

**DIVERSITY IN CONTEMPORARY ENTREPRENEURSHIP: THE EVOLUTION
OF TWO REPRESENTATIVE CLEAN TECHNOLOGY COMPANIES IN NEW
YORK CITY AS CASES IN POINT**

DISSERTATION

Submitted in Partial Fulfillment of the Requirements for the Degree of

DOCTOR OF PHILOSOPHY (Technology Management)

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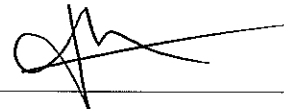
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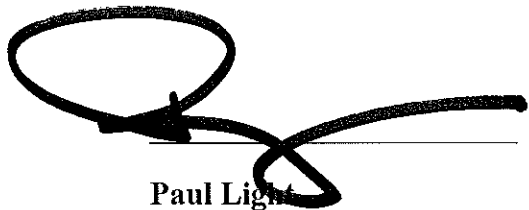
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This study is dedicated to my parents:

Venugopalan Mulloth

and

Malini Mulloth

Acknowledgments

The road to my Ph.D. has been an exceptional journey, one that I had never dreamed of. Looking back, I owe my sincere gratitude to many many wonderful people whom I have had the good fortune to meet and get to know. However, a few special people stand out in my mind who directly influenced my Ph.D. aspirations and the writing of this dissertation. I will focus on these individuals.

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I had access to others in their organization in a timely and efficient manner. Although not named specifically, I also must thank the many individuals I interviewed in the course of my research. Without their help, my analysis and understanding of the organizations would be have been much less valuable and in depth.

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AN ABSTRACT

DIVERSITY IN CONTEMPORARY ENTREPRENEURSHIP: THE EVOLUTION OF TWO REPRESENTATIVE CLEAN TECHNOLOGY COMPANIES IN NEW YORK CITY AS CASES IN POINT

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Advisor: Mel Horwitch, Ph.D.

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At the highest level, this dissertation examines the diversity, especially the existence of both purely business and socially purposeful activities, prevalent in contemporary entrepreneurship. This study uses the clean technology industry and New York City as its research context. A central component of this study is a comparative analysis and discussion of two New York City based clean technology organizations: Verdant Power and Green Map System. This study explores these enterprises employing an in-depth, case study approach. Based on the analysis and discussion of these two case studies, nine critical dimensions of contemporary entrepreneurship were identified. The two organizations were then individually placed within the nine identified critical dimensions and significant related observations were also made. The nine dimensions were then further coalesced into four major areas. These areas are: Management, Values, Technology and External dimensions. Ultimately, certain overall conclusions were reached. Among the most important is that contemporary entrepreneurship is dynamic,

which is illustrated by the movement of the two organizations across the identified critical dimensions.

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Chapter 1: Introduction and Overview

This dissertation is about the diversity in contemporary entrepreneurship at the most general level. In order to study this topic, the dissertation is focused substantively on an emerging set of clean technology activities in New York City. I chose the clean technology sector because I believe that this sector is a dynamic arena in which diverse and complex forms of entrepreneurial activities are taking place. I also believe that New York City is an appropriate location to study this topic because this venue already offers a huge variety of clean technology activities.

I chose two clean technology organizations in New York City on which to conduct in-depth case studies in order to illuminate this general issue of entrepreneurial diversity. As part of this dissertation, I will also aim to identify certain critical dimensions that help in understanding the diversity and varying approaches manifested in entrepreneurial clean technology enterprises.

Hence, this dissertation has three main anchors to it: *complexity of entrepreneurship, clean technology activities and New York City.*

1.1 Why Focus on Entrepreneurship?

Contemporary entrepreneurship is highly diverse. It involves traditional business/commercial activities, not-for-profit entrepreneurial activities focused on social outcomes and activities focused on social problems, which trigger entrepreneurial behavior. Diversity occurs at every level of this entrepreneurial ecosystem. It is a complex web of interaction and altering the balance between these activities can have dramatic and unforeseen effects. In order to become an entrepreneur (of any kind) one first of all has to recognize an opportunity that can be exploited (Shane and Venkataraman, 2000). Yet, opportunities for social entrepreneurship are obviously of a different nature than opportunities for business/commercial entrepreneurship. My dissertation will be a study of such diverse fields of entrepreneurship.

I am not alone in exploring the diversity in the field of entrepreneurship. Other scholars have written about how complex entrepreneurship is. It is an engine, perhaps the major engine, of Joseph Schumpeter's dynamism of "creative destruction." Schumpeter (1934) describes creative destruction as an economy-wide process, which "incessantly

revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one.” Entrepreneurship is now increasingly recognized as an essential part of the modern technological innovation process, and entrepreneurs are found throughout the globe (The Economist, 2009). Some even refer to the need for an entrepreneurial society (Scharamm, 2006). In such a scenario, entrepreneurs figure as important players. They maintain an advantage through their flexibility, freedom and risk-everything ambition to find the path back to prosperity in a rapidly changing, technology-driven global economy (Hayes and. Malone, 2009). As Karnani (2007) put it, “An entrepreneur is a person of vision and creativity who converts a new idea into a successful innovation, into a new business model.”

A major and growing segment of entrepreneurship also deals with social issues because entrepreneurship may be able to meet unfilled social needs of diverse population groups worldwide.

Important in this context is that the number of not-for-profit (NFPs) organizations is growing considerably (Wing, Pollak and Blackwood, 2008) and social problems are increasingly noticed, and they are often complex. Therefore, NFPs are now operating in a much more challenging environment. In the face of the first decline in charitable giving in the United States since 1987 (Giving USA Foundation, 2009) they currently have to cope with an intense competition for donors and are even threatened by substantial funding shortages (Pariyar and Ward, 2006; Roper and Cheney, 2005).

In view of this development, the discussion and solution of social problems recently entered the sphere of business. The exploitation of opportunities is accompanied by the generation of an entrepreneurial profit (Shane and Venkataraman, 2000) and induces a systematic change of a society facing major social problems (Drayton, 2002). A striking development in the entrepreneurship field is the rise of the social entrepreneur (Christie and Honig, 2006). “They are at the cutting edge of the social sector’s transformation” (Drayton, 2002), being able to reach millions of people and achieve a high transformational impact (Alvord, Brown and Letts, 2004). In addition to companies, also individuals who are primarily driven by the value of social justice can tackle specific deficiencies by means of commercial activities if the problems identified constitute an entrepreneurial opportunity. In today’s complex environment, such social entrepreneurs frequently complement the activities

of socially responsible enterprises by employing innovative approaches (Johnson, 2000). Social entrepreneurs are also often credited with coming up with innovative solutions to social problems (Bornstein 2003). “They see opportunities where others only see empty buildings, unemployable people and unvalued resources” (Catford, 1998: 96).

The notion of social entrepreneurship is fairly recent, emerging in the late 1990s. It gained prominence with the awarding of the Nobel Peace Prize in 2006 to Mohammad Yunus for establishing the Grameen Bank and for promoting micro-financing in Bangladesh. The social entrepreneur operates at the intersection of the market, state and civil society (Haugh, 2007). As one recent review put it (Haugh, 2007, p.743):

The capacity of individuals and communities to self-organize into groups and associations in order to provide goods and services they need has been around for a very long time, but the emergence of more enterprising social ventures which to aim to achieve financial sustainability has only recently attracted the attention of scholars. Social entrepreneurship combines the economic benefits of entrepreneurship with the delivery of social and environmental outcomes, and has the potential to assist the economic and social development of individuals and societies around the world.

Social entrepreneurs deserve attention from both researchers and practitioners because they act as a model for reforms of the state (Catford, 1998) and the socially responsible practices of enterprises. Today, social-entrepreneurship conferences are invariably the best-attended events for students at leading business schools (The Economist, August 2010).

1.2 Why Study the Clean Technology Sector?

I chose the clean technology sector as my lens to explore the field of entrepreneurship because I believe that the clean technology industry is possibly the single most important and vital industry for the sustenance of activities worldwide. Accordingly, it is worthwhile to look at this sector in detail. Clean technology is an ever-expanding realm of both science and business, with niches for many types of companies. Today, we confront a variety of difficult socio-economic, environmental, and governance challenges including climate change, oil depletion and growing threats to natural resources such as water.

Such challenges may be seen as threats; but they may also constitute new opportunities for clean technology. Clean energy technologies have received tremendous exposure as an investment opportunity over the last few years, enough so to create the term “cleantech.” It has been touted by entrepreneurs and politicians alike as the solution to our

economic and environmental crisis. On January 27, 2009, President Obama announced his plans on energy independence, which included tremendous investment in clean energy. He plans to double the capacity to generate alternative energy over the next three years. He reiterated his commitment to America's energy future on April 27, 2009 when he addressed members of the National Academy of Sciences (The National Academies Press, 2009). Many state governments are also creating cleantech initiatives. Private cleantech enterprises are also being formed. It is argued that success can be viewed as a “triple bottom line” involving economic, social and environmental performance (Skoll Foundation, 2007).

It is important to be as clear as possible in delineating what is meant by cleantech. The Cleantech Venture Network (CVN) defines clean technology or “cleantech” as embracing “a diverse range of products, services, and processes that are inherently designed to provide superior performance at lower costs, greatly reduce or eliminate environmental impacts and, in doing so, improve the quality of life.” (See Table 1-1 for the main guiding principles of cleantech.)

Table 1-1: Guiding Principles of Cleantech¹

Principle	Definition
Sustainability	Meeting the needs of society in ways that can continue indefinitely into the future without compromising the progress and success of future generations (through damage and depletion of natural resources).
“Cradle to cradle” Design	Ending the “cradle to grave” cycle of manufactured products, by creating products that can be fully reclaimed or re-used.
Source Reduction	Reducing waste and pollution by changing patterns of production and consumption.
Viability	Creating a center of economic activity around technologies and products that benefit the environment, speeding their implementation and creating careers in truly protecting the planet.

As noted by the Cleantech Group (2009), “cleantech” should not be confused with the terms “environmental technology” or “green tech” popularized in the 1970s and 80s. Cleantech is new technology and related business models that offer competitive returns for investors and customers while providing solutions to global challenges. While greentech, or envirotech, has represented “end-of-pipe” technology of the past (for instance, smokestack

¹ Marikar, F.; “Clean, Green and Sustainable: Where is the Business?”, Chemical Marketing & Economics Group-ACS New York Section, Septemeber 11, 2008

scrubbers) with limited opportunity for attractive returns, cleantech addresses the roots of ecological problems with new science, emphasizing natural approaches such as biomimicry, recycling and biology. Greentech has traditionally only represented small, regulatory-driven markets. Cleantech is driven by productivity-based purchasing, and therefore enjoys broader market economics with greater financial upside and sustainability (Cleantech Group, 2009). The New York City Economic Development Corporation (2009) defined the green sector to include green business activities that produce a good or service that substantially minimizes or corrects damage to the environment significantly more than conventional alternatives and specialized enabling activity that supports the growth of green business activity with specialized skills or knowledge.

In recent years, there has been a surge of entrepreneurship in the clean technology sector. Especially in urban settings, this rise includes entrepreneurs, in both the private and not-for-profit arenas. This entrepreneurial activity in cleantech is due to growing concerns about climate change, rising energy costs, resource constraints and to their potential social, economic and political impacts. All these forces have lead to the development of new technologies in renewable energy production, efficient usage of energy, enabling technologies for green development and efforts to reduce greenhouse gas emission. The public in general has also shown an increasing awareness of environmental issues and of ways to reduce environmental harm².

1.3 Why Use New York City as the Research Venue?

New York City offers an intriguing venue for cleantech. Its dense urban environment, mass public transit system and extensive parks network could provide the foundation for making NYC one of the most sustainable cities in the world. Combined with a large and diverse consumer market, an immense talent pool, entrepreneurial-minded industry and progressive environmental policies, NYC could emerge as a premier location for cleantech companies³ (See Table 1-2 for market potential of NYC.)

² Excerpt from the workshop “theme” for the first annual green technology and service workshop held on March 20, 2009 at the Tapei Economic and Cultural Office in NYC.

³ Excerpt from Industry snapshot provided by the New York City Economic Development Corporation. Website: www.nycedc.com/Green

Table 1-2: Market Potential for NYC⁴

Green Talent <ul style="list-style-type: none"> ▪ NYC is a destination for well-educated professionals and has a versatile talent pool. ▪ Over 1000 LEED accredited professionals. ▪ Nearly 500000 students attend NYC's colleges and universities. ▪ Home to architecture and design schools with growing environmental programs, such as Columbia Graduate School of Architecture, Planning and Preservation and the center for Sustainable Energy at Bronx Community College. ▪ Innovative green collar job training programs such as Sustainable south Bronx.
Green Projects <ul style="list-style-type: none"> ▪ 240+ LEED registered projects are in progress throughout NYC. ▪ 60+ public building projects incorporating sustainable elements are in design, under construction or have been built. ▪ 24 LEED certified projects have been completed. ▪ 6 NYC projects are included in the LEED ND pilot program, the first national system for neighborhood design.

NYC is an interesting venue to study entrepreneurship in general, due to the city's focus on promoting business innovation through entrepreneurial activity. An example of such an initiative is the recently created business incubator at 160 Varick where I work as a manager. Launched in July 2009, the 16,000-square foot incubator⁵ is now home to about 35 newly-formed companies focused on a diverse and vibrant range of industries such as clean technology, finance, information technology, web development, social media and fashion.

The incubator is also home to a unique executive education program titled "CleantechExecs" created by Polytechnic Institute of NYU with the support of New York State Energy Research and Development Authority (NYSERDA). The program is designed to be a rigorous academic initiative aimed at turning business leaders in diverse fields into clean technology business leaders and entrepreneurs by facilitating the application of green business practices and technologies to the needs of an urban market (Scientific American, January 2010). The program primes leaders to spearhead clean energy projects in New York City's backbone industries: financial services, real estate, building and architecture, and hospitality. It also provides extensive networking opportunities between the city's growing base of technology developers, entrepreneurs, academics and members of the venture community⁶.

