mechanism.	Payment security mechanism backing Discom's payment obligations to ESCO required. Lender must appraise and approve ESCO's technical, managerial and financial capacities.
ESCO Equity Requirements	Contractor / ESCO does not contribute equity to the project; therefore more bids are likely for the project.	ESCO must mobilize 20-30% of total project costs as equity; this can be a barrier to entry for potential ESCOs.

Distribution of Project Roles & Risks	Distribution of project roles can be crafted according to Discom preference over range of options from (a) Utility acting as its own contractor, to (z) Utility enters turnkey contract with extended warranties and guarantees. Generally, the Utility assumes more risks and responsibilities as borrower.	ESCO typically provides complete turnkey project installation and services over term of contract. Some roles could be retained by Discom. Generally, ESCO assumes more risks and responsibilities as borrower.
Discom Payment Obligation	Fixed debt service	Payment to ESCO, can be structured several ways: payment for delivered savings; or combination of fixed and variable payments
Project Risk Distribution	Discom can shape the distribution of project risks	ESCO assumes most project risks related to turnkey installation, equipment performance, M&V , etc.
Summary	If the Discom has available funds / borrowing capacity and wants to manage the project directly, then the Discom as borrower option should be considered first. Turnkey contractors could still be used.	If a Discom prefers to outsource, have a contractor assume most project responsibilities and risks, to minimize contribution of own funds and preserve borrowing capacity, the ESCO model should be considered first. Capable ESCOs must be recruited.

5. PROJECT ECONOMICS & FINANCIAL MODEL

We developed a financial model for a hypothetical project based on representative project economics and reflecting a basic "Discom as Borrower" structure and a holistic project design. This total project investment size is Rs. 87.6 Crore ($21.9 million), representing a commercial scale project. In this section we review the principle assumptions that shape the project economics, including capital costs, operating costs, power savings, and project financing. This enables us to review typical values, assess the impact of changes in key variables on the internal rate of return (IRR) and assess overall results. The project financial model Includes cash flow forecasts for the Discom as well as State Government.

The values for this hypothetical project are estimates based on the best available information. The model provides a framework for analysis to be applied to specific project cases. One finding from our analysis is that the outcomes can be sensitive to changes in input assumptions, so the values for all assumptions should be tailored to the context of each candidate site.

5.1 PROJECT SCOPE AND CAPITAL COSTS

The project involves full pump system rectification for all pumps in a given distribution circle. It is assumed that there are 5 sub-stations in the target area, 12 feeders per sub-station and an average of 400 pump sets of all types, per feeder, that are targeted for rectification for a total of 24,000 pump sets.

5.1.1 *Pumping system equipment*. The cost per pump set rectification, including foot valves and both suction and delivery piping is estimated at Rs. 30,000 for equipment and installation. The average pump is 8.1 hp. Depletion of groundwater and declining water tables are driving a shift in demand to submersible pumps so we have used an average value for both mono-block and submersible pumps. A site-specific analysis will be required to develop a definitive analysis of actual field inventory of pumps and specify costs per each pump type. The full system rectification includes right-sizing the design, foot valves and piping for suction and delivery. In the full project cost estimate, a replacement inventory of pumps equal to 5% of total pump system costs is included, (in addition to estimated annual pump system costs).

Project Scope & Unit Costs		
1	# sub-stations	5
2	# of feeders, per substation	12
3	Average pump sets per feeder	400
4	Total pump sets for rectification	24,000
5	Cost per pump set Full rectification	Rs. 30,000

A project involving the procurement of 24,000 pump sets may be able to achieve a volume discount and reduce the per-unit pump set cost. Further, if a State-wide or nation-wide program can be undertaken, the increase in the number of high-efficiency pump sets should be substantial and could be enormous relative to the current output of

pump set manufacturers in India. Assuming reasonable stability in input costs — or the ability to find substitutes — this could create a significant market opportunity for manufacturers and the potential to drive down the per-unit cost of high efficiency pumps. This would be a worthy area for a collaborative study.

5.1.2 *Load Management & Metering*. Load management and metering equipment is included. Total investment in metering and load management is Rs. 1.2 Crore ($300,000) and represents 1.7% of the investment in pump set equipment. The model assumes that individual pump sets will not be metered. Further work is needed to detail, engineer and costs these systems, so this budget should be considered a rough estimate.

5.1.3 *Network Upgrades*. The model assumes the Discom will implement a high-voltage distribution system (HVDS) or the segregation of agricultural feeders in the target project area as a pre-condition to the Ag DSM project. The investment required to achieve the high power quality needed by high efficiency pumps is a mandatory investment that is part of the utility mission and, thus, the capital costs of the network upgrades are not included in the financial model.

5.1.4 *Water efficiency projects*. It is vitally important that water efficiency projects be implemented as part of the project. Investments in drip irrigation can boost savings in electricity by up to 15% while enabling much-needed improvements in water efficiency. The model assumes that these investments are made by the farmers themselves, probably with grant support from the State government, as a means to address increasingly critical groundwater problems. The project does provide a budget for (a) project development costs, as a capital cost, and (b) additional services to farmers, as an operating cost. These budget line items could be used to fund technical support to farmers for water efficiency projects.

5.1.5 *Project engineering & development*. The project includes a budget of 4.3 Crore ($1.08 million) for project engineering and development, including

- field survey work,
- initial education and communication to farmers,
- feasibility studies,
- engineering,
- business and financial advisory services,
- legal,
- DPR preparation, and
- other expenses incurred during the project development cycle.

The Discom, State and other agencies could also provide in-kind staff contributions to help with the coordination of the project. A petition for grant funding could also be made for these expenses.

5.1.6 *Other Project Capital Costs*. Construction period interest is the accumulated interest cost of incurred prior to project commissioning. One Ag DSM project will consist of multiple sub-projects, broken into geographic areas. These sub-projects will likely be commissioned in stages, which will help to minimize net construction period interest costs. Although it may take 18-24 months to complete all stages of a project, each stage individually may only take 3-6 months to complete. Assuming some front-end loading of construction costs for equipment purchases, and level disbursements for the balance of installation, net construction period interest for multiple six-month project stages is estimated at

4% of the equipment and installation cost. Fees associated with closing the project debt financing are budgeted at about 1% of the project loan amount. A contingency equal to 4% of the total pump set rectification costs is also included.

5.1.7 Total Project Capital Costs.

Total project capital costs are summarized below.

	Project Capital Costs	INR (Crore*)	USD
1	Equipment & installation, pump set rectification	72.00	18,000,000
2	Replacement equipment inventory	3.60	900,000
3	Load management & metering systems/equipment	1.20	300,000
4	Conversion to HVDS	0.00	0
5	Water efficiency investments	0.00	0
6	Project engineering & development	4.32	1,080,000
7	Finance fees	0.72	180,000
8	Construction period interest	2.88	720,000
9	Other, Contingency	2.88	720,000
10	Total Project Costs	87.60	21,900,000

* Crore = 10,000,000

5.2 OPERATING COSTS

5.2.1 *Pump set Maintenance*. Annual maintenance cost per pump set is budgeted at an average of Rs. 2,000 per year. The Discom would be responsible for these costs, to assure equipment performance, although it could outsource these activities. An equipment replacement allowance has been capitalized and included in the budget in an amount equal to 5% of the value of replacement pump sets. In practice, pump set maintenance is likely to be higher in the latter years, so unspent funds can be reserved in a repair fund.

