Solar Irrigation in Bangladesh
Country Context

- Bangladesh is the one of the most densely populated countries in the world
  - Land Area (~144,000 sq km) slightly smaller than the State of Iowa
  - Population (156 million) almost half of the entire population of the USA
  - Per Capita Gross National Income: US$ 830

- Access to electricity is low: 50% to grid, 10.5% to solar home systems
  - Primary Fuel: Natural Gas (~65% of generation) is in short supply. Short-term liquid fuel run plants supply about 25%, coal (2%), hydro (2%), import from India (5%)

- Irrigation pumps run by electricity
  - 0.27 million pumps covering 1.7 million hectares. Consumption of 1500 MW of electricity.

- Irrigation is mostly done by diesel-run pumps (3.4 million hectares of land)
  - 1.34 million pumps (Deep Tube-well – 3000, Shallow Tube-well – 1.2 mil, Low-lift Pump– 0.14 mil)
  - Consumes about 1 million tons diesel/year worth US$ 900 mil.
  - Diesel is subsidized. Annual subsidy ~US$ 280 mil.
Project Context

• Rural Electrification and Renewable Energy Development II (RERED II) Project
  • Predecessor RERED Project approved in 2002 (closed in 2012) started the Solar Home Systems (SHS) program
  • Innovative Partnership
    • NGOs installing SHS and offering micro-credit to households. Project providing refinancing and capital buy-down grants
  • Supported 1.2 million SHS (3.5 million installed by now)
  • Matching grant from GEF and GPOBA (SIDA and DFID)
  • RERED II approved in Aug 2012 with the objective of increasing access to clean energy in rural areas

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Targets</th>
<th>Achievements (As of February 2015)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar Home Systems (SHS)</td>
<td>1,030,000</td>
<td>709,414</td>
</tr>
<tr>
<td>Mini-grids</td>
<td>30</td>
<td>3 (6 under construction)</td>
</tr>
<tr>
<td>Solar Irrigation Pumps</td>
<td>1,250</td>
<td>124</td>
</tr>
<tr>
<td>Improved Cook-stoves</td>
<td>1,000,000</td>
<td>24,704</td>
</tr>
<tr>
<td>Biogas Digesters for Cooking</td>
<td>33,000</td>
<td>1,453</td>
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</table>
**Targeting of Subsidies**

- Rural, off-grid farmers are the direct beneficiaries of the subsidy

**Accountability**

- Project sponsor is accountable for results, and is reimbursed after delivery of agreed and verified outputs

**Innovation and Efficiency**

- Service “solutions” are partly left to the project sponsor to encourage innovation and efficiency

**Using Incentives to Serve the Poor**

- Subsidies are used as capital buy-down grants to make irrigation affordable to poor farmers.

**Output Verification and Monitoring**

- OBA schemes require a monitoring system ensured by IDCOL

**Sustainability**

- Focus: Affordability, cost recovery through tariffs

**OBA Principles**

- RERED = OBA Facility
Project Context

- **Implementing agency- Infrastructure Development Company Limited (IDCOL)**
  - Government-owned financial intermediary
  - A company with professional staff hired from the market. Market-based compensation
  - Oversight by Board represented by the Government and private sector
  - Provides long-term loans for large infrastructure and renewable energy projects
  - Partners with non-government organizations (for the SHS program) and private sponsors
  - Due diligence of project design and close supervision of implementation.
Why replace Diesel with Solar Pumps?

- Frequent technical problems and high maintenance costs for diesel pumps
- Increasing cost of diesel (foreign exchange costs) and on-going subsidy burden on government
- Transportation of diesel to the field is challenging
  - Supply disruptions
  - Rent seeking
- Environmental pollution
IDCOL is currently practicing two business models:

- **Fee for Service Model** - Larger pumps for a group of farmers
- **Ownership Model** – smaller pumps for individual farmers
Program Structure – Fee for Service Model

- Trust Funds
  - OBA
  - Grant
- IDA and JICA
  - Credit
  - Loan Repayment
- IDCOL
  - Grant & Credit
  - Technical Support
  - Loan Repayment
- Project Sponsors
  - Water Supply
  - Water Tariff
- Farmers
Program Structure – Ownership Model