⁴ Industry snapshot provided by the New York City Economic Development Corporation. Website: www.nycedc.com/Green

⁵ For a detailed listing of the services provided and the companies incubated at the Varick Street Incubator, please visit the incubator website at <http://www.poly.edu/business/incubators/160-varick>

⁶ For more information on the Cleantech Execs program, please visit <http://www.poly.edu/cleantechexecs>

Further, following the successful launch of the Varick Street incubator, the City of New York has announced plans for a total of five business incubators – focused on everything from fashion to food – and expects to announce several more by the end of the year, with hopes of nurturing a robust start-up culture. This focus on entrepreneurs is a recent shift for the Bloomberg administration (WSJ, May 2010) and initiatives such as this underscore the Bloomberg administration's and the city's growing belief that traditional technological clusters such as Wall Street will play a much smaller role in the city's economy for years to come, and perhaps forever.

In order to study the three main anchors of this dissertation in detail and explore the general issues highlighted above, in Chapter 2, I will provide a detailed literature review and discussion of each of the anchors. In Chapter 3, I will discuss the intellectual aim and research focus of the dissertation and the research methodology employed. In Chapter 4, I will present the case study on Verdant Power, a marine renewable firm that develops technologies that harness the energy potential of tidal and water currents. In Chapter 5, I will present the case study on Green Map System, a social venture that develops and hosts maps of eco-sites around the globe. In Chapter 6, I will offer a comparative analysis and discussion of the two organizations studied. Finally, in Chapter 7, I will present my observations and general conclusions on the dissertation topic, state my contributions to the management literature in the field of entrepreneurship and provide my suggestions for future research.

Chapter 2. Literature Review and Discussion

This chapter presents a discussion of relevant literature for this dissertation study. I have organized the relevant research domains as follows:

- Complexity of Contemporary Innovation and Entrepreneurship
- Social Entrepreneurship
- Emerging Clean Technology Sector and Activities in New York City

2.1 Complexity of Contemporary Innovation and Entrepreneurship

2.1.1 Complexity of Contemporary Innovation

Innovation is clearly a very complex and multifaceted topic. Scholars have studied many aspects of the subject. Ever since innovation and technology management first began to be examined as a scholarly field its inherent diversity was recognized, and technological innovation was quickly acknowledged to be a diverse and complex phenomenon. Within the context of this dissertation, I would specifically like to call attention to the inherent complexity and variety of technological innovation, especially with reference to social entrepreneurship and the clean technology sector.

The differences between types of innovation, e.g. radical vs. incremental (Myers and Marquis, 1969) or product vs. process (Abernathy and Utterback, 1975), were acknowledged. Scholars also noted that technological innovation takes place in different settings — e.g. the large corporation, entrepreneurial start-ups and growing enterprises and government-funded basic R&D and large-scale macro-level endeavors — and that innovation operates somewhat differently in each of these venues (Horwitch and Prahalad, 1976).

As research continued, rather explicit distinctions and models broke down somewhat as such factors as the growing linkages and interactions between various innovation types, the incorporation of technological innovation and technology management into other functions of an enterprise, e.g. marketing, strategy and HR (Branscomb, 2004)(Porter, 1985), a growing number of options for implementing innovation (Sawhney, 2006), the increasingly global scope of innovation (The Economist, 2007) , the emerging novel venues in which technological innovation takes place (especially network-like structures), and the complex

range of sources of innovation — all of which have by now emerged in considerable clarity in the innovation literature (Brown and Hagel, 2008)(Von Hippel, 2006).

Of particular importance when considering the changing nature of modern technological innovation is the rise of a digital environment, powered especially by powerful and accessible telecommunication networks, software, appliances and computing capabilities in the 1980s and 1990s and by the growth of the Internet in the 1990s. The rise of digital (or hybrid digital-physical) platforms permitted new forms of technological innovation to take place, in which the user increasingly contributed to content and in which development is at times carried out by a disparate collection of individuals linked together by the Internet so that low-transaction collaboration can occur on a worldwide basis (Tapscott and Ticoll, 2003). The impact of these latter developments includes such varied outcomes as pure digital-based innovation firms as eBay, financial services analytic boutiques and search engines from Google, Yahoo and others, the Open Source movement in software and even encyclopedias like Wikipedia (Schiff, 2006), user-driven content initiatives like Facebook, YouTube and other very recent initiatives to monetize user-centric innovations, like Kluster, InnoCentive, Cambrian House, and VenCorps (Tedeschi, 2008). As an indication of this change, the world's largest company, Wal-Mart, was founded in 1962 and did not go public until a decade later; multi-million dollar companies such as Google and Facebook barely existed a decade ago. Among the most important developments is a perceptible shift away from the single organization as a core source of technological innovation and a move toward using networks and leveraging external ecosystems to enhance innovation. This ecosystem emphasis in technological innovation and technology management is a growing trend and presents firms in an ever-increasing number of sectors with significant opportunities and challenges (Adner, 2006). Going forward, it will most likely be much more difficult to identify the providers of infrastructure and resources as well as the potential customers for those individuals who do not have the opportunity to tap the social resources of an established business in the relevant area. Through social networks, potential entrepreneurs can in particular get access to tacit industry knowledge.

The increasingly complex environment-geographic, economic and socio-political in which businesses must operate today often seems to demand new network-like structures which offer innovative, highly adaptive models that directly and indirectly serve mainstream

businesses' larger interests. New networks of innovation and changing mindsets among people have a distinctive way of “reperceiving” many of the enormous and urgent challenges before us such as climate change, oil depletion, water scarcity, global warming and ever-increasing environment pollution into opportunities to “leverage the power of markets and business to have transformative, system wide impacts” (Hendricks and Inslee, 2007).

Of late, a form of innovation called, “social innovation” has been increasingly getting attention of both the press and of scholars in the field of innovation. Social innovation refers to new strategies, concepts, ideas and organizations that meet social needs of all kinds — from working conditions and education to community development and health — and that extend and strengthen civil society. Over the years, the term has developed several overlapping meanings. It can be used to refer to social processes of innovation, such as the use of social media platforms and open source methods and techniques. Alternatively it refers to innovations, which have a social purpose, like microcredit or distance learning.

Scholars such as Peter Drucker and Michael Young discussed this form of innovation in the 1960s. It also appeared in the work of French researchers such as Pierre Rosanvallon, Jacques Fournier, and Jacques Attali in the 1980s (Chambon et al, 1982). However, the themes and concepts in social innovation existed long before that. Benjamin Franklin, for example, talked about social innovation in terms of small modifications within the social organization of communities that could help to solve everyday problems. Many radical 19th century reformers like Robert Owen, founder of the cooperative movement, promoted innovation in the social field and all of the great sociologists including Karl Marx, Max Weber and Émile Durkheim focused much of their attention to broader processes of social change. However, more detailed theories of social innovation and its practical application are only becoming prominent and widely accepted in recent times.

It is rare today to find complex, adaptive and public problems that do not require solutions in which stakeholders from non-profit, public and private sectors must collaborate. Ours is increasingly a shared-power world, that is, “a highly networked policy environment where many individuals, groups and organizations have partial responsibilities to act on public problems, but not enough power to resolve the problem alone” (Bryson & Crosby, 2005). For example, President Obama’s administration has championed public-private collaboration as a strategic way to address the complex mandates of its numerous federal

agencies, viewing it as a key requirement to advance change (Natsios, 2009; Saul, Davenport & Ouellette, 2010). U.S. State Department's special representative for Global Partnerships, Ambassador Elizabeth Frawley Bagley, defines public-private partnership as "a collaborative working relationship among, not only governmental, but also non-governmental stakeholders where goals and structuring governance, as well as our roles and responsibilities, are mutually determined and decision-making is made among the players" (Keegan, 2010). Ambassador Bagley also highlights the challenges of training professionals adequately, changing organizational cultures so people recognize the value of collaboration and assessing effectively the quality and impact of these collaborative efforts (Keegan, 2010; Saul et al., 2010; Natsios, 2009).

On July 22, 2010 the Obama administration listed the first 11 investments by its new Social Innovation Fund (SIF). About \$50m of public money, more than matched by \$74m from philanthropic foundations, will be given to some of America's most successful non-profit organizations, in order to expand their work in health care, in creating jobs and in supporting young people (The Economist, August 2010). The fund, which was pushed by the White House's Office of Social Innovation and Civic Participation (OSICP), is an example of one of several efforts worldwide to promote new partnerships of government, private capital, social entrepreneurs and the public. Such public-private partnerships foster new and diverse kinds of innovation by tapping into the ingenuity of social entrepreneurs. Most difficult and important social problems cannot be understood, let alone solved, without involving the nonprofit, public and private sectors. We cannot even think about solving global warming, for example, without considering the role of global petrochemical firms such as Exxon Mobil Corp. and BP, national agencies such as the EPA and the Department of Energy, supranational governmental agencies such as the United Nations and the World Bank, and non-profit groups such as Greenpeace and Environmental Defense (Phills et al, 2009).

2.1.2 The Changing Nature and Expanding Role of Entrepreneurship

Entrepreneurship is a key component of technological innovation and we now turn our attention to the changing nature of entrepreneurship and its various forms. A major development underway is a growing emphasis on leveraging entrepreneurship and on the changing nature of entrepreneurship itself. But what is an entrepreneur?

Skipping the concept's early French history of the sixteenth and seventeenth century (Sullivan Mort, Weerawardena and Carnegie, 2003), the first major contributions have been made by Richard Cantillon, Jean-Baptiste Say and Joseph Schumpeter who highlighted that entrepreneurs are able to bring together and coordinate the different factors of production in an innovative way while being faced with income uncertainty (Sexton and Bowman, 1985; Lim and Wee, 1994). According to Dees (2001), this traditional definition has recently been complemented by, among others, Peter Drucker who stressed that entrepreneurs recognize and exploit opportunities.

Economists have realized that in a knowledge-based economy entrepreneurs play a central role in creating new companies, commercializing new ideas and, just as importantly, engaging in sustained experiments in what works and what does not (Baumol, 2007). The Kauffman Foundation spends about \$90 million a year, from assets of about \$2.1 billion, to make the case for entrepreneurialism, supporting academic research, training would-be entrepreneurs and sponsoring "Global Entrepreneurship Week," which last year involved 75 countries. The Kauffman Foundation has also developed a business-building course called FastTrac dedicated to entrepreneurship research and education which is currently offered in 37 states in the US by local development organizations, chambers of commerce and other groups. Goldman Sachs is spending \$100 million over the next five years to promote entrepreneurialism among women in the developing world, particularly through management education (The Economist, 2009). Entrepreneurs are people who, through the practical exploitation of new ideas, establish new ventures to deliver goods and services currently not supplied by existing markets (Skoll Foundation, 2007). As mentioned in the Introduction, over eighty years ago Schumpeter called attention to the necessity for entrepreneurship in unleashing the "creative destruction" of innovation (Schumpeter, 1934). Others have enhanced this fundamental insight and have elaborated on the shifting and important role that entrepreneurship plays in the modern innovation process (Freeman, and Soete, 1982) (Roberts, 1991). It is also interesting to note a different perspective from Columbia University's Amar Bhidé who points out that a great deal of creation is of the non-destructive variety. Rather than displacing existing products and services, many innovations promote and satisfy new demands (Bhidé, 2008). William Nordhaus (2000), an economist at Yale University, points out that around 70% of the goods and services consumed in 1991 bore

little relationship to those consumed 100 years earlier. There are worlds of non-destructive creation yet to be conquered — new cures for diseases, say, or innovations that will improve the life of elderly people. And even when the creation does involve some destruction, there is usually not a lot of it. Most technological innovations increase productivity and improve the general standard of living (Nordhaus, 2000).

Peter Drucker (1993) defined the entrepreneur as somebody who “upsets and disorganizes.” “Entrepreneurs innovate,” he said. William Baumol (2007), one of the leading economists in the field, describes the entrepreneur as “the bold and imaginative deviator from established business patterns and practices.” Entrepreneurship is viewed as a key way to facilitate and enhance a dynamic process of “creative destruction” (Gliedt and Parker, 2007). Edmund Phelps (1966), a Nobel Prize winner, argues that attitudes of entrepreneurship have a big impact on economic growth. Howard Stevenson (2006), the man who did more than anybody else to champion the study of entrepreneurship at the Harvard Business School (HBS), defined entrepreneurship as “the pursuit of opportunity beyond the resources you currently control.” In 1998 HBS made entrepreneurship one of the foundation stones of business education, partly in response to demand from students. The school’s Arthur Rock Center for Entrepreneurship now employs over 30 professors. Between 1999 and 2003 the number of endowed chairs in entrepreneurship in America grew from 237 to 406 and in the rest of the world from 271 to 536 (The Economist, 2009).

Recent scholarship on entrepreneurship has also tended to emphasize the efficacy of entrepreneurship in a modern network economy, i.e., an economy characterized by, for example, interwoven global networks (Nijkamp, 2003). According to this line of thinking, entrepreneurship, which tends to seek new combinations or re-combinations, can fit in well in a network economy. Paul Romer (2005) of Stanford University has argued that, “Economic growth occurs whenever people take resources and rearrange them in ways that are more valuable.” In such a business environment, where speed, adaptation, flexibility and somewhat fluid restructuring are often needed, a successful entrepreneurial venture is one that is responsive and adaptable to changing settings. As a recent overview of entrepreneurship noted, “The entrepreneur is thus back on the scene. But these strategies may be entirely different from those in the past, as the institutional and technological environment of entrepreneurship has changed drastically” (Nijkamp, 2003). The triumph of

entrepreneurship is driven by profound technological change. A trio of inventions — the personal computer, the mobile phone and the Internet — is democratizing entrepreneurship at a cracking pace (The Economist, 2009).

There are also entrepreneurs at many different levels. Some people build small organizations, some build medium ones, some build large ones. The main difference is what is most important to them in life, how big they allow themselves to dream and where they come to rest along the way (Tracey and Phillip, 2007). Defining Entrepreneurship as “guiding an idea along the innovation process” (Roberts, 2006), Catford (1998) points out this basic concept of entrepreneurship can be broadened to also capture the phenomenon of social entrepreneurship. That is, in order for an activity to be identified as social entrepreneurship, it has to have the characteristics specified above and an additional quality that justifies the use of the supplemental adjective “social.”