5.2.2 *Monitoring & Verification and Project Administration*. Feeder level metering and load management equipment are budgeted as part of the project's capital costs. These systems can include a central computer system to monitor and report data. An annual operating budget of Rs. 0.48 Crore ($120,000) is included, in addition to Discom administrative costs of an equal amount, Rs. 0.48 Crore.

5.2.3 *On-going Services to Farmers and Communities*. The holistic project approach includes organizing farmers and communities, and providing additional services to farmers on agricultural matters. These services can be coordinated with other community development functions and agencies. In addition, Discoms may elect to use the Ag DSM project to promote the establishment of agricultural

distribution franchises. In this project case, annual expenditures of Rs. 0.88 Crore ($220,000) are included in the project operations budget to perform these functions. Funds are also included in the project development budget for the initial organizing and marketing efforts that will be required for the first four years of the project.

5.3 POWER COSTS OF SERVICE SAVINGS CALCULATION

5.3.1 *Quantity of saved energy, kwh in water pumping*. Based on assumed annual hours of operation of 1,652 hours, the total annual power consumption equals 239,699 MWh. Estimated power savings achievable from the pump rectification is estimated at 42.5%, attributable to right sizing, improved motor and pump efficiency, and installation of foot valves and lower friction piping and pipe design. This savings value is based on performance data from prior pump efficiency programs and is deemed reasonable. Efficiency gains of 50% are technically feasible and have been achieved on some pilot projects. However, our study of earlier pilot projects concluded that those gains were not sustained so we have discounted it[1]. Further deterioration in performance is assumed and estimated at 2% of the base year savings per year. Based on these values, annual reduction in MWh consumption of the target pumps will be 101,872 MWh.

5.3.2 *Savings Calculation*. In this hypothetical case, the Discom's cost of supply to the agricultural pumps is Rs. 2.92 /kWh. This value represents the *delivered cost* including the distribution losses incurred delivering the power to the pump set in addition to the power generation costs. This value is also averaged for an estimated time of day usage pattern. This value is calculated based on Rs. 2.10 per kwh with distribution losses estimated at 28%. With distribution losses at this level, the Discom must put 1.39 kwh into the distribution system in order to deliver 1.00 kWh to the agricultural pumps. The Discom's revenue realization is estimated at Rs. 0.40 /kwh used by the target agricultural pumps.[2] Thus, the Discom's net costs of supply to the target pumps is Rs. 2.52 /kwh. On this basis, the project's base year annual power cost savings for the Discom is Rs. 25.64 Crore ($6.4 million).

Savings Calculations		
1	Average HP per pump	8.10
2	KW per HP	0.7462
3	Average kW per pump	6.04
4	Average daily hours of operation	6.8

[1] WENEXA-II's survey of pump efficiency pilot projects in India concluded that even though efficiency gains of about 50% were achieved at the point of installation, few if any of those projects sustained the gains. It appears that some pilots experienced snapback to original levels within six to 12 months and others may have actually triggered increased consumption. However, the prime causes were managerial not technical. That creates the possibility that, with proper management, the level of sustainable gains might be higher than assumed in the model.

[2] This value is average for both authorized and unauthorized pumps. Unauthorized pumps can be included in the project scope, provided the farmer formalizes a relationship with the SEB. Revenue realization for unauthorized pumps is assumed to be 0, lowering the average revenue for all pumps in the target group.

5	Average days per year	243
6	Average annual hours of operation per pump	1,652
7	Annual kwh consumption per average pump	9,987
8	Annual MWh consumption, target pumps, before project	239,699
9	Reduction in Electricity Load & Consumption (as %)	42.50%
10	Annual deterioration in efficiency gains	2.00%
11	Annual kwh savings per average pump	4,245
12	kW load reduction for average pump	2.57
13	Discom ave. wholesale power cost, busbar, Rs. per kwh	2.10
14	Distribution losses, %	28.00%
15	Discom Cost of Service to Ag Pumps, delivered (Rs. per kwh)	2.92
16	Discom revenue realization on Ag Pump power (Rs. per kwh)	0.40
17	Discom net costs of service (Rs. per kwh)	2.52
18	Annual reduction in MWh consumption for target pumps	101,872

An even better way to value saved power would be to use the long run avoided costs, which value would include avoided capital costs to produce equivalent power. That is an economically sound and conceptually superior approach that successful DSM programs around the world use. DSM, to be successful, must be sustained over time and must be implemented programmatically, not just for one-off projects. When this occurs, the aggregate kW savings from DSM implementation will add up and result in avoided capital costs. This single hypothetical project would save the equivalent of 46 MW. Several such projects, implemented over a period of years, would have the potential to save GWs in power capacity. If saved energy was valued properly, the investment would be justified and undertaken. In power-short India, that will make a big impact on the country's power supply balance. Even though it is not included in this model, the long-run avoided cost should be calculated and used to produce a better value for saved energy.

An additional consideration is that, until remedial action begins to take effect, the problem will continue worsening. The situation is not static. Price elasticity of demand will continue to stimulate the indiscriminate use of electricity and the continued degradation of underground water sources. The longer the delay in launching corrective action, the greater will be the magnitude of the problem. In fact, for a problem that came into being in the last generation only, the momentum might be difficult to reverse until there is an agricultural calamity. It would be difficult to place an economic and social value on that potential outcome, but it would be significant.

5.4 PROJECT FINANCING PLAN

Sources of funds for project financing are assumed to come from three sources: State or Central government grants, equity and debt. A debt/equity ratio of 70/30 is assumed.

A State / Central grant equal to 5% of total project costs is assumed. This amounts to Rs. 4.38 Crore ($1.1 million). This amount is approximately equal to total project development costs. Some grant funding from the Central government is assumed for project development costs. The availability of such grants remains to be determined on a State-by-State basis. State grant support could be justified on the basis of benefits the Ag DSM projects will generate for the State, Discom, and farmers. Farmer benefits could include: better reliability and availability of power, lower pump system maintenance costs, more efficient use of existing water supplies and improved crop yields. These benefits should translate to improved farmer income. Some business models may also provide financial benefits to farmers or farmers' collectives based on energy savings and/or CDM credits earned.

Equity is estimated to derive from Discom capital contribution and is set at 30% of the total project costs net of the estimated Government grant. The balance of project costs would be funded on a project basis. A seven year term loan, plus the construction period (which may be as long as 18-24 months) is estimated. A longer term may be possible, but a seven year loan is recommended for consideration to be a conservative length relative to the pump system useful life, which is estimated to be 10-20 years with proper maintenance.

A fixed interest rate of 11.25% is estimated. This value is slightly aggressive, but the Power Finance Corporation's (PFC's) term loans for transmission and distribution upgrades are priced at about 11.5% and the possibility of a rate of 11.25% was mooted in discussion. Furthermore, the inflation rate and interest rates are trending down in India, and, as Ag DSM is deemed a priority sector, a lower interest rate may be possible.

