Cleaner-Energy Investments

Srinivasan Sunderasan

Cleaner-Energy Investments

Cases and Teaching Notes

Springer

Srinivasan Sunderasan
Verdurous Solutions Private Limited
Mysore
Karnataka
India

ISBN 978-81-322-2061-9 ISBN 978-81-322-2062-6 (eBook)
DOI 10.1007/978-81-322-2062-6

Library of Congress Control Number: 2014956384

Springer New Delhi Heidelberg New York Dordrecht London

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Preface

Clean energy is the flavor of the times. With a view to bringing the phrase closer to reality, I would prefer to refer to it in relative terms as *Cleaner Energy*. Investors have had divergent views of the sector: from being a genuine business opportunity, especially when attractive preferential tariffs are on offer, to a peripheral activity that helped "green wash" other business operations. Project financing into Cleaner Energy (often interchangeably used with renewable energy, sustainable energy, or clean energy) has not been intensely researched owing to the specifics of each project, the resource, the geography, the policy environment, the risks involved, and above all, the very availability of relevant information in the public domain. This mandates the study of cases that straddle technologies, financial structures, market conditions, risk factors, and the like. The cases developed herein highlight the relationships among capital structure, managerial incentives, social structures and, most significantly, environmental factors, to help with *Cleaner Energy* project-related decision making, with relevant environmental legislation forming a significant factor in the process.

This compilation of case studies from across countries and cultures involves contemporary technologies including electric vehicles, solar thermal power plants, hybrids, coconut-charcoaling, etc., alongside more traditional and established technologies, viz., wind energy generation and hydro electric power plants. The collection highlights the real-world situations facing individual projects and brings out the strengths and weaknesses of the underlying business propositions. It also throws light on some of the factors that are routinely ignored during project formulation and risk assessment, viz., coordination among public and private agencies, confirmed availability of relatively minor but essential components, possibility of concurrent demand for inputs from different project proponents, etc. Above all, many of the cases studied relate to first-of-their-kind initiatives, successful or otherwise, which command our appreciation all the same for the conviction with which they were taken up for implementation.

This compilation provides a systematic 'guided-tour' of the RE projects for project analysts involving, *inter alia* the development of financial models and culminates with an evaluation of risk and the design of risk-mitigation measures.

It is designed to simultaneously appeal to business school students and to serve as a do-it-yourself guide for practicing executives, policy makers, and consultants.

- The volume is a collection of real-life cases with genuine data sourced from publicly available sources believed to be reliable. Assumptions are made to fill gaps in data, if any, to help with the learning objective.
- The cases are accompanied by teaching notes which carry financial models and other quantitative and qualitative analyses relating to the cases, to help develop multiple perspectives for a given situation.
- The cases cover several countries, currencies, policy environments, technologies, resources and for the benefit of policy makers, consultants, and project analysts and proponents, for them to view *Cleaner Energy* initiatives in a new light.

The case-study method is intended to put the analyst in a specific decision-making environment. When the documented case does not contain all the information needed, it sets the stage for the analyst to seek additional information and perhaps more importantly, to make assumptions when key pieces of the puzzle are not available or readily accessible. The assumptions should be reasonable and consistent with the situation because the "correctness" of the solution derived always depends on the soundness of the assumptions made. Subject to the definition of "reasonableness", a case situation could have more than one "right" solution. It is therefore advisable that the course instructor may be more interested in the analyses and process employed to arrive at the decision than in the arithmetic precision and "correctness" of a solution proffered. The course instructor should also insist on crisp written reports containing key points, the methodology adopted, the analyses, and the conclusions.

A few themes clearly stand out from a detailed analysis of the cases presented herein, a macro analysis of the contexts and a between-the-lines reading of the case documents. The technology employed shall be simple, tested, and proven. Investors routinely face up to market risks and prefer not to absorb technology risks. In other words, mainstream investment projects could employ solar PV and thermal systems, wind energy generators, hydro-kinetic turbines, etc., while relatively nascent technologies such as deep-offshore wind-energy or tidal technologies or other such ventures whose performance and reliability are yet to be proven beyond doubt, have traditionally been funded by governments. The technological spillover thereby is available to society as a whole. In other instances, while the participants chosen could be the best there are, the roles allocated to them might lead to confusion and chaos, as with the Delhi Airport Metro Railway link discussed in this volume.

To the extent possible existing infrastructure—access roads, distribution networks, etc., should be exploited so as to minimize project costs but more importantly, to cut down on implementation time. The San Cristobal wind energy project in the Galapagos Islands illustrates this point admirably well, wherein the implementing agencies were required to build docking piers, roads and other support infrastructure, driving up costs and implementation time. Additionally, it is possible to achieve superior environmental outcomes simply by switching fuels, and conversion technologies, or both, in that order. For instance, existing diesel and gasoline cars could be displaced by electric vehicles as in the Tesla Motors Case or moved on to efficient public transport as demonstrated by the Delhi Airport Metro case.