2.2 Social Entrepreneurship

2.2.1 Is Social Entrepreneurship a Special Form of Entrepreneurship?

Is “social entrepreneurship” more than a catch phrase in the popular press? Social entrepreneurship has gained increasing interest in the popular press and on the lecture circuits of public administration and business schools. As Paul Light, a professor of public administration at New York University’s Robert F. Wagner Graduate School of Public Service has stated, “There appears to be plenty of evidence that social entrepreneurship exists, particularly when measured by the rapidly increasing number of conferences, case studies and funders interested in the topic” (Light 2005:1). Also, as Desa (2008) recently highlighted, social entrepreneurship is abundant and flourishes in resource-constrained environments, for example, as witnessed in the inner-city neighborhoods in the U.S. (Porter, 1995) and small villages in Brazil and India (Bornstein, 2003).

However, as a research topic, social entrepreneurship remains elusive from mainstream management literature. As part of this dissertation, I plan to review the definitions and early conceptualizations of social entrepreneurship. An initial review of the emerging literature on social entrepreneurship suggests three broad streams. First, there is literature that attempts to define the field of social entrepreneurship and differentiate it as a unique phenomenon of study. A second stream focuses on the resource-constrained

environments within which social enterprises operate. A third stream addresses the constraining and enabling role of institutions on social enterprise.

2.2.2 Defining and Differentiating it as a Distinct Field of Study

Social entrepreneurship can be viewed as serving and functioning in what can be termed the “social economy,” which has been defined differently by various scholars and practitioners over time. It has been defined as “...a broad category of organizations: co-operatives, mutuals and voluntary organizations, associations and foundations that engage in economic activity (traded or non-traded) with a social merit. (Smith, 2005). The social enterprise has been defined as “organizations which are not-for-profit, seek to meet social aims by engaging in economic and trading activities, have assets and accumulated wealth held in trust for the benefit of the intended beneficiaries of the enterprise’s social aims and composed of organizational structures which encourage full participation on a cooperative basis” (Conscise, 2003). McMurtry (2004) makes a distinction between the contemporary view of social economy, as defined by the previous authors, and the original foundations of the social economy based on a transformative political movement, suggesting that the modern-day social economy may have to reincorporate a “transformative” political tone if it wants to avoid being “used by government as the low-or-no cost alternative to state-funded social welfare.”

In contrast to McMurtry, Westlund (2003) argues that the social economy and the commercial economy should be viewed as “parts of a continuous spectrum” rather than as distant extremes. Similarly, others have argued that a blurring of lines between the social economy and the competitive economy could have economic, social or ecological benefits (Roper and Cheney, 2005). The tension between the traditional attribute of being dependent on donations and the more entrepreneurial attribute of being able to generate revenues through commerce, fees, etc. is at the core of the debate on entrepreneurship in the social economy. In this regard, social economy could be defined as a collection of “third sector” non-profit organizations providing socially beneficial products or services (Gliedt and Parker, 2007).

Social entrepreneurship research draws from distinguished previous works. The definitions of social entrepreneurship can be traced back to writings on non-profit organizations (Hansmann 1980, Young 1986), corporate social responsibility (Kanter 1999,

Wartick & Cochran 1985) and entrepreneurship (Gartner 1985, Shane & Venkatraman 2000). It may be best described as a set of innovative approaches that are used to address social issues (Wry 2006). The term “social entrepreneurship” has two different sources of origin in the 1980s with two different meanings. Edward Skloot of the Surdna Foundation used the term to highlight the possibility of income generation by a non-profit venture (Light, 2005). Bill Drayton, founder of the Ashoka organization, looked beyond the non-profit organization and described social entrepreneurship as a process that involved identifying, addressing and solving societal problems (Ashoka, 2006). Consequent definitions of social entrepreneurship have highlighted the role of the individual or the opportunity, and have ranged from the non-profit definition to the broader definition of social change. (See Table 2-1 for definitions of social entrepreneurship, the unit of analysis and the research focus.)

**Table 2-1: Definitions of Social Entrepreneurship, Unit of Analysis and Research Focus
(Adapted and Expanded from Desa, 2008)**

Author(s)	Definition	Unit of Analysis	Research Focus
Seelos & Mair (2004)	Social entrepreneurship is the simultaneous pursuit of economic, social and environmental goals by enterprising ventures and has gradually found a place on the world's stage as a human response to social and environmental problems	subset of business entrepreneurship	Opportunity
Tracery & Phillips (2007)	Social entrepreneurship refers to the creation of positive social change, regardless of the structures or processes through which it is achieved	Innovation	Opportunity
Young (1986)	Non-profit entrepreneurs are the innovators who found new organizations, develop and implement new programs and methods, organize and expand new services, and redirect the activities of faltering organizations (p.162)	non-profit entrepreneur	Individual
Waddock & Post (1991)	Private sector leaders who play critical roles in bringing about 'catalytic changes' in the public sector agenda and the perception of certain social issues (p.393)	private sector	Individual
Haugh, (2007)	Social entrepreneurship combines the economic benefits of entrepreneurship with the delivery of social and environmental outcomes, and has the potential to assist the economic and social development of individuals and societies around the world	non-profit innovation	Opportunity
Thompson, Alvy & Lees (2001)	People who realize where there is an opportunity to satisfy some unmet need that the state welfare will not or cannot meet, and who gather together the necessary resources (generally people, often volunteers, money and premises) and use these to 'make a difference'(p. 328).	subset of business entrepreneurship	Opportunity
Thompson (2002)	People with the qualities and behaviors we associate with the business entrepreneur but who operate in the community and are more concerned with caring and helping than 'making money' (p. 413)	social entrepreneur	Individual
Frumkin (2002)	Social entrepreneurs have a combination of the supply-side orientation and the instrumental rational, providing a vehicle for entrepreneurship that creates enterprises that combine commercial and charitable goals" (p. 130).	social entrepreneur	Opportunity
Alvord, Brown & Letts (2004)	Social entrepreneurs are individuals who are catalysts for social transformation. They are leaders who need two types of skills: 1) the capacity to bridge diverse stakeholder communities, and 2) long term adaptive skills and response to changing circumstances.	social entrepreneur	Individual
Barendsen & Gardner (2004)	Social entrepreneurs are unusual "in terms of their compelling personal histories, their distinctive profile of beliefs and their impressive accomplishments in the face of odds" (p. 50). The social entrepreneur is a new version of the long existing term "changemaker".	social entrepreneur	Individual

Light (2006)	A social entrepreneur is an individual, group, network, organization, or alliance of organizations that seeks sustainable, large-scale change through pattern-breaking ideas in what and/or how governments, nonprofits, and businesses do to address significant social problems.	social entrepreneur	Opportunity
Dart (2004)	Social entrepreneurship is an encompassing set of strategic responses to many of the varieties of environmental turbulence and situational challenges that nonprofit organizations face today (p.13)	non-profit innovation	Opportunity
Perrini & Vurro (2006)	Only those innovators who are able to actively contribute to social change with creativity and innovation, typical of the classical entrepreneurial process, can be called social entrepreneurs, regardless of their specific organizational form (for-profit or nonprofit).	social entrepreneur	Individual
Mair & Marti (2004)	Social entrepreneurship is defined as the innovative use of resources to explore and exploit opportunities that meet a social need in a sustainable manner	social entrepreneurship	Opportunity
Dees (1998)	Social entrepreneurs possess five criteria: 1) adopting a mission to create and sustain social value; 2) recognizing and relentlessly pursuing new opportunities to serve that mission; 3) engaging in a process of continuous innovation, adaptation and learning; 4) acting boldly without being limited by resources currently in hand; and 5) exhibiting a heightened sense of accountability to the constituencies served and to the outcomes created (p.4)	social entrepreneur	Individual

Broadly speaking, two overlapping conceptions of social entrepreneurship can be identified. In this regard, Seelos and Mair (2005) note that some authors emphasize the social outcome of an entrepreneurial activity while others refer to social problems triggering entrepreneurial behavior. For some scholars, social entrepreneurship refers to the creation of positive social change, regardless of the structures or processes through which it is achieved (Tracey and Phillips, 2007). From this perspective, social entrepreneurs are concerned with reconfiguring resources in order to achieve specific social objectives, and their success is measured by the extent to which they achieve “social transformation” (Pearce, 2003; Alvord et al, 2004; Bornstein, 2003). While they may develop business ventures in order to fund their activities, they are likely to rely on philanthropy or government subsidy to achieve their social missions. Within the corresponding “enterprise school” of social entrepreneurship, researchers explore how the ideas and tools of the business world can be used in a sector that,

by definition, ultimately does not make any financial profits at all (Fulton and Dees, 2006). That a great number of authors treat social entrepreneurship as a not-for-profit concept (Peredo and McLean, 2005) was confirmed by Taylor, Hobbs, Nilsson, O'Halloran and Preisser (2000) who found that 83% of the articles surveyed by them related social entrepreneurship to the NFP sector.

A second strand in the literature focuses on generating “earned income” in the pursuit of social outcomes (Boschee, 2001; Oster et al, 2004). In other words, these are “socially responsible practices of commercial businesses engaged in cross-sector partnerships.” (Seelos and Mair, 2005). From this perspective, social entrepreneurship is concerned with enterprise for a social purpose and involves building organizations that have the capacity to be both commercially viable and socially constructive. It therefore requires social entrepreneurs to identify and exploit market opportunities in order to develop products and services that achieve social ends, or to generate surpluses that can be reinvested in a social project (Leadbeater, 1998; Amin et al, 2002).

Research in the area of social entrepreneurship can advance more quickly by utilizing the universe of knowledge gained in the study of commercial entrepreneurship. It would possibly be useful to build our theory of social entrepreneurship on the strong tradition of entrepreneurship theory and research. Social entrepreneurs are described as individuals in non-profit organizations who start social transformations by bringing about changes in the public perception of social issues (Waddock & Post 1991; Alvord et al, 2004). Social entrepreneurs are one species of the genus entrepreneur” (Dees, 2001:2). The logic of this approach is that both social and commercial entrepreneurship address similar conceptual questions about the processes of discovery, evaluation and exploitation of opportunities and the set of individuals who engage in these actions (Shane & Venkataraman, 2000). These socially responsible, values-led/centered, ethical or sustainable entrepreneurs endeavor to be good as well as successful by simultaneously achieving economic (profit), environmental, and social goals — the so-called “triple bottom line” (Elkington, 1997).

Venkataraman (Venkataraman, 1997) studying traditional entrepreneurship sees the creation of social wealth as a by-product of economic value created by entrepreneurs. In social entrepreneurship, by contrast, social value creation appears to be the primary objective, while economic value creation is often a by-product that allows the organization to

achieve sustainability and self-sufficiency. It is however interesting to note that entrepreneurship is reshaping the voluntary sector as much as the private one. Rich people have often turned their hand to philanthropy in their later years, but this old story has acquired some new twists. Today's entrepreneurs routinely apply business techniques to philanthropy. Some of them are even using a venture-capital model, investing in a range of promising start-ups and making long-term funding conditional on performance (Scharamm, 2006). The fundamental difference between a social entrepreneur and a purely business entrepreneur can be observed in terms of what the founder seeks to maximize (Alvord et al, 2004). Social entrepreneurs are less motivated by monetary goals as in the case of a business entrepreneur but are more motivated by an ethical imperative and mission to change society. There seems to be a link between this difference and the hierarchy of values that govern the person's decisions — what they feel they “need” to accomplish to be happy and feel good about themselves or, alternatively, whose esteem and admiration they are seeking (Alvord et al, 2004). The most important qualities in social entrepreneurship are empathy, the ability to collaborate well with others and the stubborn belief that it is possible to make a difference (Peredo and McLean, 2006). Social entrepreneurs often blur the distinction between making money and offering charity. Some use the profits from their main business to cross-subsidize their charitable work. India's Aravind Hospitals, which performs 250,000 eye operations a year, do 60% of their work for nothing. Other social entrepreneurs establish for-profit social enterprises, also known as “FOPSEs,” that try to make money as well as doing good (Cohen, 2008). In terms of intrinsic drive, vision and aspiration, there is not much difference between leading business entrepreneurs like Bill Gates and Steve Jobs and leading social entrepreneurs such as Jim Grant, Muhammad Yunus or Bill Drayton. *The distinction between social and commercial entrepreneurship is not dichotomous, but rather a continuum ranging from purely social to purely economic.* Even at the extremes, there are still elements of both. That is, charitable activity must still reflect economic realities, while economic activity must still generate social value. Also, this continued blurring of boundaries between social and economic value creation suggests that there may be numerous examples of cross-fertilization of knowledge between commercial and social entrepreneurship (Mair & Marti, 2006). In its broadest sense, social entrepreneurship is defined as the innovative use of resources to explore and exploit opportunities that meet a *social* need in a *sustainable* manner (Mair &

Marti, 2004). In this definition, the primary emphasis is on meeting a “social need” that market forces have failed to address or ignored. Social entrepreneurship is exercised where some person or persons (1) aim either exclusively or in some prominent way to create social value of some kind, and pursue that goal through some combination of (2) recognizing and exploiting opportunities to create this value, (3) employing innovation, (4) tolerating risk and (5) declining to accept limitations in available resources (Peredo et al. 2006).

In addition to the challenges faced by all entrepreneurs, social entrepreneurs encounter another set of issues pertaining to their social objectives that add an extra layer of complexity to their activities (Tracey and Phillip, 2007). At the heart of social entrepreneurship is the challenge of balancing social and commercial objectives (i.e. managing a double bottom line), which can create a series of tensions across the businesses (Pharaoh et al, 2004). The kinds of tension experienced depend on the nature of the enterprise and the “costs” imposed by the social mission (Boschee, 2001), but the apparent conflict between social and commercial priorities is a central characteristic of social entrepreneurship. For example, in social enterprises that engage in *unrelated business activities* (i.e, where the enterprise operates in markets that are not connected to its social mission and uses the surpluses to subsidize the component of the enterprise that is responsible for social outcomes), social entrepreneurs must consider the appropriate balance between investment in the revenue-generating part of the enterprise with a view to building competitive advantage and investment in the part of the enterprise responsible for achieving social outcomes (Hansmann, 1987). On the other hand, for *mission-driven social enterprises* (i.e, enterprises that provide products or services with a social objective, such as public transport, banking facilities in rural areas, and the development of renewable sources of energy), social entrepreneurs often use income they generate from providing the same service in profitable markets to cross-subsidize the less profitable ones (Weisbrod, 1998). Thus tensions arise about the appropriate balance between serving locations and markets with varying prospects for generating earned income.