Other methods should be explored to lower lending costs. Since these loans can help lenders fulfill their environmental and agricultural preferential sector lending requirements, they may (as has been the case with other equipment) qualify for a lower interest rate.

	Project Financing Plan	**INR (Crore)**	**USD**
1	State Government grant	4.38	1,095,000
2	Net Project Cost to Finance	83.22	20,805,000
3	Discom capital contribution, %	30.00%	
4	Discom capital contribution	26.28	6,570,000
5	Total equity	26.28	6,570,000
6	Equity as % total project costs	30.00%	
7	Total debt	61.32	15,330,000
8	Debt as % of total project costs	70.00%	

9	Debt term, years	7	
10	Interest rate	11.25%	Fixed rate
11	Annual debt service	13.12	3,279,582

5.5 PROJECT CASHFLOW AND SUMMARY BENEFITS

Based on these values for capital costs, operating costs and financing plan, the project cash flow can be estimated for year 1 as follows.

	Base Year Project Savings Calculation for SEB	**INR (Crore)**	**USD**
1	Discom Annual power cost savings for target pumps, Rs. Crore	25.64	6,409,458
2	Debt Service, principal & interest	13.12	3,279,582
3	Pump system maintenance costs	4.80	1,200,000
4	Measurement & Verification costs	0.48	120,000
5	Discom Project Administration	0.48	120,000
6	Additional Services to Farmers & communities (4 years)	0.88	220,000
7	Total Annual Costs	19.76	4,939,582
8	Net Project Benefit	5.88	1,469,876

5.5.1 *Project Cash Flow*. A 10 year project cash flow table has been prepared. Year to year, inflation rates are applied to project operating costs and to the Discom's costs of power supply and revenue realization. A 4% rate has been used. The deterioration in pump system efficiency has also been applied.

5.5.2 *Summary: Benefits to State and Discom*. Project cash flows from the State and Discom perspective are included. First, the annual State subsidy to the Discom to cover its net costs of power supply to targeted agricultural pumps is estimated before implementation of the project. After the project has been implemented, the State prior amount of the subsidy will be reduced although payments will continue at the prior level until the program investment is paid. Thus, the subsidy will pay for (i) the Discom's ongoing but reduced net costs of power service to the target pumps, (ii) the project debt service and other operating costs to implement the Ag DSM program, plus (iii) an incentive payment to the Discom, calculated as a share of the net project savings. In this case, the share of the net savings retained by the Discom is set at 50%. This results in net savings to the Discom after all project costs of Rs. 2.94 Crore, (over $730,000). Of course, this distribution of benefits is subject to negotiation between the State and the

Discom. It can also change over time. Further, eligible Discom uses of these funds could be prescribed in a State/Discom Incentive Agreement.

The net savings value is estimated to grow slightly, reflecting the increased estimated costs of Discom power service to the agricultural pumps, net of increasing project operating costs and decreasing efficiency gains. Project savings benefits are calculated for the loan term and for ten years, in both cumulative and net present value terms (using the loan interest rate as the discount rate for the NPV calculation). Further, the internal rate of return on equity is calculated. Summary results are as follows.

Summary Results			USD
1	Year 1, Net Project Savings, Rs. Crore	Rs. 5.88	1,469,876
2	Cumulative Project Net Savings, over debt term	Rs. 49.08	12,269,967
3	Cumulative Project Savings, over 10 years	Rs. 138.64	34,660,800
4	Present Value of Project Net Savings, over debt term	Rs. 31.88	7,971,068
5	Present Value of Project Net Savings, over 10 years term	Rs. 66.28	16,569,667
6	Project IRR on Equity, over debt term	17.17%	
7	Project IRR on Equity, over 10 years	30.73%	
8	Debt Service Coverage ratio on TRA, Year 1	1.95	

5.5.3 *Summary Analysis*. These results are sensitive to key project economics factors, some highly sensitive, including pump set rectification costs, percentage reduction in pump set power consumption, and the Discom's costs of power supply. We believe these assumptions are reasonable based on our experience with Ag DSM, including on the WENEXA II pilot project in India, our survey of other pilot projects and information and insight gained from other experts in this area. Nonetheless, the actual values for any given project will be company-and site-specific and can only be determined in the context of a specific project and the characteristics of the applicable Discom.

In this hypothetical project case, as currently estimated, the Ag DSM project investment can pay for itself from power cost savings, and generate net benefits for the State and the Discom. The return on equity investment is acceptable, especially when projected beyond the loan term. A longer loan term could be considered to improve net savings benefits in the early project years and to enhance the IRR.

The holistic Ag DSM project approach recommended in this report involves extra costs for services to farmers and farm communities. This project model is useful to test whether estimated projects remain attractive when these extra costs are added. The preliminary conclusion is: yes, they are. Furthermore, the Ag DSM project can open the way to reform and rationalization of the rural and agricultural power which could provide additional benefits not accounted for in this analysis.

5.5.4 *Debt Service Coverage Ratio: the Lender's Viewpoint*. Under the proposed payment security mechanism, the State would enter into a multi-year budget agreement with the Discom to provide a budgeted subsidy amount for the project. With the project, the State subsidy amount is assumed to pay for (i) the Discom's reduced net costs of power service to the target pumps which have been rectified, (ii) the project debt service and other operating costs, plus (iii) an incentive payment to the Discom, calculated as a share of the net project savings. State payments would flow into a Trust & Retention Account (TRA) for the project. From this account, the Discom will pay its project debt service and other project operating expenses, and its net costs of power service for the targeted pumps. The lender will be interested to understand the debt service coverage ratio (DSCR), that is, the ratio between (a) funds available for debt service in this account, to (b) project debt service, principal and interest. The project cash flow projection performs this calculation.

In the TRA Agreement and Loan Agreement, payment of debt service will have first call on available TRA funds so that, to the extent that the power cost savings do not materialize, the lender is not exposed to Discom payment risk. This will be an aspect of negotiation of these agreements. For the purposes of calculating the DSCR, however, the Discom's payments of its net power costs of service are assumed to be paid *prior* to debt service. On this basis, the DSCR in Year 1 is estimated at 1.61, which is strong. This value rises over the loan term.

5.6 CARBON VALUES

The pump set rectification project will generate an estimated 101.872 MWh per year in annual reduction in power use. In India, the average carbon intensity of the power system is relatively high, at approximately 0.90 kg CO_2/kwh. On this basis, annual emissions reductions are estimated at 91,685 tons per year CO_2. Given a value of $20/ton for certified emissions reductions, and an estimated revenue realization of this value of 80% net of all costs for certifying and marketing the CERs, the annual value of CER sales could be over Rs. 5.8 Crore or $1.4 million. This represents significant revenue potential — more than 40% of project debt service and equal to the project's net benefit — that will improve the project economics and may incentivize the parties to undertake the project. Thus, capture of carbon values should be pursued as part of a project development plan.

Carbon Values, Estimate		
1	Annual MWh savings	101,872
2	carbon intensity of power system, tons CO2 per MWh	0.90
3	Annual tons CO2 savings	91,685
4	Value of one ton CO2, CER	$20
5	% revenue realization for project sponsor, net expenses	80.00%
6	Annual revenues, $	$1,466,959
7	Annual revenues, Rs Crore	5.87

5.7 ESCO AS BORROWER OPTION

A similar project financial model could be prepared for the ESCO as borrower option. Certain adjustments would be required to accommodate this model.