Involving the communities during the planning stages of the project and taking them into confidence and ensuring that the locals assume moral ownership goes a long way in sustainable operations. *Cleaner Energy* supply should be seen more as a service provision rather than as a hardware lead initiative, requiring constant interaction with the consumers. Presence on the ground and, more significantly, post-installation service support are vital for the sustained operation of plants, across technologies. In the case of the Sri Lanka–REcogen Project, weak social interface had delayed expansion while public opposition to the Norfolk incinerator had almost driven the County Council to bankruptcy. Engaging the local power centers and community leaders, volunteers and NGO workers' helps with coordination and timely implementation, prevents resentment to higher tariffs, increases coordination, and ultimately efficient use of the available energy.

For *Cleaner Energy* technology solutions to be scalable and replicable, capital from private as well as public sources would need to be optimally deployed, structured to suit the specific context, supported by streamlined supply chains for equipment, spares and services, and the institutional framework to manage O&M service delivery and to mitigate the potential risks of O&M deficits. While the promise of power supply raises expectations among the target populations in developing countries, sustained and reliable supply and cost-effective O&M are crucial to supporting local economic development. Grant funding, especially for one-off demonstration projects, has increasingly become scarce as individual projects have not been economically viable or effective in bringing about significant change and measurable development-related outcomes, or both. Replication and the provision of adequate supply of reliable power are hampered by site-specific conditions, including but not limited to, the spatial dispersion of the potential consumers. In all, success with *Cleaner Energy* projects requires a solution-oriented perspective as opposed to a technology and hardware supply motivation.

Transparent and accountable commercialization of energy services is a frequently stated goal of most energy sector reform programs but tariff rationalization in its true form, making the power attractive for private sector investors is without exception impeded by political compulsions. It is believed that the increase in electricity tariffs (or fuels and other intermediate goods) feeds into the general inflation in the economy which is considered a vote-loser for the political decision-makers. Under these circumstances, average tariff realizations are consistently below average costs of delivery. When the transmission and distribution losses and pilferage are added to the mix, the picture becomes less attractive for mainstream private sector investors. In countries with heavy subsidy burdens imposed on the exchequer, the price-cost margin has to be borne by the tax payers, which implies diverting scarce resources from more immediate priorities, say, within the health and education sectors. While rendering decentralized generation less attractive, suppressed retail tariffs also do not encourage investments into conservation or more efficient use of the available electricity.

Supply as well as demand side management should constitute equally important components of energy policy. The use of energy-efficient appliances and the phasing of their use during the day could help optimize sizing of the generation capacities more effectively. Improved matching between generation and consumption could minimize the need for energy storage, round-trip losses, and maintenance requirements. While evaluating the project's ability to service its debt, cash allocations for operation, maintenance, and management should also be integrated into the project's business plan right from inception. Subsidies could be linked to successful and continued operation of the plant and supply of electricity as projected in the business plan.

Generating electricity as a by-product as with the Sri Lanka–REcogen Project, or the proposed Norfolk—Willows incinerator make it more attractive and less risky for investors. The primary product, coconut-char or recycled metal or aggregates that could be used in construction, could be held in inventory and transported across relatively longer distances to earn anticipated returns on investments, while electricity needs to be supplied simultaneous with generation, within the immediate neighborhood of the plant. The San Cristobal wind energy project in Ecuador also serves as a means of increasing the attractiveness of the location as a tourist destination. Such a razor-and-blade (complementary product) business model could help defray tariff risks and potential delays in payments from the utilities.

Customer expectations need to be managed judiciously, by laying out the scope and limitations of the quality and quantity of the proposed service beforehand, to avoid consumer disenchantment and consequent non-payment for the power actually supplied. If for instance, it were proposed that power would be supplied for a few hours each day, for commercial and residential consumers, such timings need to be communicated unambiguously and upfront.

Donor agencies and government departments, when involved, need to assess the project implementation capabilities of the contractors involved in execution to ensure timely completion of projects, avoiding wastage and duplication of effort, and ensuring judicious and targeted use of the funding offered.

Cleaner Energy services function and thrive in an environment with supporting legal and regulatory frameworks and low-cost and effective contract enforcement mechanisms. Simultaneously, public funding continues to play a crucial role in extending utility grids to serve marginal consumers with low incomes, limited consumption, and those who are projected to contribute slim returns to the private investors. For long-term success of electrification programs, therefore, involving mini-grids or extending grids to underserved clusters, both the business case and the development argument need to be strong and compelling. Public and donor funding could be used to close the "viability gap" and to access the "last mile".