As opposed to private enterprises where the lines of accountability are reasonably clear, accountability is often a complex issue for social enterprises. Specifically, by taking on a social mission on behalf of a particular constituency, social entrepreneurs create an additional stakeholder, which they must take into account and communicate with when

building the venture and developing its strategy (Emerson and Twersky, 1999). This could be a difficult balance to strike, because social entrepreneurs also need to build profitable businesses based upon competitive products and services, and the process of stakeholder consultation may impede competitiveness and slow down decision making (Franks & Mayer, 1995).

The hybrid nature of the social enterprise leads to complex and difficult identity issues. Social entrepreneurs who have worked mainly in the nonprofit sector may find it difficult to identify closely with the commercial side of the business; for entrepreneurs with a for-profit background, the problem may be a difficulty identifying with the goals and approach of the social side of the venture, especially when they undermine the stability of the business (Pharoah et al, 2004). In other words, the tension between the for-profit and non-profit dimensions of the enterprise has the potential to create dissonance and interfere with the critical processes of organizational identification on which much positive behavior depends (Albert and Whetten, 1985). It appears to be becoming increasingly clear that regardless of their commitment to their social vision, only by operating profitably can social entrepreneurs engender sustainable social change.

2.2.3 Social Entrepreneurship for Innovation

There has been a profound neglect in most of the literature dealing with social entrepreneurship on the relationship between social entrepreneurship and technological innovation. Is social entrepreneurship a source of technological innovation — a source that has hitherto been ignored or undiscovered in innovation and technology management research as well? There are hints that, at least for certain technologies, certain industrial settings and certain socio-political situations, that social entrepreneurship can act as an important innovation source. It is acknowledged, for example, that although social entrepreneurship is “messy,” and it is “not tidy,” that very messiness can be an asset in a context of rapid change, uncertainty, multiple stakeholders and changing technologies (Beveridge, 2005) (Peredo and McLean, 2006). Moreover, research has shown that vigorous social entrepreneurship can be a much-needed source and channel of new energy, revitalization and hitherto untapped talent in a context of constrained resources. For example, effective social entrepreneurship and support for social entrepreneurial activities are

correlated with positive change in municipalities (Beveridge, 2005) (Korosec and Berman, 2006).

Catford (1998) defined social entrepreneurs as individuals who are “often at the heart of community-based initiatives, finding innovative solutions to problems which face the most impoverished and marginalized communities.” The entire conceptualization of social entrepreneurship is actually rather complex, and is also somewhat contradictory. Most of the scholarship dealing with social entrepreneurship in various ways examines the skills and beliefs of entrepreneurs, the environment in which they act, and the interactions and influences affecting the social entrepreneur and the external environment (Beveridge, 2005). Even the term “social entrepreneurship” is somewhat difficult to comprehend. How much is “social” and how much is “entrepreneurial”? More specifically, are the goals more socially purposeful or more profit-seeking? It also turns out that there are several types of social entrepreneurs. In particular, some place a high premium on social goals, while others emphasize the importance of commercial exchange (Peredo and McLean, 2006). Still, social entrepreneurs are acknowledged to be different from, say, salaried officials working on ostensibly similar issues in an agency, foundation, etc.

There have also been various attempts to establish a typology of social entrepreneurship. For example, one study lists three social enterprise forms: mission-centric, mission-related and mission unrelated, and then overlays three operational types: embedded, integrated and external (Haugh, 2007). Another attempt to differentiate social entrepreneurs, or “eco-preneurs,” is to distinguish structure (hard vs. soft) and motivations for action (primarily economic vs. primarily green aims). This generates a two-by-two matrix, resulting in four types of “eco-preneurs”: innovative opportunists, visionary champions, ethical mavericks and *ad hoc* eco-preneurs, as seen in Figure 2-1.

		Motivations for Action	
		Primarily Economic	Primarily Green
Structure	Hard	Innovative Opportunist	Visionary Champions
	Soft	Ad Hoc Eco-Preneurs	Ethical Mavericks

Figure 2-1: Possible Types of Eco-Preneurs (Beveridge, 2005)

The notion of studying the connection between social entrepreneurship and technological innovation and technology management is also related to how innovation now often occurs — within increasingly network-like, fluid and interlinked structures. Innovation as a whole is becoming increasingly concerned with the overall ecosystem (Adner, 2006). Indeed, the greater the complexity of decision making, the more numerous and diverse the key participants, and the more widespread the expertise needed, the more likely that a network of relationships and organizations is useful, due, in part, to the “strength of weak ties.” (Granovetter, 1973) (Granovetter, 1983). While attention is increasingly paid to social networking and Web 2.0 activities (Johnson, 2007), the relevance of the ecosystem orientation that characterizes some twenty-first century innovation may be much broader. In this sense, much of technological innovation is becoming more “democratized” and more “open,” recently described as populated with numerous flexible “creation nets” rather than traditional stand-alone or formally linked firms (Von Hippel, 2006) (Chesbrough, 2003) (Brown and Hagel, 2008). In such a setting, social entrepreneurship may well flourish, adapting in an on-going way to changes and opportunities.

2.2.4 Social Entrepreneurship as an Emerging Model for Value Creation?

It has been stated that social entrepreneurship creates new models for the provision of products and services that cater directly to basic human needs that remain unsatisfied by current economic or social institutions and that it provides a unique opportunity for the field of entrepreneurship to challenge, question and rethink important concepts and assumptions in its effort towards a unifying paradigm (Mair and Marti, 2006). Prahalad and Hart (2002) incorporated the idea about “the fortune at the bottom of the pyramid” and propositioned that there is much untapped purchasing power in low-income markets which represent an enormous opportunity for the private sector to make significant profits by selling to the poor and thereby bring prosperity to the aspiring poor and help eradicate poverty. This has proven to be a very appealing proposition and has drawn much attention from senior managers, large companies and business schools. Muhammad Yunus initiated the worldwide growth of the anti-poverty “microcredit” strategy and proved that it was far better to compete against non-consumption at the base of the pyramid and then migrate from that profitable base toward successively more sophisticated customers and applications in global markets. Yunus took a

product (credit) and brought it to a mass audience. In doing so, his bank helped to democratize access to capital.

Some of the key stakeholders in social entrepreneurship include community leaders, leaders in non-profit organizations, users, institutional leaders, and entrepreneurs who reach into their communities (Christie and Honig, 2006). It can be argued that increasingly, non-government organizations, non-profit organizations (NPOs), entrepreneurial firms, governments⁷ and public agencies are recognizing the significance of strategic social entrepreneurship towards the development of world-class competitive services. Mair and Marti (2006) argue that all entrepreneurial endeavors contain both a social and an economic component, and that the differences often depend on ones' perspective and priority. Karnani (2007) had stated that as opposed to Prahalad and Hart's (2002) approach of viewing the poor primarily as consumers, an alternative approach would be to focus on the poor as producers and to emphasize buying from the poor. He recommends that we should not romanticize the poor as "value conscious consumers" (Prahalad and Hart, 2002) and the best way for the private sector to help eradicate poverty is to invest in upgrading the skills and productivity of the poor and to help create more employment opportunities for them.

Is the Grameen Bank an economic or social enterprise? Given the intensity of interest in microcredit and the resources devoted to it, it is reasonable to ask how profitable it is and whether it is really an effective tool for eradicating poverty. Karnani (2007) argued that microcredit often yields non-economic benefits for its clients, such as increasing self-esteem and social cohesion and empowering women. It also helps the poor smooth consumption over periods of cyclical or unexpected crisis. However, would this alone be able to eradicate global poverty?

Increasingly it can be observed that there are more and more social founders who are using a business format to achieve their objectives. As an example, Iqbal Quadir, a Bangladeshi who emigrated to America to become an investment banker and then a business academic, struck a relationship with Yunus to design mobile phone kits equipped with long lasting batteries that were given to woman who then sold time on their phones to local villagers. Grameen has become Bangladesh's largest telecom provider with annual revenues

⁷ As an example, the renewable-energy sector got a huge lift from the \$787 billion economic stimulus package signed by President Obama in February 2009, which represented a possible breakthrough in U.S. energy policy. The American Recovery and Reinvestment Act will invest nearly \$79 billion in renewable energy, energy efficiency and green transportation, according to a final tally of the legislation by the nonprofit Environment California.

of \$1 billion. And the entrepreneurial phone ladies have plugged their villages into the wider economy (Isenberg, 2008). It is likely that in the future, there will be a lot more for-profit social entrepreneurship as well as blending of legal formats. New models of wealth creation and capitalism have much to contribute to strengthening the economic analysis of social entrepreneurship. They also have the potential to impact policy determination at national levels (Amin et al, 2002). It is interesting to note that for-profit organizations are increasingly treating climate change as a business opportunity (Cook and Barclay, 2002; Aulisi et al, 2004; Hanson, 2005). Today, “being green is not a cost of doing business, but a catalyst for innovation, new market opportunity and wealth creation” (Hartman and Stafford, 1997). It is evident that the for-profit environment sector is experiencing rapid transformation due to an increase in the volume of environmental product, service, and process innovation activity. The willingness of the for-profit sector to create environmental innovations designed to meet consumer demand for environmental services provides opportunities and threats for non-profit environmental organizations services (Gliedt and Parker, 2007). The key to successful social entrepreneurship may be to align the revenue-generating services with the environmental goals of the organization so that the perceived conflict is avoided (Gliedt and Parker, 2007).

Advocates of social entrepreneurship have also argued that it should be considered by governments as a key mechanism to enable local economic development and sustainable development initiatives (Dodds, 2007). Within the context of the cleantech sector, social entrepreneurship could be flexible local delivery agents of climate change mitigation programs and environmental services among others and ride the green wave of citizen demand locally and nationally. The first Earth Day, organized on April 22, 1970, marked the popularization of the environmental movement and catalyzed greater participation in environmentally oriented activities. For ground-level eco-activists, the creation of voluntary, non-profit community recycling programs became one of the key expressions of this nascent environmental movement (Schnaiberg, 1973). Most entrepreneurs were motivated by a broader set of anti-institutional ideals that were part of the late 1960s environmental movement (DeBell, 1970; Gottlieb, 1993). In their seminal article on the rise of the U.S. recycling industry, Lounsbury et al (2002), showed how marginal practices promoted by fringe actors can provide the basis for a new industry as a result of political mobilizations

that alter established structures of meaning and resources which are upheld by field frames. In their article, social movement activism focused on ending the construction of waste-to-energy (W-T-E) incinerators and was crucial to the eventual de-institutionalization of the dominant resource recovery field frame, enabling recycling practices to become transformed into a mainstream economic institution. What were once marginal practices promoted by a radical social movement came to be central practices, core to the technology and strategies of large, profit-seeking firms and a growing segment of the solid waste management field. Ironically, the rise of the recycling industry was made possible by the principles and policies that were developed by social-movement-inspired non-profit recyclers, and that were subsequently adapted and incorporated into the core of the solid waste field by for-profit actors (Weinberg et al, 2000). This was mainly because recycling practices came to be associated with a social change agenda advocated by “radical” activists (Nader, 1972). Social entrepreneurship has been propositioned to occur either *through* existing institutions or in the *absence* of existing institutional arrangements. When social entrepreneurship happens *through* existing institutions, scholars look at how institutions facilitate and create boundaries of practice for social ventures (Lasprogata & Cotton, 2003). Social entrepreneurship often takes place at the intersection of multiple institutions and may be influenced concurrently by the government, the market, and the community (Shaw & Carter 2004). When social entrepreneurship happens in the *absence* of existing institutional arrangements, the creation of a venture may in itself cause a change in that existing institutional arrangement (Mair & Marti 2006). For example, environmental degradation may be seen as the result of failed (or absent) market mechanisms that include environmental protection.

In the case of social entrepreneurship *through* existing institutions, social enterprises may help lower entry barriers to business by forming a link between the social issues relevant to the local context and the economic benefits of the market (Roberts, 2006). Wallace (1999) suggested that in contrast to traditional businesses and volunteer agencies, social enterprises formed an effective social, political and economic link between the government and free market enterprise. Social enterprises such as affirmative businesses and direct-service agencies played a large part in revitalizing the local community by providing self-help, development of local jobs, businesses, and human resources by and for communities. These

enterprises provided viable alternatives for transitional employment into the mainstream business community (Haugh, 2007).

When social entrepreneurship happens *against* existing institutional arrangements, the creation of a venture may in itself cause a change in the existing institutional arrangement (Mair & Marti 2006, Sarasvathy 2006). An example of social entrepreneurship in the absence of amenable institutions is put forward by Sarasvathy (2006) who argues that in contrast to current separations (for-profit vs. non-profit) in business and society, equity markets should be opened up to all social ventures that invest in human potential, whether they be for-profit or non-profit. Existing institutional arrangements are often designed to achieve a variety of organizational goals through collective action. For-profit organizations for example, achieve goals through the specific institutional arrangement we call the “market.” Non-profit organizations achieve goals through non-market mechanisms that include charity and philanthropy. Sarasvathy (2006) points out that there are problems with market and non-market mechanisms. Social enterprises that are able to survive under these conditions are forced to go against existing institutions and come up with creative mechanisms that incorporate the best of both market and non-market solutions. By alluding to the fact that social entrepreneurs leverage resources to create new markets, or to transform existing ones (Mair & Marti 2006, Sarasvathy 2006), researchers have opened a new avenue of study of the process of new industry emergence. As Christensen et al (2006) mention, it is important to support organizations that are approaching social-sector problems in a fundamentally new way and creating scalable, sustainable, systems-changing solutions. These “catalytic innovations” (described as low-cost and simple but useful services for people whom traditional social sector organizations ignore), share principal features with Christensen’s disruptive-innovations model. Like disruptive innovations, which challenge industry incumbents by offering simpler, good-enough alternatives to an underserved group of customers, catalytic innovations can surpass the status quo by providing good enough solutions to inadequately addressed social problems. The existing players in any sector are set up to support their existing business models and have resources, processes, partners and business models designed to support the status quo and hence implementing a simpler, less expensive, more socially accessible product or service could sabotage their current offerings. Therefore, catalytic innovations that will bring new benefits to most people are likely to

come from outside the ranks of the established players (Christensen et al, 2006). Social entrepreneurs seek to provide social improvements and enhancements to their communities, including attractive return on investments (both social and financial) to their key stakeholders. Social entrepreneurs assess their impact and influence in terms of their social impact, innovations and outcomes, not simply in terms of size, growth or processes (Choi and Gray, 2008).