Most of the project equipment is likely to qualify as energy efficiency equipment and therefore be eligible 80% declining balance accelerated depreciation.[3] This treatment will provide shelter for a company's tax liability and improve after-tax returns. For certain financing structures, it may lower the ESCO's cost of capital. Experience indicates that a pre-tax cash-on-cash return on equity of 25%+, and an after-tax return in the high teens would likely be needed to attract an ESCO.

The ESCO may also incur certain additional capital costs for overhead and profit. The State and Discom can help lower an ESCO's project development period and farmer organizing costs by helping them access grant funding for these purposes. The ESCO may also be able to better reduce equipment capital and operating costs by negotiating volume purchases of pump sets and extended warranty and service agreements, for example.

The ESCO may be able to assume responsibility for capturing carbon values, sharing revenues with the Discom, and use this as a means to boost returns. Further, there may be additional related business opportunities involving development of agricultural power franchises, for agricultural power distribution system operations services, for example, that the ESCO will be well positioned to capture by virtue of implementing the Ag DSM project. These could also help boost ESCO returns and make the project more attractive.

[3] 80% of the depreciable basis can be expense in year 1; 80% of the remaining depreciable basis can be expensed in year 2, etc.

6. MAJOR CONCLUSIONS & RECOMMENDATIONS

6.1 MAJOR CONCLUSIONS

In the course of conducting the analysis to develop this report, a number of overarching issues emerged that we present here as major conclusions relevant to the development and implementation of successful Ag DSM projects. Some are directly relevant to project design and development whereas others are by-products of the study effort. They are presented below.

6.1.1 *The proper allocation of risks, responsibilities and rewards is the key to a sustainable solution* - Financing solutions can be crafted from a basic set of ingredients that have been demonstrated in other DSM projects. This report outlines four basic scenarios that embody the same ingredients. The basic ingredients can be implemented as presented or as hybrids but the core of any solution rests in getting the incentives aligned properly. Up to now, proposed solutions have underweighted the role of farmers in success. Whatever solution is adopted must link risks, responsibilities and rewards in a way that encourages the various players — especially Government and farmers — to behave in a manner that supports the continuous reinforcement of a common goal, i.e. to use electricity and water resources in the most efficient manner practicable. The body of this report deals with these issues, including the pros and cons of each.

6.1.2 *Use long-term marginal cost to value Ag DSM* – A central question in analyzing a proposed Ag DSM project is how to value saved energy. Should saved energy be valued at the average wholesale rate or at the rate in effect when energy is saved, i.e. a higher value during peak periods and a lower value overnight? This report uses an estimate of the bus bar cost based on an estimate of usage patterns, including the impact of distribution losses. But even this may not reflect the full value of saved energy. As noted in the report, a reduction in electricity consumption will also reduce the supply-demand gap in power. If the proportion of electricity used in agricultural pumping today could be reduced to the proportion of 25 years ago, India's supply gap would disappear. While that may not be possible given the increased role of groundwater in agricultural irrigation, a better estimate of the value of Ag DSM would include the long-term marginal cost of supply. That could put the economic viability of Ag DSM in a different light.

6.1.3 *Recognize that the implications of inaction go well beyond economics* – Even the incorporation of long-term marginal cost may not recognize the full cost of inaction. The current problem — which is not isolated to India — came into being in the past generation only. It would appear that current trends will not be sustainable for another generation. A failure to provide sustainable water for agriculture would lead to crop failures and severe social impacts. Thus, the impact of inaction that will allow the problem to become more serious should be factored into decisions on Ag DSM.

6.1.4 *Adopt a flexible and segmented approach* – There may not be any "one size fits all" solution to the problem. A flexible approach should be adopted to enable a variety of schemes and allow a segmented marketing approach, i.e. encourage solutions for high-impact areas first.

6.1.5 *Success lies in the implementation of a workable plan* – As with business strategy, success resides in implementation. Even the simplest of administrative

mechanism will require a great effort and effective collaboration among powerful stakeholders. This suggests that the simplest solutions will have the highest probability of success. It also suggests that an incremental approach that encourages experimentation will provide for learning by doing and a feedback loop to incorporate lessons learned to improve the process.

6.1.6 *Learn from the past and emphasize site-specific analysis* – There is a tendency in practical human affairs to relearn the lessons of history. The solution to the water-energy nexus as it relates to agricultural pumping appears deceptively simple. The solution may look simple, at least initially, but the reality is much more complex. The problem is actually a constellation of complex issues. The way one piece of the puzzle is solved will affect another. Our survey of prior pump efficiency pilots revealed what appears to be a pattern of common errors made in good faith based on what was known at the time, and our own struggle to resolve them on WENEXA triggered our decision to look to other pilot projects. The lessons learned from those pioneering projects have made it possible to learn from experience. This is the source of our commitment to a holistic approach involving both water and electricity. It is also the source of our conviction that a thorough analysis of the site-specific conditions that shape what is doable for any given project is essential.

6.1.7 *Encourage experimentation* – Since there may not be a “one size fits all” solution, innovation and experimentation should be encouraged. Pilot projects to test different approaches should be encouraged rather than allowing further delay while searching for an optimum solution. New initiatives need to be thoroughly analyzed, intelligently framed and adequately resourced. They will also require strong support from Government. But a solution (or solutions) will not be discovered on a desktop. The testing must be moved to the field. The cost of even multiple pilot projects would pale against the consequences of a failure to find a sustainable solution, so action should be encouraged. If pilot projects were viewed as research and development (R&D) activities, they would not be subjected to the same strict tests as a commercially proven venture.

6.2 RECOMMENDATIONS

6.2.1 *Create a framework to advance the state of the art in Ag DSM* – India’s Bureau of Energy Efficiency is leading an initiative to create a workable framework for implementing Ag DSM. The complexity, scope and scale of the problem are breathtaking, and BEE’s initiative is an opportunity for States, various ministries and development finance institutions to join in a collaborative effort to create a solution.

6.2.2 *Communicate the case for Ag DSM* – One of the difficult realities of the water-energy nexus is how few people have more than a superficial understanding of the complexities. Studies of change management have shown that this is a typical occurrence. Developing consensus and achieving legitimacy for Ag DSM programs requires a broad public understanding of the issues. Thus, a simple but very important (but often overlooked and / or under-resourced) first step is to marshal the facts and conduct the analysis needed to establish a compelling case for change. In the case of Ag DSM, this should involve a range of activities including the logical analysis of the technical and economic aspects of the problem (much of which has already been done by experts in this field) and the documentation of workable and "bankable" business models, as presented in this report. These ingredients would provide the ingredients to conduct an effective

campaign to inform and educate key stakeholders, including farmers. This should include articles and regional seminars as well as one-on-one meetings with key decision-makers and workshops tailored to individual State Governments and Discoms in addition to a grass-roots effort to educate farmers to enable their informed participation.

6.2.3 *Estimate the long-term marginal cost of saved energy* – The economics of Ag DSM are sensitive to the value of saved energy. If the avoided cost of new generation was factored into the equation, it would change the picture for many potential Ag DSM projects.

