Microgrid / Minigrid Finance and Investment Risk
UNEP-FI Microgrid Workgroup

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Objective – To provide an overview of the investment risk in developing or financing a micro/minigrids.

Introduction
Capital flows naturally where risk is well defined in both amount and probability. Investors ideally want to predict the future as best they can to meet their "risk adjusted return" capital goals. Both high risk as well as low risk investments with well defined parameters can attract investors. The challenge for microgrid investment is to identify and quantify risk a complex energy systems involving rapidly evolving technologies, numerous participants with an end product (energy services) that is both invisible and transient. Hybrid microgrids (fossil fuel + renewable) can provide a risk reduced design vs. the full renewable plus energy storage and man provide a lower risk transition leveraging an existing diesel fuel system. Increasing costs of diesel fuel and kerosene are helping to economic justify remote microgrids. Following is an overview of the key risk areas and other elements that should be addressed in a microgrid investment prospectus for locations with no energy access, to expand existing fossil fuel or fragile grid systems and full grid served locations seeking the ability to "island" or for demand response with the local utility.

Proposed Construction: The Risk Ladder
"It is difficult to make predictions, especially about the future" Niels Bohr, et al
With any project the risk is fundamentally impacted by the stage of development. Moving from an idea to a seasoned operation can be roughly broken down into the following six levels of uncertainty: 1) the idea in the shower, 2) ink on paper, 3) approvals/entitlements, 4) shovel in the dirt/construction, 5) attaining full occupancy/operation, 6) seasoned with three year operating history.

As risk is removed with each progressive stage the investor pool size and personality changes, paired with a (generally) lower rate of return to attract capital. Microgrid investments are particularly sensitive to execution risk (stage 4) where appropriate technologies are installed and actual energy output becomes measurable. A quirk of the risk ladder is that investors tend to stick to their risk level sweet spot and deal size. As a result multiple investment partners may be needed at different stages of a project's development life. This is mirrored in conventional real estate development where there might be a dedicated construction lender who is paid off when the last nail is struck, mezzanine finance during initial occupancy lease up to stabilization and finally a long term lender when there is seasoned cash flow. So when a lender says "no", what might really be meant is "not now" at this stage in the development cycle.

People qualifications vs. Project merits: "Who" can be more important than "What"
Project merits are certainly key, but who is associated with the project is often more important. Venture capitalists have said they will fund a good idea with strong management over a terrific idea with weak sponsorship. Team member experience, expertise, honesty and commitment are important. Personal relationships of the team leaders can also build key project credibility. Microgrids involve numerous groups of experts and putting together a reliable, qualified team with proven performance history can be as important as the project merits. Rating a team's "quality" is a qualitative and somewhat subjective call; the numbers only take it so far, the gut feeling still has to be right.

Putting the project package together - Documentation and Information
Convincing investors of a project's merit involves decisions based on technical analysis, but is also emotional. The former is all about the numbers, while the later is about the projects intrinsic viability, externalities (soft benefits) and team qualifications. Experienced investor's want confidence in both types of analysis; so the project prospectus should include details of quantitative and also a qualitative nature.

Documentation (quantitative) analysis is technical and mathematical, including spreadsheets with construction budgets, income and expenses including a sensitivity analysis to show best, worst and most likely cash flow scenarios. Information (qualitative) is the non-numerical parts of the prospectus like well documented backgrounds of the project team leaders and candid discussions of challenges. Creating commitment might come from compelling interviews with the eventual energy users or how the project has garnered support from influential constituency groups.

The project package should have a professional look and be well organized with Executive Summary pages so a reader can quickly gain a high level understanding, but if needed also delve into details. This usually includes supporting addendums documents. Graphics can help illustrate complex designs or relationships.

<u>Investment Partners</u>
Project development involves multiple sets of partners which might begin with equipment vendors, construction crews and engineers followed by an operational team and customers. A government liaison and utility contact are usually involved. This diverse group needs to provide basic agreements which indicate how the energy generation, maintenance and operating cost and income will flow. Lack of long term project support by any of these groups will increase operational risk. Documents of agreement and contact names, backgrounds need to be included in the prospectus.

<u>Specific Risk Categories</u> - Project descriptions should address specific risks directly in the prospectus. This will vary based on system configuration: grid relationship (remote, grid tied), scale (small or large), location, local economics (low average area household income vs. high average area household income), etc

Technology Risk - Technology risk includes power generation equipment, controls and software, but increases significantly when projects need an extended repayment period. Concerns are that that today's techniques will be undercut by more evolved future technologies or the flipside, that the specified equipment is too new and therefore untested. Strong backing from top manufacturers is helpful, but Identify and quantify where significant technology threats are. Rural locations may have added risk securing expertise to install or maintain complex power systems. Interoperability with the grid (or future grid) is needed and involves influences outside the project sphere.

Execution Risk – Construction that is on time and on budget is a challenge to any complex proposed project. Emphasize components that have well controlled risk and developer strengths and experience. Honestly address more challenging unknowns in the construction or design, bracket best and worst cases and allow for contingencies in time and money. Lack of needed talent in the local labor pool might encourage a less efficient system, a lower tech solutions but that is easy to maintain or build with local materials.