2.3 Possible Distinguishing Features of an Emerging Cleantech Sector

Overall, during the first decade of the twenty-first century, increased demand for electricity grew. Concern over environmental degradation and climate change also rose significantly. With these concerns, interest in generating electricity using renewable energy also heightened. According to the U.S. Energy Information Administration (EIA), electricity generation was expected to nearly double between 2004 and 2030. Overseas, growth in the developing world is projected to be approximately 57% greater than the worldwide average (International Energy Outlook 2007 Report). With concern over climate change rising, communities across the globe are also struggling to find ways to reduce their reliance on coal, a leading contributor of carbon dioxide, and to develop alternate and clean sources for electricity production.

In order to control these emissions, carbon dioxide is likely to maintain a significant economic price in the near future. If the price is very high, as some economic models suggest (from \$50 to \$100 or more per ton emitted), and if a liquid secondary market emerges for trading emission allowances, this could raise average energy prices 30 - 60% or more. Thus, the worldwide market for clean and renewable energy technologies is expanding. The World Bank forecasts that within the next 40 years there will be a \$5 trillion global industry in renewable energy technology. Policies such as the Kyoto Protocol and diverse, aggressive renewable energy requirements have made sustainability a visible and increasingly accepted goal. To support cleantech/renewable energy growth, new public economic incentives are being proposed, and some have been adopted. Such policies and decisions include cleantech funding as part of the stimulus package, tax credits, government-directed development projects, cap and trade in carbon, production tax credits, investment tax credits and grants to organizations seeking to advance sustainable technologies.

Interest and, until very recently, investment, in cleantech during the past decade has soared, especially in solar, biomass and wind, as well as smart grids. For example, wind appears to be a fast-growing form of renewable energy in the world, with projections that installed wind capacity will double by 2015. However, even at the most optimistic levels of growth, the EIA estimates that renewable energy could only provide 16% of the world's electricity by 2030 (International Energy Outlook 2007 Report) — a figure that does not currently include marine renewables. Thus, a huge gap remains between demand for clean energy and technologies available to meet this budding market. (See the next page for Table 2-2: Comparison of Fuel Sources.)

Table 2-2: Comparison of Fuel Sources

The following table reflects the rapidly changing dynamics in the costs of energy generation that have occurred in the past few years, comparing 2005 cost information as reported by the Energy Information Agency (Annual Energy Outlook 2005) versus contemporary (Spring 2008) reports from industry and government sources.

	<u>Supply Outlook</u>	<u>2005 Cost/kW Installed</u>	<u>Cost/kWh (US Cents)</u>	<u>Supply Outlook</u>	<u>2008 Cost/kW Installed</u>	<u>Cost/kWh (US Cents)</u>
Coal Fuel costs have risen by 30-50% over the past two years. Cost of coal plant construction has doubled in four years. Financing of facilities has come under threat in US via major bank redlining, suspension of some US Government loan guarantee programs, and environmental pressures at the State level.	Plentiful	\$1,500	4 - 6	Tightening	\$3,000 – \$3,200	5 - 8
Natural Gas Increasingly imported from more distant sources, at greater and greater costs, including added transport, storage, processing facilities, and supply chain vulnerabilities. US fuel prices hit a two-year high in March 2008 at \$10+, and kept increasing, while some competing LNG importing countries are signing new purchase contracts at \$14-18.	Costs Escalating	\$1,800 – \$2,000	5 - 7	Costs Escalating	\$2,000 – \$2,200	7 - 11
Wind Component scarcity seems to be the main immediate problem, resulting in increasing system costs. Turbine costs are up \$400/kW since 2001, resulting in higher delivered system costs. Growing concentration of industry results in 85% of US market now controlled by four firms. Listed prices do not reflect required additional transmission system upgrades (ranging up to an additional 50% of capital costs) to bring the wind energy from generation areas to ultimate users.	Sustainable	\$1,400 – \$2,000	4.5 - 14	Sustainable	\$1,800 – \$2,400	5.5 - 14
Solar Increases in efficiencies have not resulted in meaningful reduced costs for consumers as global pricing competition pulls much of world production into selected high tariff areas (e.g. Germany). Shortages of materials have sustained high prices, while longer term constraint is lack of adequate storage capacity to offset nocturnal generation stoppages.	Sustainable	\$8,000 – \$8,750	20 - 38	Sustainable	\$8,000 – \$8,750	20 - 38
Marine – Current Costs Industry is still at early stage with limited production volume and installation experience, similar to wind industry in the early 1980's. The relatively current production costs are offset by various government mandates and incentives directed at renewables in general and marine renewables specifically, which reduce the effective costs to early adaptors to competitive levels.	Sustainable	\$5,000 – \$7,000	15 - 26	Sustainable	\$5,000 – \$7,000	15 - 26
Marine – Future Costs Costs should decline approximately 15-18% each time production volume doubles, according to analyses of The Carbon Trust and Electric Power Research Institute. Manufacturing consultants' "should cost" studies support these analyses.	Sustainable	\$1,500 – \$4,000	5 - 11	Sustainable	\$1,500 – \$4,000	5 - 11

"Spend billions on green investments now to reverse economic downturn and halt climate change"

—Nicholas Stern, former Treasury economist and now chair of the Grantham Research Institute on Climate Change and the Environment

The role of cleantech was recognized over a decade ago as potentially important when considering technological innovation. Innovation in cleantech has exploded in the last decade: Approximately 1,500 cleantech start-ups operate worldwide – 930 in energy, 45 in air, 90 in water, 120 in waste, and 315 in sustainability. 29,874 scientific journal articles were published on cleantech topics in 2006, while 4,093 U.S. patents focused on cleantech were issued. U.S. cleantech patents issued have grown at an average of 5% per year since 1995, double the rate for patents overall (Lux Research, 2007). Technological innovation *per se*, both systemic and linear, could play an important role in dealing with the so-called “greening of technology” and with the possibility of “limits to growth,” the latter of which was an argument that was made by some in the environmental arena (Freeman, 1996). But the development of other types of innovation patterns, e.g. incorporating new kinds of actors and structures, was not discussed at that time. With Barrack Obama now president, there is the potential for environmentally-focused policies to be passed that would spur demand for the cleantech products being developed by local and national companies. (See Table 2-3.)

Table 2-3: Green Policies⁸

<p>PlaNYC</p> <ul style="list-style-type: none"> ▪ Announced on Earth day 2007, Mayor Michael Bloomberg affirmed NYC's commitment to long-term sustainable development with the release of PLANYC: A Greener, Greater New York. ▪ 127 initiatives address the major challenges to the future of urban living, including the need for affordable housing; a renovated, expanded transit system; clean air, water and land; cleaner, more reliable energy; ample open space; and climate change adaption. ▪ Intended to upgrade and modernize NYC's infrastructure in order to improve quality of life and support its environmental and economic sustainability. <p>Environmentally Preferable Purchasing (EPP)</p> <ul style="list-style-type: none"> ▪ Package of legislation passed in 2005 by City government. ▪ Focuses on the human health and environmental impact of goods and products purchased by City government. 	<p>Local Law 86</p> <ul style="list-style-type: none"> ▪ Effective on January 1, 2007, this law recognizes the impact that building construction has on the environment and the benefits to designing and constructing buildings to minimize the use of energy, water and other natural resources. ▪ Requires all city-owned construction and renovation projects valued at \$2 million or more, as well as projects receiving more than \$ 10 million or at least 50% of estimated construction budgets from the city to achieve of LEED silver or higher. <p>New Green Building Legislation</p> <ul style="list-style-type: none"> ▪ Set of new codes developed to modernize and streamline NYC's 1968 Building and Electrical Codes. ▪ Enhance building safety while encouraging sustainable building practices by offering fee rebates for the use of renewable energy, water conservation, and achievement of LEED certification. ▪ Through a joint effort with the US Green Building Council, the city is also 'greening' the building and energy code, comprehensively, to encourage sustainable and energy efficient building across all sectors.
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If there was a single event that crystallized the reason why cultural embrace of environmental issues may have been the biggest business or technology story, it may have been the day in November 2007 when Al Gore, former vice president and winner of the Nobel Peace Prize for his work on climate change, announced that he was joining Kleiner Perkins Caufield and Byers, the Silicon Valley venture capital firm, as a partner to focus on green businesses (O'Brien, 2007) (Richtel, 2007). His relationship with Kleiner Perkins indicated just how large a role green technology would play in the nation's future. Since then cleantech has become even more prominent. There are now calls for a "War on Oil" (Khosla, 2007). Cleantech is seen as a possible answer for economic growth, employment, new

⁸ Industry snapshot provided by the New York City Economic Development Corporation. Website: www.nycedc.com/Green

clusters of innovation and revitalization of cities (Apollo Alliance, circa 2006). In 2007, cleantech was responsible for 770,000 U.S. jobs. While that number is still relatively small, the trend is heading in the right direction — the number of cleantech jobs increased by 9.1% from 1998 to 2007, at a time when overall U.S. job growth was just 3.7%, according to the Pew Charitable Trusts. And as federal recovery act funds are invested over the coming year, those numbers will continue to rise (Cho, 2009). The Energy Department, through the renewable energy grant program included in 2009's economic recovery plan, gave out \$2.6 billion that went to fund American projects and \$2.3 billion in tax credits provided for 183 clean energy manufacturing projects in 43 states that will generate more than 17,000 jobs (Vestel, 2010). Cleantech-associated technologies are almost always listed as among the top prospects for major technological innovation in the near future. In one study on the "global technology revolution" in 2020, two of the top candidates cited were cleantech technologies: cheap solar energy and hybrid vehicles (Silberglitt, 2006). Of the fourteen "engineering grand challenges" listed by the National Academy of Engineering in 2008, at least six deal with some aspect of clean technology, including making solar energy economical, managing the nitrogen cycle, providing energy from fusion, providing access to clean water, providing carbon sequestration methods and restoring and improving urban infrastructure.

Cleantech is also quite pervasive and encompasses a wide variety of industries, firms and technologies. A major cleantech information source and investment firm lists the following industry segments as making up a large part of the cleantech universe: energy generation, energy storage, energy infrastructure, energy efficiency, transportation, water and wastewater, air and environment, materials, manufacturing/industrial, agriculture, and recycling and waste.⁹ A diverse range of products, processes and services, spanning industries, also comprise cleantech. What all of these cleantech activities have in common, according to a leading cleantech information source, is that they all tend to strive to provide superior performance at lower costs; to reduce significantly or even eliminate negative

⁹ In a more detailed fashion the various industry segments include sub-segments, such as: energy generation (wind, solar, hydro/marine, biofuels, geothermal, and other); energy storage (fuel cells; advanced batteries, and hybrid systems); energy infrastructure (management and transmission); energy efficiency (lighting, buildings, glass, other); transportation (vehicles, logistics, structures, fuels); water and wastewater (water treatment, water conservation, and wastewater treatment); air and environment (cleanup/safety, emissions control, monitoring/compliance, trading & offsets); materials (nano, bio, chemical, and other); manufacturing/industrial (advanced packaging, monitoring and control, smart production); agriculture: (natural pesticides, land management, aquaculture); and recycling and waste (recycling, waste treatment) (Cleantech Network, 2008)

ecological impacts, and to upgrade productive and responsible use of natural resources. (Cleantech Network, 2008)

Businesses in a variety of sectors are recognizing that going green can save money, open up new avenues and help keep employees, shareholders and customers happy. They are also embracing cleantech as part of their operations, e.g. establishing environmental management systems to become “lean and green.” Cleantech is also becoming a core segment of their overall strategy (The Economist, February, 2008). These firms include GE, IBM, Wal-Mart, GE, Google, HP, Dell and various auto companies (Florida and Davison, 2001) (The Economist, 2007) (CNN.com, 2007). For example, according to a 2008 study in The Economist titled “Doing Good: Business and the Sustainability Challenge,” DuPont cut costs by \$2 billion since 1990 through energy reduction initiatives alone. In addition, \$3 million has saved \$82 million between 2001 and 2005 and reaped another \$10 million in savings in 2006 alone (Wills, 2009).

But research has also shown that firms act in this manner for varied reasons, including maintaining competitiveness, complying with regulation, laws and public expectation (called legitimation) and acting out of a sense of social responsibility (Bansal and Roth, 2000). Cone Inc. conducted a survey of Millennials, those born between 1979 and 2001, to find that this group had even stronger opinions in support of the above claim. This survey found that 83% of Millennials trust a company more if it is environmentally responsible. Sixty-nine percent consider a company’s social and environmental commitment when deciding where to shop. Eighty-nine percent will switch from one brand to another if the second is associated with a good cause and 74% will pay more attention to a company’s message if the company has a deep commitment to a cause (Wills, 2009).

Cleantech venture investment also has experienced rapid growth on a worldwide basis (Cheng, 2007). Venture investment in cleantech grew from about \$714 million in 2001 to about \$5.18 billion in 2007. Cleantech investments grew from \$3.6 billion in 2006 to about \$5.18 billion in 2007, a growth of about 43%. U.S.-based venture capital investments in energy technologies increased 22%, from \$2.7 billion in 2007 to \$3.3 billion in 2008, according to New Energy Finance. As a percentage of total VC investments, energy tech grew nearly 30%, from 9.1% of all investments in 2007 to 11.8% in 2008. In 2000, energy tech represented just a half a percent of all VC investments (Makower et al., 2009). Venture

capital firms invested at least \$5.6 billion in clean technology in 2009 in North America, Europe, China and India totaling 557 deals (Energy Business Daily, 2009).