6.2.4 *Assess the social impact of a potential failure of agricultural water supply* – The full cost of failure goes well beyond economics. A water supply failure would be tantamount to crop failure and while the early impacts may be scattered and regional, the consequences could involve an increase in the price of basic foodstuffs and an increase in regional migration from rural to already-stressed urban areas. A study of the potential failure of irrigation water should be done to assess the likelihood it will occur, by region, and to estimate the time horizon for implementing a solution.

6.2.5 *Create a scheme to indemnify qualified projects against uncontrollable risks* – One of the ongoing topics of debate in the search for a solution to the crisis in irrigation water involves the issue of top down vs. bottom up solutions. Top down typically relates to the proper role of government whereas bottom up relates to the literal grass roots, i.e. farmers and farming communities. A significant problem getting Ag DSM projects launched is the high initial cost and the high level of unknowns and uncertainties associated with any individual project. Thus, while the efficacy of Ag DSM is known, it is difficult to take the first step. If Government created a scheme to indemnify qualified projects if they did all the right things but failed because of unforeseen and uncontrollable factors, e.g. undetected geological factors, a project promoter would be able to focus on known and controllable factors. The unknown factors could be delimited and a cap placed on indemnification. If a project could document that it had followed prescribed process and met predetermined standards, it could qualify for indemnification in the event of a failure due to uncontrollable factors. Implementing such a scheme would require a clear specification of requirements, a project registry and an audit capability (which might be coupled with CDM) to ensure compliance. However, the very existence of such a compliance mechanism would encourage compliance with best practices.

6.2.6 *Launch an R&D program to develop rugged, low-cost, high-efficiency pumps* – “If you can’t raise the bridge, then find a way to lower the water.” This adage applies to pumps. An innovation in pump technology would be a timely accelerator for the implementation of Ag DSM. Creating this program would be an appropriate role for the Centre and could, as a by-product, encourage the development of this manufacturing sector. It could also provide an opportunity to harness India’s world class technical institutes and industry to help solve a pressing social need.

APPENDIX A: SAMPLE PROJECT FINANCE MODEL

India Ag DSM Project Finance Model
SEB/Discom as Borrower

Project Scope & Unit Capital Costs			
1	# sub-stations	5	
2	# of feeders, per substation	12	
3	Average pumpsets per feeder	400	
4	Total pumpsets for rectification	24,000	
5	Cost per pumpset. Full rectification	Rs30,000	ave monoblock + submersible
6	Metering & load management capital costs per pump	Rs0	$0
7	Metering & load management capital costs per feeder	Rs200,000	$5,000
Savings Calculations			
1	Average HP per pump	8.10	
2	KW per HP	0.7462	
3	Average kW per pump	6.04	
4	Average daily hours of operation	6.8	
5	Average days per year	243	
6	Average annual hours of operation per pump	1,652	
7	Annual kWh consumption per average pump	9,987	
8	Annual MWh consumption, target pumps, before project	239,699	
9	Reduction in Electricity Load & Consumption (as %)	42.50%	
10	Annual deterioration in efficiency gains	2.00%	
11	Annual kWh savings per average pump	4,245	
12	kW load reduction for average pump	2.57	
13	SEB average wholesale cost of power, busbar, per kWh	Rs2.10	
14	Distribution losses, %	28.00%	
15	SEB Cost of Service to Ag Pumps, delivered, Rs per kWh	Rs2.92	
16	SEB revenue realization on Ag Pump power, per kWh	Rs0.40	ave, incl unauthorized pumps
17	SEB net costs of service, Rs per kWh	Rs2.52	
18	Annual reduction in MWh consumption for target pumps	101,872	
19	kW load reduction for target pumps	61,651	
20	SEB Annual power cost savings for target pumps, Rs. Crore	Rs25.64	$6,409,458
21	Rs/$ exchange rate	Rs40.00	
Project Capital Costs		**Rs, Crore**	**$**
1	Equipment & installation, pumpset rectification	Rs72.00	$18,000,000
2	Replacement equipment inventory at 5%	Rs3.60	$900,000
3	Load management & metering systems/equipment	Rs1.20	$300,000
4	Conversion to HVDS	Rs0.00	$0
5	Water efficiency investments	Rs0.00	$0
6	Project engineering & development	Rs4.32	$1,080,000
7	Finance fees	Rs0.72	$180,000
8	Construction period interest	Rs2.88	$720,000
9	Other, Contingency	Rs2.88	$720,000
10	Total Project Costs	Rs87.60	$21,900,000
Project Operating Costs		**Rs**	**$**
1	Annual maintenance costs per pump	Rs2,000	$50
2	Annual M&V costs, per pumpset	Rs200	$5
3	Annual SEB project Administration costs, per pumpset	Rs200	$5
4	Annual services to Farmers, per farmer	Rs800	$20
5	Annual services to communities, per Panchayat	Rs100,000	$2,500
6	# of years for delivering additional services to farmers	4	
7	# of participating farmers	8000	
8	# of Panchayats	24	
9	Inflation rate	4.00%	

India Ag DSM Project Finance Model
SEB/Discom as Borrower

Project Financing Plan		**Rs, Crore**	**$**
1	State Government grant at 5%	Rs4.38	$1,095,000
2	Net Project Cost to Finance	Rs83.22	$20,805,000
3	SEB capital contribution, %	30.00%	
4	SEB capital contribution	Rs26.28	$6,570,000
5	Total equity	Rs26.28	$6,570,000
6	Equity as % total project costs	30.00%	
7	Total debt	Rs61.32	$15,330,000
8	Debt as % of total project costs	70.00%	
9	Debt term, years	7	
10	Interest rate	11.25%	fixed rate
11	Annual debt service	Rs13.12	$3,279,582
Base Year Project Savings Calculation for SEB		**Rs, Crore**	**$**
1	SEB Annual power cost savings for target pumps, Rs. Crore	Rs25.64	$6,409,458
2	Debt Service, principal & interest	Rs13.12	$3,279,582
3	Pump system maintenance costs	Rs4.80	$1,200,000
4	Measurement & Verification costs	Rs0.48	$120,000
5	SEB Project Administration	Rs0.48	$120,000
6	Additional Services to Farmers & communities (4 years)	Rs0.88	$220,000
7	Total Annual Costs	Rs19.76	$4,939,582
8	Net Project Benefit	Rs5.88	$1,469,876
9	Share Net Benefits retained by SEB	50.00%	
10	Net Benefits retained by SEB as Incentive	Rs2.94	$734,938
Carbon Values, Estimate			
1	Annual MWh savings	101,872	
2	carbon intensity of power system, tons CO2 per MWh	0.90	
3	Annual tons CO2 savings	91,685	
4	Value of one ton CO2, CER	$20	
5	% revenue realization for project sponsor, net expenses	80.00%	
6	Annual revenues, $	$1,466,959	
7	Annual revenues, Rs Crore	Rs5.87	
Summary Results			
1	Year 1, Net Project Savings, Rs. Crore	Rs5.88	$1,469,876
2	Cumulative Project Net Savings, over debt term	Rs49.08	$12,269,967
3	Cumulative Project Savings, over 10 years	Rs138.64	$34,660,800
4	Present Value of Project Net Savings, over debt term	Rs31.88	$7,971,068
5	Present Value of Project Net Savings, over 10 years term	Rs66.28	$16,569,667
6	Project IRR on Equity, over debt term	17.17%	
7	Project IRR on Equity, over 10 years	30.73%	
8	Debt Service Coverage ratio on TRA, Year 1	1.95	
			14-Jan-08