Demand Risk – Right sizing production for today and the future with its respective production is a particular challenge. Electricity is expensive to store, cheapest when used immediately. Scoping demand with whom exactly will pay, timing use of renewable production wisely and an efficient payment collection process is key to the financial puzzle. Plans might allow for flexibility with different payment scenarios to be tested when a new system becomes fully operational. Payment schemes, tariff rates, use limitations, pay-as-you go, fixed price all need to be considered. Classic cost incenting as well as sometimes counterintuitive behavior economic motivation needs to be considered. Building a power purchase agreement with a reliable base load business user can provide key support for higher risk, more variable residential population service.

Regulatory Risk - The relationship of government controls and utilities must be considered and is highly varied. Distributed generation might be viewed negatively as a threat to the utility monopoly or positively as a partner helping with peak load regulation and energy reliability. Energy pricing is generally regulated and might be subsidized. The cost per kWh of utility supplied power is a primary project economic driver. Low energy costs can undermine feasibility and a high cost per kWh can encourage microgrid construction. Well defined national and/or utility policy about grid tied pricing, microgrid licensing, regulations and grid interconnection (now or future) means a lot regarding investment predictability. For example Tanzania has set up guidelines for small power distributors that could include microgrids and in India joint ventures and distribution franchises have been created to build a standardized and repeatable structure.

Operational Risk - Expertise is difficult to find to keep a microgrid operating within its specified budget with minimal downtime and maintenance costs. Unfortunately when electricity demand is lost due to an outage, that missing income cannot (like unpaid rent) be recovered later and this disrupts cash flow. For investor's, the reliability of cash flow can be just as important as the amount of cash flow, meaning the day to day system performance vital. Achieving this is a combination of expertise (people) and tools (reliable generation, sensors, controls, etc) so both risks should be addressed in the prospectus. Local village commitment and an engaged organizational structure can help assure long term management success. This can/should involve creating local operation and maintenance expertise particularly in an area with limited employment opportunities.

Protection from Negative Threats - Unfortunately attempts at fraud, outright energy or equipment theft and system gaming are inevitable where resources and money exchanges exist. Sabotage by status quo entrenched interests can occur. Unintended consequences from providing energy where it previously did not exist will occur. System management can purposefully create obfuscation to advantage a position in a complex organizational structure or to mask discovery. Local corruption of police, oversight agencies and government officials is unfortunately too common, particularly in rural locations. All of these negative threats can undermine delivery targets. Investors want the highest levels of transparency and disclosure and without it even the best designed and most needed microgrid will not attract capital. A key part of any proposal should be to address these issues head-on, in particular what long term surveillance and reporting structure will police the system and protect the investors.

<u>Capital Sources</u>

The challenge of obtaining investment capital is to match the investment source funding profile and target return rate to the amount of capital needed, project location, type, stage in the development cycle. Managing different capital inflow at different points in the project cycle to the final income stream is necessary to envision clearly. Large projects might need to attract a team of investors to share risk or require the borrower to have a financially strong partner as credit enhancement. A strong backup partner is particularly important early construction and development stages.

Fortunately there is a vast pool of capital that seeks to be placed, but few are interested in very small projects. Many microgrids need too few dollars and cannot easily scale or be repeated. Overcoming this can be to "cluster" a new commercial base energy load user (perhaps including low cost off peak energy) to increase project size sufficient to reach funding source hurdles and overcome fixed lending costs. Ideally a successful project might be repeated at another location or a number of locations ganged into a single "project"

Funding or credit underwriting could come from a variety of places including non-profit foundations, public-private partnerships, utilities or public funds. Needs at different project cycles might require hard dollars for wages or, perhaps the credit enhancement offered via a loan loss reserve that assumes a limited first loss position. Nation government, international NGO, socially responsible non-profits, business incubator groups or corporate giving programs might support credit enhancement to offset particularly risky development tiers, first stage seed money, or expansion. Operational working capital, capital maintenance or loan loss reserves and management expertise donations can be other structures for financing.

<u>Benefits beyond income from energy sales</u>

A microgrid creates more than just the dollars flowing to the sale of the power generated. Identifying the numerous benefits beyond supplying energy and energy surety is a significant part of the value case and not be relegated to second tier importance. Energy delivery creates opportunity, by broadening the scale and improving efficiency in the economic constellation. Access to energy expands education and safety which drives business development on the most fundamental levels. Health impacts can be significant including improved interior and exterior air quality, medical supply refrigeration and hospital/clinic creation.

Clean renewable energy can reduce environmental impacts, particularly if that energy replaces diesel and kerosene (spillage, transit impact, particulate and noxious air pollution, noise pollution) or wood (deforestation, air pollution).

Additional soft benefits, externalities and collaborative advantages should be prominently featured in the project description. Only relying on income from energy sales to justify the microgrid investment rate of return misses a huge portion of the impact to the society at large.