The first quarter of 2010 saw a record number of cleantech investments: 180 deals totalling \$1.9 billion globally, according to a preliminary tally released by the Cleantech Group and Deloitte (Mercury News, 2010).

"The first three months of 2010 represent the strongest start to a year we have ever recorded"

— Sheeraz Haji, president of the Cleantech Group consultancy

As of March 2010, the leading cleantech sector was transportation, which is dominated by electric vehicles. A \$350 million investment in Better Place, the Palo Alto-based company that is building charging stations for electric cars in Israel and Denmark, helped transportation have a record quarter: \$704 million in 27 deals. Irvine-based Fisker Automotive raised \$140 million. The solar sector recorded \$322 million in 27 deals, including \$40 million to Enphase Energy of Petaluma. Energy efficiency attracted \$217 million of investments in 39 deals, with the top three deals all going to LED companies (see Table 2-4 for top areas of cleantech investment).

Table 2-4: Cleantech Investment**Top Areas of Cleantech Investment Globally (2010, first quarter)¹⁰**

Sector	Investment Size	Deals
Transportation	\$704 million	27
Solar	\$322 million	27
Energy Efficiency Products	\$217 million	39

Top Areas of Cleantech Investment Globally (2009)

Sector	Investment
Solar	\$1.2 billion
Transportation (including electric vehicles, advanced batteries, fuel cells)	\$1.1 billion
Energy Efficiency	\$1.0 billion
Biofuels	\$554 million
Smart Grid	\$414 million
Water	\$117 million

North American companies received 81% of the total global venture investment, with Europe (including Israel) accounting for 14%, China for 4% and India for 1%. North American companies raised \$1.5 billion in the first quarter. California led the way, with \$870 million, or 57% total share of investment, followed by Oregon, with \$179 million, or 12%.

Energy generation deals grabbed the lion's share in 2007 representing \$2.75 billion worth of investment (Cleantech Group, 2008) (LaMonica, 2008). SunPower, based in San Jose, said its stock price grew 251% in 2007, faster than any other Silicon Valley company, including Apple and Google at that point. Overall cleantech investment, encompassing all investment not just ventures, was recently estimated to be about \$100 billion (Kanter, 2008). The increase in investment dollars follows continued regulatory action to reduce greenhouse-gas emissions and a rising consciousness among government and consumers to address energy security and global warming (Cheng, 2007).

¹⁰ Siliconvalley.com, "Record number of cleantech deals in the first quarter of 2010." Retrieved 4/1/10 World Wide Web, http://www.siliconvalley.com/news/ci_14795545?source=email&nclck_check=1

In any event, in spite of the downturn of the economy, the overall mood with regard to cleantech prospects is quite bullish (Parker, 2007) but is currently quite volatile and analysts have had to reevaluate bullish positions. According to research firm Renaissance Capital there were just 43 U.S. IPOs of all types in 2008 that raised at least \$50 million, down from 272 in 2007, marking it the slowest year for IPOs in nearly three decades (1979). Clean Edge's two clean-energy-related stock indexes, which were both up more than 60% in 2007, were down a similar amount in 2008, reflecting the volatility of the clean-energy sector and broader markets overall (Makower et al., 2009). There were 13 cleantech IPOs during the first quarter of 2010, which raised a total of \$1.5 billion. Eight of the transactions were in China. Despite rumors of numerous companies preparing S-1 filings, only three North American companies actually registered to go public in the first quarter: Tesla Motors, Fallbrook Technologies and First Wind. (See Figure 2-2 for Seed Stage Cleantech Investment breakdown from 2004-2009 on following page).

Cleantech Sector	Total Number of Deals	Total Amount Invested (in millions)	Average Amount Invested	Median Amount Invested
Air & Water Technologies	7	4.1	0.58	0.5
Alternative Energy & Power	15	8.5	0.57	0.55
Materials & Green Building	3	1.84	0.61	0.56
Transportation & Logistics	2	0.55	0.27	0.58

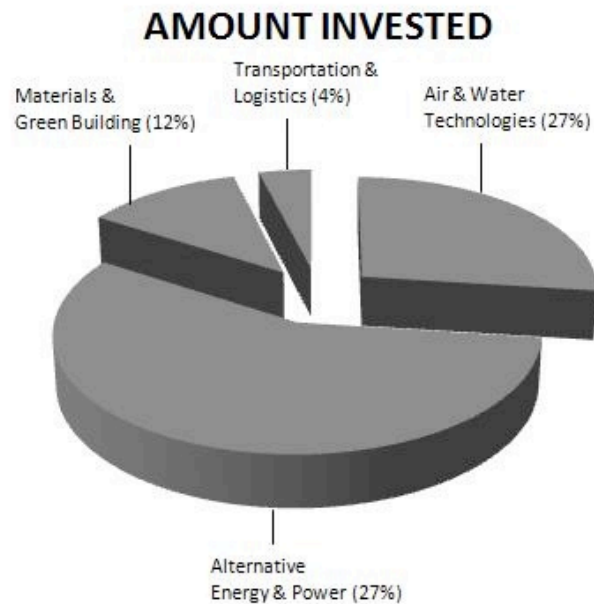


Figure 2-2: Historical Cleantech Investment Breakdown (Seed Stage Only) 2004-2009¹¹

Although this arena appeared to have a bright future in terms of investment, economic growth and technological innovation (Cheng, 2007), alternative energy is inherently less stable than its conventional counterparts and cost-efficient transmission, distribution and storage systems do not yet exist. Following a financial crisis in which the markets lost a quarter of their value in the space of a month, we are now in a situation where credit is very difficult to come by, and where cleantech ventures must have significant financial prospects if they are to be considered viable.

In 2009, The National Venture Capital Association and PricewaterhouseCoopers released year-end data that showed a 37% overall decrease in investment compared to 2008.

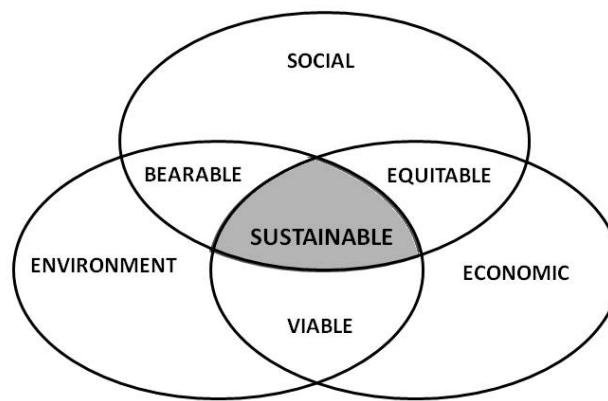
¹¹ Data provided by Thomson Reuters; includes a sample of seed stage VC investments below \$1mm 1/1/2004 to 6/18/2009

Venture spending on clean technology specifically — such as alternative energy and pollution reduction — was \$1.9 billion in 2009, well below the \$4 billion the prior year. But cleantech accounted for some of the year's 10 largest venture capital investments. The largest funding round in any sector was the \$286 million that California solar panel maker Solyndra Inc. raised (Carbon Capture Report, 2010).

Renewable cleantech ventures will be banking on the fact that in the long term, the energy crunch will create a consistent need for their products and protect their value. In the short term, however, much of that expected demand is connected with oil pricing, and as oil prices fall on weaker demand interest in the sector could wane (Brandbury, 2008). States and regions are competing with funding and by establishing environments friendly for cleantech. California and Massachusetts aim to be leaders in cleantech. Silicon Valley sees cleantech as the next wave of opportunity, and already cleantech makes up a large percentage of new growth in that region. From 2006 to 2007, cleantech grew in Silicon Valley by 94% (compared to 7% for the rest of California) (Harris, 2007), (Joint Venture Silicon Valley Network, 2008), (Nauman, 2007), (O'Brien, 2007); San Jose aims to be the “home of clean technology” (Tam and Carlton, 2007). But Boston, Massachusetts and Austin, Texas are also vying for that title. Other states are investing in cleantech, like New Jersey, Ohio and Iowa (The Economist, 2007). It is also interesting to note that despite of all the criticism; Detroit holds a quarter of the nation's clean and green technologies. The big three automakers in Michigan hold more clean and green patents than all of Europe together (Lou Dobbs Tonight, 2009).

Especially given such massive and growing business investment, venture investment, corporate and governmental R & D, and widespread industrial relevance, perhaps one characteristic that makes cleantech unique is the growing involvement of a highly diverse set of actors who generally were not previously involved in the development of such technology-rich arenas. Social entrepreneurs and grassroots organizations in cleantech are mobilizing around the country. They may well have an impact on the evolution of cleantech in a manner not previously witnessed in stereotypical high tech. Indeed, it has been recently argued that innovation and community action can reinforce one another, constituting two significant forces for sustainable development (Seyfang and Smith, 2007). Such forces may also help break the traditional logjam that often occurs in cities in the so-called “planners triangle,”

with the advocates for economic growth, social equity and environmental protection confronting and often stifling one another (Campbell, 1996). Perhaps emerging grassroots movements in cleantech can operate more effectively in such situations. In fact, research has shown that although there are many dimensions associated with sustainable development (outlined in Figure 2-3), social entrepreneurship can make a difference in cities (Dodds, 2007) (Sullivan, 2007). In short, at least in such an opportune innovation arena as cleantech, grassroots movements and social entrepreneurship might represent new sources of technological innovation, sources that have been neglected thus far.



The Brundtland commission in 1987 coined the term Sustainable Development.

The world commission on Environment and Development (WCED), chair, Gro Harlem Brundland was convened by the United Nations in 1983 to address growing concern about the accelerating deterioration of the human environment and human resources and the consequences of that deterioration for economic and social development.

Figure 2-3: Sustainable Development (UNECE Annual Report, 2005)

In modern societies, entrepreneurship and technological innovation are widely seen as key sources of economic growth and welfare increases. Yet entrepreneurial innovation has also meant losses and hardships for some members of society: it is destructive of some stakeholders' wellbeing even as it creates new wellbeing among other stakeholders (Dew and Sarasvathy, 2007). Innovation in the cleantech industry on the other hand appears to be an exception to the rule. It is perceived as being extremely pervasive and in fact beneficial to all stakeholders involved in the long term. The key point is that a range of social, environmental and governance challenges increasingly demand something more than corporate citizenship

responses. They require innovative, entrepreneurial and — often — disruptive strategies which incumbent companies are often ill-prepared to develop or deliver (Christensen, 1997).

It might well be that the crucial breakthrough for sustainable energy technologies for example will not take place in a laboratory. Instead, such technologies must be incubated and refined where they can be profitably deployed through disruptive strategies in markets where they do not compete against established systems (Hart and Christensen, 2001). Pioneering companies will have to optimize a new technology for use in poor rural areas and develop production, sales, service and micro financing packages that enable non-consumers to gain access. Sustainable energy pioneers who focus on the base of the pyramid could set the stage for one of the biggest bonanzas in the history of commerce since extensive adoption and experience in developing countries would almost certainly lead to dramatic improvements in cost and quality (Hart and Christensen, 2002). Growing numbers of mainstream corporations are switching on to the area and trying to work out what the business case might be for investment, partnership or other forms of engagement. The twenty-first century so far has seen a series of interlinked economic, technological, social, political and managerial transitions that has the potential to transform the global economy.

2.4 Relevant Research Theory

The research approach used for this dissertation is qualitative in nature. The theory underlying social entrepreneurship is still in its infancy. In order to contribute to theory development the research design has to enable answers on such key questions as how, when and why (Bacharach, 1989). By limiting ourselves to how and when questions, the embedded and contextual nature of social entrepreneurship cannot be revealed. In meeting the criticisms of case study research in the field of social entrepreneurship, certain scholars have already demonstrated the potential of case studies as inspiration for new ideas (Siggelkow 2007). Therefore, I will employ an inductive approach¹² where the cases are given much space in order to inform, above all, the theory. Following the theoretical sampling of cases, I will build on the suggestive arguments that multiple cases create more robust theory grounded in varied empirical evidence (Eisenhardt and Graebner, 2007). Grounded theory could appear in

¹² An approach in which the researcher has no preconceived ideas to prove or disprove. Rather, issues of importance to participants emerge from the stories that the participants (the interviewee) tell about an area of interest that they have in common with the researcher (Morse, 2001).

various forms. "Grounded theory could be presented either as a well-codified set of propositions or in a running theoretical discussion, using conceptual categories and their properties" (Glaser and Strauss, 1967). Strauss and Corbin, in the evolution of grounded theory, acknowledge the importance of a multiplicity of perspectives and "truths" (Strauss, 1987; Strauss and Corbin, 1990, 1994, 1998) and as such have "extended and emphasized the range of theoretically sensitizing concepts that must be attended to in the analysis of human action/interaction" (MacDonald, 2001). My research approach will be inductive, building on some existing concepts in research on social entrepreneurship, but explorative for new strategies, processes and relationships. Qualitative researchers view themselves as the primary instrument for collecting data. They rely partly or entirely on their feelings, impressions and judgments in collecting data (Greene and Caracelli, 2003). The qualitative method (in this case qualitative analysis of case studies) is expected to give us a rich and deep interpretation (Bryman, 1988; 2001) of the organizations being studied.

In choosing an interpretive paradigm (Burrell and Morgan 1979; Gioia and Pitre 1990), I aimed to gain a deeper understanding of a phenomenon through understanding the interpretations of that phenomenon from those experiencing it (Shah & Corley, 2006). Following the work of other scholars (Amabile et al., 2001, Leonard-Barton, 1990; Gibbert, Ruigrok and Wicki, 2008), I carried out my case study research in close interaction with practitioners who deal closely with the organizations of study. Following case-study methodology (Yin, 2003), I used such methods as in-depth individual, semi-structured interviews (interviews which leave room for adjustments during the interview process) with key members of the organizations (those responsible for their management, governance and administration), entrepreneurial teams and others. Following Maxwell (2004), before locking onto interview questions, I attempted to get a good sense of what my theoretical and methodological commitments and options were and their implications for my questions.

Additionally, I also performed extensive primary and secondary historical research and analysis. I accessed primary and secondary archival sources such as news reports, governmental reports, industry reports issued by consulting firms, as well as coverage of industry developments in the media and industry trade presses.