		1	2	3	4	5	6	7	8	9	10	
SEB Cashflow		**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Totals**
Calculation of Savings												
1 SEB Cost of Service to Ag Pumps, Rs per kWh		Rs2.92	Rs3.03	Rs3.15	Rs3.28	Rs3.41	Rs3.55	Rs3.69	Rs3.84	Rs3.99	Rs4.15	
2 Cost of Service to Ag Pumps, % incr. over prior yr			4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	
3 SEB revenue realization on Ag Pump power, per kWh		Rs0.40	Rs0.42	Rs0.43	Rs0.45	Rs0.47	Rs0.49	Rs0.51	Rs0.53	Rs0.55	Rs0.57	
4 SEB revenue on Ag pumps, % incr. over prior yr			4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	
5 SEB net costs of service, Rs per kWh		Rs2.52	Rs2.62	Rs2.72	Rs2.83	Rs2.94	Rs3.06	Rs3.18	Rs3.31	Rs3.44	Rs3.58	
6 Annual MWh consumed, target Ag pumps, before project		239,699	239,699	239,699	239,699	239,699	239,699	239,699	239,699	239,699	239,699	
7 SEB Net Costs of Service to target Ag Pumps before project, Rs Crore		Rs60.32	Rs62.74	Rs65.25	Rs67.86	Rs70.57	Rs73.39	Rs76.33	Rs79.38	Rs82.56	Rs85.86	
8 Pumping system reduction in power use, with project		42.50%	41.65%	40.82%	40.00%	39.20%	38.42%	37.65%	36.90%	36.16%	35.43%	
9 Annual reduction in MWh consumption for target pumps		101,872	99,835	97,838	95,881	93,964	92,084	90,243	88,438	86,669	84,936	
10 SEB Annual Net Costs of Service after project, Rs Crore		Rs34.69	Rs36.61	Rs38.62	Rs40.71	Rs42.91	Rs45.20	Rs47.59	Rs50.09	Rs52.71	Rs55.44	
11 **SEB Annual Savings in costs of services, Rs. Crore**		Rs25.64	Rs26.13	Rs26.63	Rs27.14	Rs27.66	Rs28.20	Rs28.74	Rs29.29	Rs29.85	Rs30.42	
SEB Project Costs												
12 Annual inflation rate on operations costs		4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	
13 Debt Service, principal & interest		Rs13.12	Rs13.12	Rs13.12	Rs13.12	Rs13.12	Rs13.12	Rs13.12	Rs0.00	Rs0.00	Rs0.00	Rs91.83
14 Pump system maintenance costs		Rs4.80	Rs4.99	Rs5.19	Rs5.40	Rs5.62	Rs5.84	Rs6.07	Rs0.00	Rs0.00	Rs0.00	Rs37.91
15 Measurement & Verification costs		Rs0.48	Rs0.50	Rs0.52	Rs0.54	Rs0.56	Rs0.58	Rs0.61	Rs0.00	Rs0.00	Rs0.00	Rs3.79
16 Additional Services to Farmers & communities (4 years)		Rs0.88	Rs0.92	Rs0.95	Rs0.99	Rs0.00	Rs0.00	Rs0.00	Rs0.00	Rs0.00	Rs0.00	Rs3.74
17 SEB Project Administration		Rs0.48	Rs0.50	Rs0.52	Rs0.54	Rs0.56	Rs0.58	Rs0.61	Rs0.00	Rs0.00	Rs0.00	Rs3.79
18 Total Annual Costs		Rs19.76	Rs20.02	Rs20.30	Rs20.59	Rs19.86	Rs20.13	Rs20.41	Rs0.00	Rs0.00	Rs0.00	Rs141.06
19 Net Project Benefit after all project costs		Rs5.88	Rs6.11	Rs6.33	Rs6.56	Rs7.81	Rs8.07	Rs8.33	Rs29.29	Rs29.85	Rs30.42	Rs138.64
20 Share Net Savings retained by SEB		50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	Rs5.00
21 Net Benefits retained by SEB, as Incentive Payment		Rs2.94	Rs3.05	Rs3.17	Rs3.28	Rs3.90	Rs4.03	Rs4.17	Rs14.64	Rs14.93	Rs15.21	Rs69.32
State Government and Trust & Retention Account Cashflow												
22 Annual State Subsidy to SEB for net service costs, before project		Rs60.32	Rs62.74	Rs65.25	Rs67.86	Rs70.57	Rs73.39	Rs76.33	Rs79.38	Rs82.56	Rs85.86	Rs724.26
23 Annual State Subsidy to SEB for net service costs, after project		Rs34.69	Rs36.61	Rs38.62	Rs40.71	Rs42.91	Rs45.20	Rs47.59	Rs50.09	Rs52.71	Rs55.44	Rs444.56
24 Net Balance in TRA for Available for Project Debt Service		Rs25.64	Rs26.13	Rs26.63	Rs27.14	Rs27.66	Rs28.20	Rs28.74	Rs29.29	Rs29.85	Rs30.42	Rs279.70
25 Annual State Subsidy to SEB for Project costs		Rs19.76	Rs20.02	Rs20.30	Rs20.59	Rs19.86	Rs20.13	Rs20.41	Rs0.00	Rs0.00	Rs0.00	Rs141.06
26 Annual State Subsidy to SEB, Incentive payment		Rs2.94	Rs3.05	Rs3.17	Rs3.28	Rs3.90	Rs4.03	Rs4.17	Rs14.64	Rs14.93	Rs15.21	Rs69.32
27 Total Annual State subsidy with project		Rs57.38	Rs59.68	Rs62.08	Rs64.58	Rs66.67	Rs69.36	Rs72.16	Rs64.74	Rs67.63	Rs70.65	Rs654.94
28 State net Savings		Rs2.94	Rs3.05	Rs3.17	Rs3.28	Rs3.90	Rs4.03	Rs4.17	Rs14.64	Rs14.93	Rs15.21	Rs69.32
29 Debt Service Coverage Ratio on Net TRA funds		1.95	1.99	2.03	2.07	2.11	2.15	2.19	n.a.	n.a.	n.a.	
Project IRR Calculation, over debt term		17.17%										
	-Rs26.28	Rs5.88	Rs6.11	Rs6.33	Rs6.56	Rs7.81	Rs8.07	Rs8.33	Rs0.00	Rs0.00	Rs0.00	
Project IRR Calculation, over 10 years		30.73%										
	-Rs26.28	Rs5.88	Rs6.11	Rs6.33	Rs6.56	Rs7.81	Rs8.07	Rs8.33	Rs29.29	Rs29.85	Rs30.42	
Project Net Savings over Debt Term		Rs5.88	Rs6.11	Rs6.33	Rs6.56	Rs7.81	Rs8.07	Rs8.33	Rs0.00	Rs0.00	Rs0.00	Rs49.08
	NPV	Rs31.88										
Project Net Savings over 10 years		Rs5.88	Rs6.11	Rs6.33	Rs6.56	Rs7.81	Rs8.07	Rs8.33	Rs29.29	Rs29.85	Rs30.42	Rs138.64
	NPV	Rs66.28										

APPENDIX B: A CHECKLIST FOR STATES

Developing Ag DSM Projects: Guide for State Governments and Discoms

This Annex A provides guidance to State governments and Discoms on steps required to develop Ag DSM projects. The outlined steps are generally chronological, through the project development process. This checklist suggests an approach to project development, and topics to research along the way to inform decision making. The key actors will be (a) the Discom, (Managing Director and Chief Financial Officer or other) and (b) the State nodal agency with greatest responsibility and/or interest in this topic (e.g., State Energy Development Agency). Key officials from these two agencies will be the core leadership team.