- Trust Funds
  - OBA Grant
- IDA and JICA
  - Credit
  - Loan Repayment

IDCOLUM

- Grant & Credit
- Technical Support
- Loan Repayment

Project Sponsors

- Selling of pumps on credit
- Monthly installment payment

Farmers
### Solar Irrigation Pump

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Fee for Service Model</th>
<th>Ownership Model</th>
</tr>
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<tbody>
<tr>
<td>PV capacity</td>
<td>11.0 kWp</td>
<td>4 kWp</td>
</tr>
<tr>
<td>Pump capacity</td>
<td>7 kW</td>
<td>2.5 kW</td>
</tr>
<tr>
<td>Flow rate</td>
<td>900,000 liter/day</td>
<td>250,000 liter/day</td>
</tr>
<tr>
<td>Total head</td>
<td>10-14 meter</td>
<td></td>
</tr>
<tr>
<td>Project cost</td>
<td>USD 36,000</td>
<td>USD 9,000</td>
</tr>
<tr>
<td>Land coverage</td>
<td>Paddy: 17 acre Others: 28 acre</td>
<td>Paddy: 5 acre Others: 8 acre</td>
</tr>
<tr>
<td>Irrigation charges</td>
<td>USD 115/acre for paddy</td>
<td></td>
</tr>
</tbody>
</table>
Responsibilities of Parties Involved

**Project Sponsors**
- Selection of areas, target customers and formation of cooperatives
- Installation of pumps as per approved technical specifications
- Operation of pumps and supply of water to the farmers on crop basis at affordable rate
- Collection of payments

**Implementing Agency IDCOL**
- Technical support
  - Independent Technical Committee sets technical specifications and enlists manufacturers/vendors
- Financial support to the Sponsors after due diligence of project costs and credit-worthiness of the Sponsors
- Inspection and monitoring of pump performance
Area Selection

- Farmers currently using diesel run pumps i.e. off-grid area
  - Most of the farmers in Bangladesh are small and marginal farmers
- Has the potential to grow 3 to 4 crops per year
- Does not go under water during rainy season or flood
- Ground water level is not low or surface water is available
- Water is arsenic free or arsenic level is acceptable for irrigation
- Sufficient land is available for installation of solar panels
(Sample of an 11 KWp solar irrigation pump)

<table>
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<th>Financing Mechanism</th>
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<tr>
<th><strong>Pump cost</strong></th>
<th>USD 36,000</th>
</tr>
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<tbody>
<tr>
<td><strong>Grant from Trust Funds (40% of project cost)</strong></td>
<td>USD 14,400</td>
</tr>
<tr>
<td><strong>Remaining Cost</strong></td>
<td>USD 21,600</td>
</tr>
<tr>
<td><strong>Loan from IDA/JICA (40% of project cost)</strong></td>
<td><strong>USD 14,400</strong></td>
</tr>
<tr>
<td><strong>Equity participation by the sponsor (20% of project cost)</strong></td>
<td>USD 7,200</td>
</tr>
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<tr>
<th>Financing terms</th>
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| **Loan amount** | USD 14,400 |
| **Loan Tenor** | 8 years |
| **(9 months grace)** |  |
| **Interest rate** | 6% |
| **Principal repayment** | 29 equal quarterly installments |
# Cost Components

<table>
<thead>
<tr>
<th>Cost Components</th>
<th>Cost (USD)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land and Land Development</td>
<td>800</td>
<td>2%</td>
</tr>
<tr>
<td>Solar Panel</td>
<td>9,100</td>
<td>25%</td>
</tr>
<tr>
<td>Pump</td>
<td>4,100</td>
<td>11%</td>
</tr>
<tr>
<td>Controller</td>
<td>4,800</td>
<td>14%</td>
</tr>
<tr>
<td>Module mounting structure</td>
<td>4,300</td>
<td>12%</td>
</tr>
<tr>
<td>Accessories</td>
<td>1,000</td>
<td>3%</td>
</tr>
<tr>
<td>Civil Construction (pump house, water tank, fencing)</td>
<td>2,200</td>
<td>6%</td>
</tr>
<tr>
<td>Boring</td>
<td>4,100</td>
<td>11%</td>
</tr>
<tr>
<td>Buried Pipe</td>
<td>4,600</td>
<td>13%</td>
</tr>
<tr>
<td>Transportation, Installation &amp; Erection</td>
<td>1,000</td>
<td>3%</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td><strong>36,000</strong></td>
<td><strong>100%</strong></td>
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Thank You