Chapter 3: Discussion of Intellectual Aim, Research Focus and Research Methodology Employed

This chapter begins with a general discussion of the main intellectual aim and research focus of this dissertation. It then proceeds to discuss the research methodology employed to study the dissertation topic with the overall research focus in mind.

The main intellectual aim of this dissertation is to illuminate the diversity of entrepreneurship in general and social entrepreneurship in particular. The main research focus is to understand this diversity by exploring how entrepreneurial clean technology companies and clean technology not-for-profits represent the changing nature of entrepreneurship. The dissertation then delineates a list of critical dimensions relevant to contemporary entrepreneurship that modern-day entrepreneurial companies in the clean technology sector may need to address or at least consider closely as they continue to evolve. As seen in the literature review, contemporary entrepreneurship is dynamic. Entrepreneurship seems to be constantly evolving, expanding and adapting itself to accommodate new and diverse forms of value creation such as social entrepreneurship. There appears to be a hybrid spectrum of entrepreneurial activities prevalent in the modern economy. These range from traditional not-for-profit activities to traditional business/commercial-oriented activities. This overarching spectrum can be represented as shown in Figure 3-1. In this dissertation I identify the critical dimensions that entrepreneurial firms in the clean technology industry need to pay careful attention to in their quest to grow in this diverse and dynamic field.

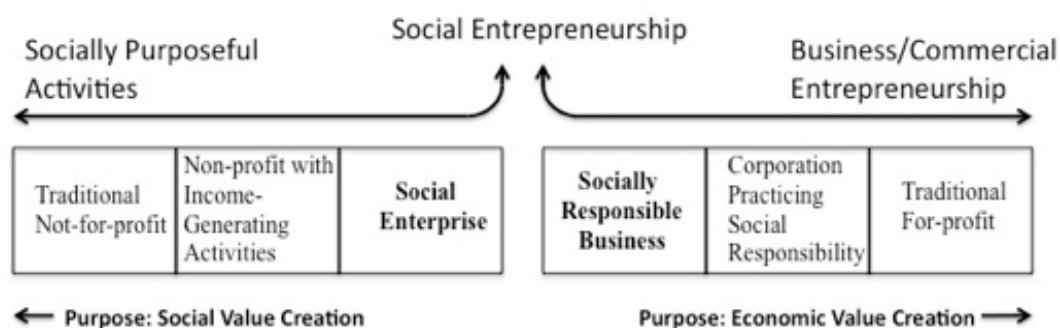


Figure 3-1: Overarching Representation of Contemporary Entrepreneurship

It can be stated that social entrepreneurship encompasses both for-profit and not-for-profit ventures. Although a single, definitive view of social entrepreneurship is not necessarily important. What is most important is understanding the key differentiating factors between social entrepreneurship and traditional business/commercial entrepreneurship while also realizing that there is not just one type of social entrepreneurship.

Illustrating the diversity of entrepreneurship, a major recent textbook on entrepreneurship provides a typology of the different types of ventures focused on social and economic value creation, and is depicted in Figure 3-2. The shaded area in this exhibit represents the general territory of social entrepreneurship.

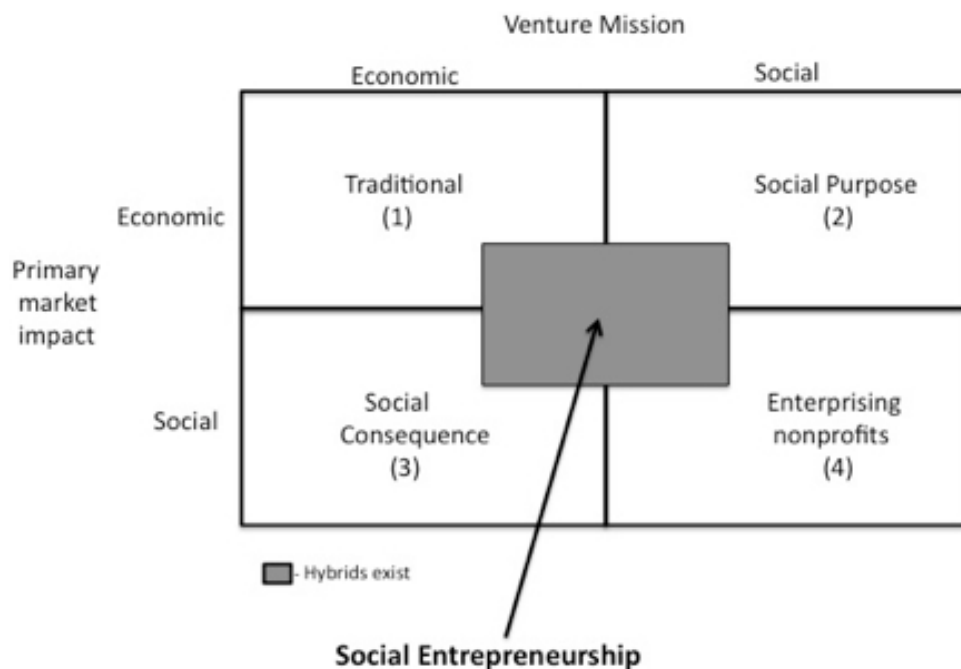


Figure 3-2: Typology of Ventures¹³

The major difference between traditional entrepreneurs and social entrepreneurs is the intended mission. Social entrepreneurs develop ventures with a mission to solve a pressing social problem. What distinguishes social entrepreneurs from everyone else is that they see

¹³ Adapted from Timmons and Spinelli (2009, pp. 247). "New Venture Creation: Entrepreneurship for the 21st Century"

their job as changing the overall patterns and systems of society. Primary goals associated with commercial entrepreneurship are traditional business objectives, such as:

- Capturing a market;
- Becoming a dominant player;
- High profitability, and;
- Personal prosperity and wealth.

Social entrepreneurship, on the other hand, explicitly aspires to solve a major societal problem and, indeed, change the world. What defines a social entrepreneur is that he or she simply cannot come to rest in life until his or her vision has become the new pattern society-wide.

Key characteristics of social entrepreneurs, which were identified, are as follows:

- Ethical concerns;
- Values-led/centered approach;
- Sustainability concerns;
- A mission to change society;
- Heightened sense of accountability to constituencies served; and
- A community oriented outlook.

As shown in the literature review in the previous chapter, it is a commonly held misperception that social entrepreneurs should behave like and be measured by the same yardsticks as commercial entrepreneurs. It should be noted that social entrepreneurs are trying to change the world, not capture a market; therefore the standard measures of organizational size and growth are inappropriate.

It can also be inferred from the literature review that clean technology is pervasive. Clean technology can significantly affect the strategies of firms in a diverse array of industries including renewable energy, manufacturing and diverse kinds of services. Some argue that cleantech constitutes the basis of a new industrial revolution. Others, including the Obama administration, view a growing cleantech sector as a key anchor for economic growth and job creation. The heightened interest and activity in cleantech has been primarily driven by the recent Gulf oil spill, volatile energy prices, concerns about climate change, environmentally-focused policies, changing societal norms, national security concerns, the

massive and growing business investment, venture investment, corporate and governmental R&D and widespread industrial relevance. Finally, cleantech represents not just a business opportunity. Becoming involved in cleantech provides a chance to “do good” whether at a local or community level or by assuming a local or global perspective to “save the planet.”

3.1 Research Design and Data Collection

Due to the exploratory nature of this dissertation, I chose an inductive, qualitative case study approach based on the in-depth analysis of two cases (Yin, 1994). This approach combined the chance of discovering the unanticipated with the possibility of comparing the findings of the cases with each other (Eisenhardt, 1989). My empirical study was carried out using a quasi-ethnographic approach (Fetterman, 1989). Its purpose was to gain experience and raise issues for further research. The theory behind this research methodology is explained in detail in section 4 of Chapter 2 (Literature Review and Discussion).

The organizations where I conducted initial research, preliminary interviews, and obtained stakeholder feedback from, are listed in Table 3-1.

Table 3-1: Considered Organizations

Organization	Areas of Technological Innovation
Ecological Development	Sustainability services for urban infrastructure.
Green Drinks	Social Networking Meetup group for clean technology enthusiasts
Fig Food Company	Organic plant-based food
Verdant Power	Marine renewable energy technology
Ecological Solutions	Sustainable cleaning products and services
GrownUp Permaculture	Permaculture
Nanobiz LLC	Clean technology advising services
Green Map System	Mapping to indicate sustainability and related sites
Solaire Partners	Solar system design
vision42	Surface transit

Eventually, I decided to choose two representative organizations that I studied over a period of 11 months, in an in-depth, open minded and quasi-ethnographic manner with the overall research focus in mind. These two studies served as cases in point and are the basis for my exploratory study examining the diversity in contemporary entrepreneurship in the clean technology sector.

Criteria for selection of the two representative organizations were as follows:

- Each organization had to be at least five years old
- Each organization had to employ at least 15 people (full time and part time included)
- One of the two organizations had to be from the not-for-profit sector and the other from the for-profit, private sector
- The two organizations had to be based locally in New York City
- Finally, due to the exploratory nature of study, the founding entrepreneurs of the two organizations needed to give me the impression that they saw the potential value and importance of my dissertation study. In order to do so, the company founders needed to be willing to allocate the time and energy to be involved in an enthusiastic and supportive manner to discuss with me their personal views, provide access to their management and staff for interviews and observations, and share company data and corporate documents with me.

Based on the above-mentioned criteria, the two organizations that I chose for the purpose of my dissertation are:

- *Verdant Power*, a private sector marine renewable firm that develops technologies that harness the energy potential of tidal and water currents.
- *Green Map System*, a social venture that develops and hosts maps of eco-sites around the globe.

Each of the case studies are structured into the following two parts:

- *Description of the company*. This was based on data provided to me by the founding entrepreneurs of the company, review of company corporate documents and industry and third party research.
- *Observations of the company*. This was based on my coding of the transcripts of the several onsite and phone interviews conducted with key management personnel at the two organizations. It is also based on my personal observations and notes written down while spending time working and interacting with members of each of the two organizations.

In order to better understand the evolution of these two representative clean technology organizations and to detect the “S-curve” of development for each of the two organizations, I focused my study on the following three stages of each organization’s growth cycle:

- Origin (founding/inception stage)

- Transitional period (if any)
- Current stage (where they are today)

Each of these two case studies was written over a time period of about 11 months from August 2009 to July 2010. To study these organizations thoroughly, I immersed myself in the culture and daily routine of the two organizations. As with most qualitative case study research, this study combines different data collection methods, such as archived research documents, interviews, questionnaires, and direct observations at formal and informal settings (Eisenhardt, 1989). Both Verdant Power and Green Map System provided me with a cubicle and workstation where I was based during my visits to the organization¹. I collected data primarily via a series of onsite and phone interviews, reviews of company corporate documents, listening (sometimes overhearing) to conversations and reading relevant books, articles and related topics. Having been trained as an engineer (B.S. in Electrical Engineering and M.S. in Telecommunication Networks), I shared a common language with most of the engineers and a basic understanding of the tasks at hand. The primary source of information was, however, in-depth interviews with individual respondents.

The interviews were semi-structured in nature. Following the qualitative interview research methodology, I used a hybrid model of specific and open-ended questions during my interviews. Based on the research focus, which emerged from my review of the literature, I developed a list of possible specific questions to begin and/or guide the conversation.

As the interview progressed, as per the qualitative research methodology, I was also very attentive to the variety of meanings that emerged as the interview progressed and the direction in which the interviewee was possibly taking me. This open stance meant being alert to developing meanings that in some cases rendered previously designed questions irrelevant in the light of the changing contexts of meaning. The longest interview was about two hours and 30 minutes and the shortest was about 30 minutes, the average length being approximately 45 minutes.

All interviews were audio recorded and then transcribed into complete manuscripts within a week of the interview. In order to get an in-depth understanding of the two companies, most interviewees were interviewed several times on different occasions.

Having done this, I started the process of interview transcripts and observation notes analysis. This process began with an open-ended coding of the interview transcripts and

observation notes followed by a more detailed and specific phase-by-phase look at the available data and information. One central activity was generating a description that captured vital aspects of the two companies. This description was based on categories generated from the data and given a meaning through the data constituting it. The goal was that the categories should be close to the empirical material in the sense that they should be recognizable and meaningful for the companies under study (Adler et al, 2004). Thus, one important part of the research process was to get feedback and test the research findings with the interviewees of the two companies.

Since the case studies were explorative, the collected data was analyzed in gradual stages during the entire fieldwork. To provide corrective input to this subjective stream of interpretation, interview data was constantly compared and triangulated with “real time” observations and written archival evidence. Tentative findings were presented and discussed in gradual stages with various members of the respective companies. However, the production of knowledge was anything but linear. On the contrary, insights and understandings were produced by several iterations, where new data from interviews and observations was compared in gradual stages with the mental picture constructed by data collected previously (Alvesson and Sköldberg, 2000).

Using these sources, the two case studies were written, one for each company. These manuscripts were then sent back to the company founders for their comments and remarks twice during the process. However, I wrote the final texts of the reports myself, taking full responsibility for their content.

Chapter 4: Case Study – Verdant Power

4.1 Introduction

This chapter focuses on Verdant Power, a marine renewable firm that develops technologies that harness the energy potential of tidal and water currents. In this chapter, I will begin by providing relevant overall external context and an overview of the marine renewable energy industry sector in general. Subsequently, I will provide a detailed and substantive description, analysis and a set of observations about Verdant Power.

The U.S.-based company is an early entrant in the NYC cleantech arena and one of the main marine renewable energy developers based in the United States. The company is a developer of a free-flow turbine system and projects at least 120 North American tidal locations, many with multiple sites, suitable for deploying its technology. It has also identified 75,000 preexisting dams and 9,000 power plants where its technology could be employed to generate electricity from flowing water leaving the facilities.