1. Data Gathering

The first step is data gathering, to assess the scope of the problems and opportunities posed by Ag water pumping and efficiency projects. Data addresses: (i) power use in the agricultural pumping sector, (ii) pumping system inventory, (iii) Discom financial losses, and (iv) initial estimates of savings potential, amongst other items. Annex B provides a detailed checklist.

2. Define Project Concept, Conduct Consultations, Convene Decision Makers, and Create a Project Task Force

The leadership of the Discom (Managing Director and Chief Financial Officer or other) and the State nodal agency with greatest responsibility and/or interest in this topic (e.g., State Energy Development Agency) should conduct consultations and convene decision makers to formulate the project scope and objectives and create an inter-agency project task force to coordinate project development.

***Project Concept, Objectives & Scope*.**

- Based on preliminary data gathered, draft a brief "Project Concept" statement of research findings, project potential and draft proposal for project scope and objectives. The audience for this Project Concept paper is State and other agencies to be consulted. The Concept Paper can outline questions for consultation.

- The Project Concept Paper should state the rationale and benefits, i.e., objectives, for the proposed project which the State and the Discom will be seeking, which may include:

  - Reducing Discom costs of service to agricultural pumping loads; improve
  - Provide services to farmers to improve farm practices and incomes
  - Reduce Groundwater depletion
  - Rural power reform; development of rural power franchises; Ag power reform
  - Rural economic development and improvement
  - Reduce State fiscal impacts of subsidies

The Project Concept Paper can state initial views on the "holistic approach" to Ag DSM as recommended in this Report. It can include an assessment of prior experience with Ag DSM projects and outline key project challenges and risk factors.

- The Project Concept Paper should have a preliminary proposal on the role of the State government to enable the Ag DSM project and support its financing.

Convene Decision Makers & Organize a Project Task Force.

- Identify all responsible agencies, departments, decision-making officials and staff. Make initial contacts and gain initial responses to the Project Concept.
- Contacts with central Government Agencies, MoP, BEE, etc. to determine support available to the State and Discom for project development.
- Convene initial meetings to organize an interagency Project Task Force. The Task Force would coordinate project development and liaise with their respective agencies. The Task Force will need staff appointed to do its work and the mandate to the Project Task Force should be given by each agency and the work plan adopted.
- Identify and arrange sources of funding for project development. The participating agencies must organize sufficient resources for the Task Force and/or the Discom or State Agency to conduct its operations. Resources may be available from BEE or other Central Government agencies.

3. Continue Consultations & Research, Confirm Project Scope & Objectives and prepare a Project Development Plan

Conduct initial consultations and discussions of big issues:

- Farmer and community political strategy
- Preferred financing and contract structure: initial assessment and criteria for selection; views on ESCO as borrower vs. Discom as borrower and other options
- Prospects for Multi-year budget agreement, Incentive Agreement and Tariff Order
- Prospects for an effective payment security mechanism
- Regulatory approval process; views of the ERC
- Views on the "holistic approach" as recommended in this report; assessment of prior experience with Ag DSM projects and key project risk factors
- Development of rural power distribution franchises
- Status of groundwater depletion issue; availability of grant funding for water efficiency investments
- Required procurement procedures

Additional Research

- Perform additional background studies, as needed

Project Scope. Define the initial and indicative scope of the project.

- Indicative project sizing
- Candidate project locations, e.g., where HVDS / feeder segregation investments have already been done, or studied and are economically attractive; where strong

political basis exists and community/farmer support can be gained; where agricultural load densities are high; and other success factors, etc.

- Estimate project economics
- Define economic & financial criteria for program design: level of investment, target return on investment, willingness to pay. State and Discom budget funds available.

Project Development Plan.

- Formulate a Project Development Plan, outlining the complete process the Discom and State will follow through the course of project development.

4. Define Strategy with Farmers

Farmer response and behavior is a major risk factor in project development and operations. The Discom should formulate early on a strategy for communicating with, marketing to and organizing farmers. A consistent message should be formulated and delivered. Organizations which can be hired to manage farmer communications, marketing and organizing should be identified, interviewed and hired.

5. Review and Define Preferred Project Contract & Financing Alternatives

The Task Force should develop a preliminary view on its preferred contract and financing structure alternatives, vet the issues associated with these (as described in the Report), and define further information needed to arrive at a decision. This includes discussing the roles that the Discom wants to play in implementing a project, the roles it wants to contract out, how the Discom assesses project risks, which project risks it wants the contractor to assume and manage (e.g., in construction and operations), and the necessary procurement procedures. ESCO as borrower vs. Discom as borrower financing model options should be reviewed. Initial determination on the possibility to create a payment security mechanism including a multi-year budget and tariff agreement should be made. Final decisions do not have to be made; these will be made following further project feasibility studies are completed and project economics are known. But, the issues should be discussed and framed. The Task Force may want to arrange some business and financial advisory assistance at this stage to provide analysis and guidance on the options.

- What procurement rules must the Discom comply with to undertake the project? The DPR must define plans for preparing the procurement documents and conducting the procurement including the decision-making process for selecting a contractor, negotiating a contract and approving the contract for execution.

  a) Define the criteria for evaluating the proposals and selecting the contractor.

  b) Who will participate in the evaluation/selection committee?

  c) Once a contractor is selected, who will participate in negotiating the contract?

  d) What legal counsel will the Discom use for this purpose?

  e) What other consulting assistance (business and financial advisory, technical and engineering advisory) will the State / Discom need to prepare the RFP and conduct proposal evaluation and contract negotiation?

f) Will the RFP specify a preferred contract structure? If so, what structure? What range of flexibility regarding proposed contract structure will the RFP allow; will proposers be permitted to offer alternative contract structures? Does the Discom want to prepare the sample contract or invite proposers to offer their own contracts?

Further, to initiate communication and gain feedback from the contractor community, an Expression of Interest (EOI) document can be floated at this time. The Project Concept would be refined and include statements regarding the Discom's preferred contracting approach and other aspects of the project as defined in the consultations. The EOI can solicit expressions of interest from prospective contractors, ask for statements of qualifications, and get initial feedback on how the project can be organized so as to be viable as a business proposition for the contractor.

6. Procure/Prepare Project Feasibility Study

At this stage, a complete project feasibility study needs to be conducted, including the full cost/benefit analysis of prospective measures.