Irrespective of the price paid for substitutes, viz., candles, dry cells, kerosene lamps, etc., when customers are required to pay for electricity, they are bound to compare the service and costs available to grid connected consumers—the source of generation whether diesel or solar PV is a matter of irrelevant detail as far as consumers are concerned, and rightly so—and would expect *not* to pay a premium over grid-connected customers next door. Frequently, inexperienced third-party agencies plan and implement projects with the implicit assumption that consumers would be willing to pay higher tariffs for superior illumination, relative to the candles and lamps displaced: independent of tariffs paid by grid-connected acquaintances residing in the vicinity.

Once an irreversible investment is made and a cleaner energy project asset is installed, it needs to provide the intended service and earn projected revenues, and shall not be stranded by subsequent developments as with the expansion of the utility grid supplying, possibly unreliable, but potentially cheaper power; adequate safeguards and guarantees need to be built into concession agreements to protect investor interests.

Lifecycle costs of electricity generated (levelised cost of energy generated—LCoE) are frequently employed as benchmark figures for policy formulation. This holds good only if the terms of financing for given projects match revenue generation profiles, for mutually exclusive projects to be rendered comparable. While fossil fuel-based generation plants are exposed to fuel price risks, renewable energy plants, viz., solar PV plants and wind energy generators face uncertainties relating to the sustenance of preferential tariff regimes. The concept of energy security therefore needs to be broadened to include impacts of fossil fuel price variations on the economy while comparing the two alternative courses of action. The challenge therefore lies in minimizing project-level uncertainties while ensuring predictable and reliable energy supplies. Long-term policy stability is fundamental to delivering such levels of deployment of energy efficient end-use and renewable energy technologies and to ensuring that these technologies continue to operate and deliver services as planned.

Efforts to 'decarbonise' the economy and to provide reliable electricity for productive use are a worthwhile investment, simultaneously curtailing runaway climate change. In the context of several developing countries, rural electrification, cleaner energy use, poverty alleviation, ecosystem protection, watershed management, combating desertification, and achieving social equity are all inter-related goals.

The case documents and teaching-notes are intended to help instructors guide classroom discussion on the underlying issues and are definitely not meant to serve as an endorsement, or to judge regulatory prescriptions, management styles, decision-making, or outcomes. The cases and teaching notes are designed to provide multiple perspectives on a given situation, to aid academic discourse, and to help evolve alternative recommendations subject to relevant assumptions relating to the future.

Mysore, India, June 2014 Srinivasan Sunderasan

Contents

Abbreviations

CDM	Clean Development Mechanism
CSP	Concentrating Solar Power
DNI	Direct Normal Irradiation
EfW	Energy from Waste
EIB	European Investment Bank
EPC	Engineering, Procurement and Construction
EWEA	European Wind Energy Agency
FERC	Federal Energy Regulatory Committee (USA)
GHG	Greenhouse Gas
GWEC	Global Wind Energy Council
HTF	Heat Transfer Fluid
IFC	International Finance Corporation (member World Bank Group)
IRR	Internal Rate of Return
kV	kilo Volt
kW	kilo Watt
kWh	kilo Watt hour
LCoE	Levelized Cost of Energy
MW	Mega Watt
MWh	Mega Watt hour
NGO	Non-governmental Organization
NPV	Net Present Value
O&M	Operations and Maintenance
PLF	Plant Load Factor
PPA	Power Purchase Agreement
PV-T	PV–Thermal (hybrids)
RD&D	Research, Design and Development
SHP	Small-hydro Power
SPV	Special Purpose Vehicle

t CO_2e	ton of Carbon-di-oxide equivalent
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change
WAPP	West African Power Pool

About the Author

Srinivasan Sunderasan is an Economist at Verdurous Solutions Private Limited (Mysore, India), which is an investment advisory and consultancy specializing in management and financing aspects of renewable energy, microfinance, water, waste, and other 'sustainable development' initiatives. Prior to this, he was the Deputy Country Manager (India) of Photovoltaic Market Transformation Initiative (PVMTI), an Investment Officer with the South Asian Region for Solar Development Group (SDG) and Triodos Renewable Energy for Development Fund. He has obtained his Ph.D. from University of Vienna, Austria in 2005, specializing in business economics.

He has 20 years of rich and diversified experience as a techno-commercial professional, in planning, project management, research, academics, and consultancy in various industries including construction, telecom, energy, financial services, and 'sustainable development'. He is recognized as an expert on rural energy supply models by the International Solar Energy Society and a specialist in evaluation and financing for renewable energy and other cleantech ventures. He has authored, and contributed to, many books on related subjects published by Routledge, Taylor & Francis Group, Nova Publishers, and Springer Verlag. He is an editorial board member of *J. Reviews on Global Economics* and expert peer-reviewer with prestigious publishers including Elsevier B.V. and Springer Verlag. He is guest faculty of finance/economics at reputed business schools.