- Selection of project site candidates needs to be finalized.
- The project feasibility study will involve considerable field work, so, again, the farmer communications and marketing strategy needs to be revisited and implemented as part of the study.
- The project feasibility study will includes analysis of a range of Ag DSM project components and investment measures, and its results will be used to finalize the scope of the project to be implemented. The project feasibility study should include a project financial model for use in making these decisions. The project financial model should include cash flow projections from the point of view of the several parties, e.g., Disco, State, contractor and farmers, and lender.

The scope of work for the project feasibility study will have to be formulated. A consultant will need to be procured to prepare the feasibility study.

7. Project Financing Plan

Based on the results of the project feasibility study, the recommended scope of the project, investment size, costs and benefits can be estimated. A financial model of the project will be prepared and this will also include a project financing plan that will include the following components:

- Discom capital contribution
- State capital contribution
- Payment security mechanism
- Proposed project contract method

At this point, and prior to conducting its procurement, the Discom should make another round of contacts with prospective project lenders. If the Discom will be the borrower, then the lender arrangements need to be made. If an ESCO will be the borrower, it is still recommended for the Discom to identify interested lenders, formulate the project financing plan in consultation with lenders, and include this information in the procurement document.

8. Prepare DPR

With the project scope established, the project feasibility study complete, and a project contracting method and financing plan defined, the Discom in consultation with the Task Force should be ready to prepare the Detailed Project Report or DPR. The DPR provides a summary and detailed description of the project and is used as a decision document to gain approvals from all the necessary agencies. An outline of a DPR is provided as an Annex to this report.

The first project is also a pilot. So, it will be important to include description of project monitoring and replication plans.

9. Implementing Agreements

Accompanying the DPR will be draft forms of or at least term sheets for the implementing agreements.

- Directives from Government, including the Tariff Order from the ERC and a Multi-year Budget and Incentive Agreement between the Discom and the State
- Procurement documents for the Discom to procure a Contractor / ESCO
- Project Contract between the Discom and Contractor / ESCO
- Revenue Pledge & Assignment Agreement, between Government, Discom, ESCO and its lender
- Farmer Agreement (either with Discom or ESCO)
- Project financing documents, including, potentially a debt placement memorandum, Loan Agreement and related Escrow Agreement or Trust & Retention Account Agreement

Development of these agreements can be a joint undertaking of the financial advisory consultant, the project feasibility consultant, the Discom and legal counsel, with review and consultation with the Task Force.

10. Apply for and Gain Government Approvals

With the DPR in hand, the Discom and State agency can now seek necessary approvals from the various involved parties:

- State Government agencies and budget office
- ERC
- Discom Board

Final appropriations decisions will need to be requested and made.

11. Complete Procurement Documents Conduct Procurement Process

Once the DPR and the various supporting agreement from amongst the State agencies have been approved, the project is ready for procurement of a contractor. Proposals will be solicited using a RFP document. Then proposals will be evaluated, a contractor selected and then implementing contracts negotiated. The Discom can retain its financial advisory and project feasibility consultant team to advise it in this process.

ASSESSMENT & PLANNING POTENTIAL STATE AGRICULTURE DEMAND SIDE MANAGEMENT PROJECTS

INITIAL DATA NEEDS
INFORMATION CHECKLIST

Introduction

This document provides an initial checklist of information needed from State governments and Discoms to start assessment and planning of potential agriculture demand side management (Ag DSM) projects.

C.1 Ag PUMPING POWER CONSUMPTION AND COSTS OF SERVICE

- % of Discom total power sales which are made to the Ag sector
- total unit sales to Ag water pumping sector, kwh
- tariff charged to agricultural water pumping
- ATC losses on rural loads
- cost of delivering power service to agricultural loads, including (i) wholesale cost of power, and (ii) distribution losses → value of saved power
- Discom losses incurred serving agricultural pumping loads, annual basis, in Rupees

C.2 STATE FISCAL IMPACTS

- amount of State government subsidy, in Rs. and as % Discom budget
- annual amount of State subsidy attributable to the Discom's Ag power losses

C.3 RURAL POWER DISTRIBUTION SYSTEM UPGRADE INVESTMENT PROGRAMS

- Experience to date with HVDS conversions / feeder segregation: projects implemented and results; projects defined or planned; estimated investment requirements.

C.4 Ag PUMPING SYSTEM INVENTORY & SAVINGS POTENTIAL

- Number of pump sets in the Discom; status of data and information system on agricultural pumping loads
- pump inventory by pump size, type and efficiency

- connected load for agricultural pumping, KW
- estimated # of unauthorized pumps
- Number of new pump set connections, annually, and new loads being added
- Experience to date with pump set replacement projects: projects implemented and results; projects defined or planned; investment requirements.
- Estimated savings potential from investment in efficient pump sets
- Existing programs to support farmers; identification of local and State groups that can assist in organizing farmers and farm communities
- Identification of candidate sites (distribution circles or feeders) for implementation of pilot Ag DSM projects. Initial estimate of project size for given sites.

C.5 BUDGET & INSTITUTIONAL INFORMATION

- Annual Discom budgeting process with the State and the ERC. Adherence to budget system defined in the Electricity Act 2003. Copy of latest tariff orders pertaining to the agricultural sector.
- Experience with franchisees & licensees, OYT and similar programs
- Status of any discussions and efforts to move to a metered tariff for agricultural power service; prospects
- Financial statements for the Discom
- Discom borrowing experience and access to and capacity for additional project debt financing
- Experience with IPP and performance contracts that might set precedents for use of an ESCO contract structure

APPENDIX D: DPR OUTLINE

Draft Outline for Detailed Project Report*

1. Background & Perspective

- General
- Basis for selection of area for intervention (sub-station/feeder)

2. Project area data baseline

- Distribution Network Details
  - Network Mapping (agriculture dominated feeders)
  - Validation of Loss Level Data
- Consumer Profile
  - Consumer categories
  - Water & electricity consumption details
  - Cropping pattern
  - Land, irrigation method & other details
- Pump Set Survey
  - Number, type, capacity & efficiency of pump-sets
  - Type of well, availability of ground water, pumping head & other details

3. Estimation of efficiency improvement potential

- Energy savings by network upgrades
- Energy savings by pump set efficiency improvement
- Water saving by implementation of improved irrigation technique
- Groundwater augmentation potential

4. Cost benefit analysis

- Investment and cost benefit analysis of Electrical Network Augmentation Interventions (agriculture dominated feeders)
- Investment and cost benefit analysis for pump set replacement
- Investment and cost benefit of adoption of improved irrigation techniques
- Analysis of benefits from Clean Development Mechanism (CDM) Mechanism
- Summary of Cost Benefit from overall efficiency improvement plan

5. Risk Assessment & Management Plan

- Commercial risk
- Monitoring risk
- Policy risk
- Regulatory risk
- Political risk

7. Monitoring and Verification Plan

8. Annexures

---

* The format for DPR may vary depending on the ground level scenarios in states i. e. factors like HVDS, groundwater availability, stakeholder preparedness, etc will influence the activities and cost benefit analysis calculations in the DPR's.

U.S. Agency for International Development
1300 Pennsylvania Avenue, NW
Washington, DC 20523
Tel: (202) 712-0000
Fax: (202) 216-3524
www.usaid.gov