In New York City, along the East River, six small tidal turbines manufactured by Verdant Power have been installed as part of a state funded demonstration called the Roosevelt Island Tidal Energy (RITE) Project. Claimed to be the first project in the world to attempt to place underwater turbines in major population centers, this demonstration has been used to test the technology's viability and thus far the turbines have generated ~80 MWH of electricity since their installation in 2006 and 2007. If the experiment is successful, hopes are to install 300 turbines in the East River, with a 10 MW capacity. The current rate to install the turbines is ~ 15 Million/MWH. Once made commercially viable, and the company scales up, Verdant Power management believes that the projected installation cost will come down to ~ 4 Million/MWH. The company also plans to use these projects to demonstrate how its systems can be scaled to deliver clean and renewable energy within major population centers worldwide.

The company section will be structured into the following two parts:

- Description of the company from personal observations and third party research
- Analysis of the company (with research questions in mind). This section is based on the several onsite and phone interviews conducted with various stakeholders at Verdant Power.

4.2 Marine Renewable Energy Industry Overview

For thousands of years, civilizations have employed the energy in flowing water — the ancient Greeks used water wheels to grind wheat into flour, Americans in the 1700s operated milling and pumping stations powered by moving water, in the early 1880s, Michigan was the site of the first U.S. hydroelectric power station. By 1940, 1,500 hydroelectric stations were producing one-third of the nation's electrical energy (In Business, 2005).

Today, hydroelectric power is the country's largest source of renewable energy. Over 70,000 dams leverage our nation's rivers to produce 90,000 MW of power, representing approximately 10% of the country's electrical generating capacity. According to the New York State Energy Research and Development Authority, there is more than 1,000 MW of kinetic hydropower potential within just the state of New York.

Increasing demand for electricity, as well as concern about environmental degradation and climate change, has accelerated the need to develop renewable sources of electrical power. According to the U.S. Energy Information Administration, electricity generation is expected to nearly double between 2004 and 2030. Growth in the developing world will be approximately 57% greater than the worldwide average (International Energy Outlook, 2007).

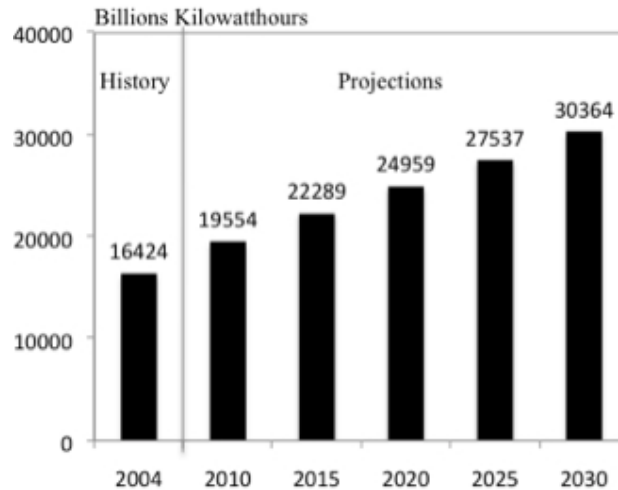


Figure 4-1: World Electric Power Generation 2004-2030¹⁴

Unfortunately, as alluded to in the Literature Review section, cleantech/renewable energy estimates such as the Energy Information Administration's have not taken into consideration marine renewables. These energy sources did not figure into any of the forecasted projections of energy demand. This presents a great opportunity for companies in the marine renewable energy space to play meaningful roles by deploying such technologies.

The total addressable market (TAM) for kinetic hydropower¹⁵ is estimated by the U.S. Department of Energy to be 250 GW. Table 4-1 provides a detailed breakdown of this resource.

¹⁴ 2004: Energy Information Administration (EIA), International Energy Annual 2004 (May-July 2006), Website www.eia.doe.gov/iea
Projections: EIA System for the Analysis of Global Energy Markets (2007)

¹⁵ General term used to describe hydropower derived from the kinetic energy found in rivers, tides, channels, etc without the use of dams. It is also referred to as hydrokinetics (FERC).

Table 4-1: Kinetic Hydropower Gigawatt (GW) Potential¹⁶

Resource	Region	Potential	Source
River	US	12.5 GW	NYU Study
River	US+CDN	21.4-170 GW	Department of Energy/Idaho National Laboratory
Aqueduct & Canal	US	72 GW	Federal Energy Regulatory Commission
River & Tidal	CDN	15GW	National Research Canade (NRC), considering 3 main river reaches and 13 tidal cross sections
Tidal	UK	2.8GW	The Carbon Trust
Tidal	EU	26 GW	The Carbon Trust, considering 77 sites
River & Tidal	Developed	50 GW	Department of Energy (Developed countries)
River & Tidal	Developing	200 GW	Department of Energy (Developing countries)

On March 24, 2010, three United States federal agencies announced a Memorandum of Understanding for Hydropower (the “MOU”) that impacts developers of traditional hydropower, hydrokinetic, pumped storage and small-scale hydropower facilities. In signing the three-agency memo, the U.S. government signaled a renewed vision for greater use of hydroelectric power (Rahim, 2010).

The Department of Energy (DOE), the Department of the Interior (DOI), and the Department of the Army, through the U.S. Army Corps of Engineers (USACE) (collectively, the “Agencies”), signed the MOU to “meet the Nation’s needs for reliable, affordable, and environmentally sustainable hydropower by building a long-term working relationship, prioritizing similar goals, and aligning ongoing and future renewable energy development efforts” between the Agencies. The MOU came at a time when industry representatives and eleven U.S. Senators were requesting that DOE support a \$200 million appropriations request

¹⁶ Figures are derived from a presentation on "Offshore Renewable Energy Future in the Northeast/Mid-Atlantic Region" by Steve Lindenberg, Senior Advisor, Office of Energy Efficiency and Renewable Energy at the US Department of Energy

for the advancement of both conventional and advanced waterpower technologies (Stoel Rives LLP, 2010).

In this “new approach to hydropower,” the Agencies intend to focus their collective efforts on advancing sustainable, low-impact, and small hydropower projects and promoting the goal of energy efficiency through water conservation or improved water management. Operating under the MOU, the Agencies will work together to advance four primary objectives:

- Support the maintenance and sustainable optimization of existing federal and non-federal hydropower projects;
- Elevate the goal of increased hydropower generation as a priority of each Agency to the extent permitted by their respective statutory authorities;
- Promote energy efficiency; and
- Ensure that new hydropower generation is implemented in a sustainable manner.

Several important developments over the past five years demonstrate an enhanced climate for marine and hydrokinetic (MHK) renewable energy systems in the United States. MHK energy systems include tidal stream and river current systems, wave energy systems, and ocean thermal energy conversion (OTEC) systems.

Some of the most important of those events and activities are as listed below¹⁷:

- *Establishment and Increasing Funding for US DoE Advanced Water Power Programs (AWPP)* In FY2008, the U.S. Department of Energy established the headquarters based AWPP within the Energy Efficiency and Renewable Energy (EERE) Directorate with \$10 million of funding from the Energy and Water Development Appropriations Committees of the U.S. Congress. The AWPP Program was funded with \$30 million in FY2009, and with \$50 million in FY2010. For FY2011, the President’s Budget requests \$40 million, the US House Committee request is \$50 million, and the U.S. Senate request is \$100 million. This funding supports the AWPP Program Office operations, and DoE National Laboratories, universities and industry through public solicitations and competitively awarded grants with the objective of technology and industry commercialization. Increasing

¹⁷ This information is taken from a report on the “Emergence of Marine Renewable Energy Technologies in the United States and the United Kingdom” by Verdant Power Inc, April 2010.

- Congressional funding is designed to accelerate the commercialization process through technology development, deployment and validation, and to provide support for early pre-commercial projects. On December 3, 2009, the Energy and Environment Subcommittee of the U.S. House Science and Technology Committee held a hearing on “Marine and Hydrokinetic Energy Technology: Finding the Path to Commercialization.” The American Clean Energy Leadership Act was passed in the Senate Energy and Natural Resources committee and contains the re-authorization of the AWPP program at \$250 million per year for 10 years. The U.S. House Energy and Environment Subcommittee of the Science and Technology Committee are drafting similar legislation. With funding from solicitation awards in FY2009, advanced waterpower programs have been established at the National Renewable Energy Laboratory (NREL) and the Sandia National Laboratories, national knowledge centers that were key in the development of wind energy technologies, among other technologies. Waterpower program elements are also being established at Oak Ridge National Laboratories and the Pacific Northwest National Laboratory (PNNL).
- *Regulatory Support for MHK at US Federal Energy Regulatory Commission (FERC)* FERC regulates hydropower in the U.S. and issues licenses for the generation of hydropower. FERC has taken two initiatives to encourage the commercialization of new MHK technologies in the U.S.. On July 27, 2005, FERC issued the “Verdant Ruling” (based on Verdant Power’s RITE Project), which allowed new MHK technology demonstration projects to connect to the electricity grid for demonstration and testing purposes without collecting commercial revenue. Secondly, on April 14, 2008, FERC established the Hydrokinetic Pilot Project Licensing Process to allow for the licensing of MHK pilot projects without the rigorous licensing requirements required for existing hydropower licenses.
 - *US Navy Support of MHK Technologies to Meet Renewable Energy Mandate* The U.S. Navy has established ambitious goals for the use of renewable energy at its facilities worldwide (50% by 2025) and is supporting R&D projects focused on MHK systems as part of this effort. A Program Office has been established at the U.S. Navy Facilities Engineering Service Center (NFESC), Port Hueneme, CA and currently manages 8-10 MHK projects including a worldwide MHK resource assessment for

use at U.S. Navy installations. Since 2003, the Navy has spent \$43 million on marine renewable energy systems R&D.

- *Development of the Ocean Renewable Energy Coalition (OREC)* An industry association, OREC was founded in April of 2005 and has grown to include technology developers, consultants, law firms, investor-owned utilities, publicly owned utilities, universities and scientific and engineering firms. The coalition is working with industry leaders, elected officials, academic scholars, and NGOs to encourage the use of ocean renewable energy technologies and raise awareness of their vast potential to help secure an affordable, reliable and environmentally-friendly energy future.
- *Global Marine Renewable Energy Conferences (GMREC)* Organized by OREC and supported by the U.S. National Renewable Energy Laboratory (NREL), the Minerals Management Service (MMS), the Foundation for Ocean Renewables (FOR), the International Energy Agency (IEA), and the Ocean Energy Systems (OES) Group. The first conference in New York City in 2008 showcased Verdant Power's Roosevelt Island Tidal Energy (RITE) Project. The second conference in April, 2009 was held in Washington, DC at the Carnegie Building. The conferences typically attract 300-500 international industry participants.
- *Establishment of University Centers for MHK Systems Development and Testing* With funding through states and the U.S. DoE, a number of universities have established Centers for the development of MHK technologies. A listing of major centers include:
 - University of Massachusetts Dartmouth, Marine Renewable Energy Center
 - Florida Atlantic University, Center for Ocean Energy Technology
 - Oregon State University
 - University of Washington Northwest National Marine Renewable Energy Center
 - University of Hawaii, Hawaii National Marine Renewable Energy Center
- *Government Support in the United Kingdom* The U.K. industry is planning on spending \$1 billion over the next decade on its MHK industry (Entec, "Marine Renewable Energy: State of the industry report, 2009).

U.K. Government Support

- The U.K. is currently the marine renewable energy world leader with 2.4MW of wave and tidal energy projects currently installed, 27MW in the planning process, 77.5MW of projects being developed.
 - 1GW of projects have just been announced by the Crown Estate (10 wave and tidal power sites).
 - U.K. Government committed a total of £115M to technology development up to 2009.
 - Between March 2009 and March 2010 a total of £48M of coordinated and structured public funding has been announced for technology development.
 - Government funding de-risks the sector, and in turn stimulates the industry, and thereby drives private investment and technology development.
- *International Industry Development* In 2007, the International Electrotechnical Commission established Technical Committee, TC114. This was the 114th established committee, titled “Marine Energy – Wave, Tidal and Other Water Convertors.” Since the establishment of TC114, five working groups have been established:
1. 62600-1 Terminology
 2. 62600-2 Design
 3. 62600-100 Wave Convertor Performance Assessment
 4. 62600-200 Tidal Convertor Performance Assessment
 5. 62600-300 Wave and Tidal Energy Resource Assessment

The delegates to the IEC are countries, with approximately 15 countries participating in TC114. The U.S. National Committee (USNC) is sponsored by the American National Standards Institute (ANSI) in the United States (IEC Website, <http://www.iec.ch/>) Development of a new breed of hydropower technologies extracts energy from free-flowing sources such as streams, ocean currents and tidal waters as well as manmade facilities like irrigation channels, municipal water systems and effluent streams. The technologies promise to create a renewable source of electricity without adversely affecting the environment. Given sufficient experience and scale, the new devices are also expected to be competitive with traditional sources of electricity. These new sources of distributed power are known by a variety of names

including free-flow, in stream generation, tidal power and wave power. Although the devices generally produce less than one MW of power, they can be grouped into “farms” to produce power equivalent to small electrical generation facilities. One strategic research firm, Douglas-Westwood Ltd., estimates that wave power farms have the potential of producing up to 50 MW of power (In Business, 2005). A New York University study estimated U.S. free-flow turbines could produce 12,500 MW of power (Miller et al, 1986). Many of the marine energy device developers are small- and medium-sized companies formed with the sole purpose of developing a specific device. The developers are faced with the challenge of securing sufficient funding to support the day-to-day operation of the company and development of the device as well as obtaining financing for the development of specific projects. Operational and development funding may be obtained from Government grants (as described in the following paragraphs) or private investors, such as venture capitalists or through the sale of shares. Generally in order to secure private finance a developer must demonstrate the potential future market for the marine energy device. Developers may obtain financing for specific projects through private investment, for example by entering into partnerships with established companies, such as utilities. This may provide useful project development skills in addition to the finance required. It is important for the government to express confidence in the marine industry and the future growth of the marine energy market to encourage private investment not only to make projects happen but also to ensure that companies survive (Entec, 2009). Despite the promise and potential, the technologies face significant challenges to prove themselves in the market. Many of the devices are progressing from the laboratory to demonstration projects designed to prove their viability. According to Sustainable Energy Ireland, it takes nearly 10 years to bring a marine renewable energy technology from R&D to commercialization. The current short-term challenge facing the marine industry is gaining sufficient experience of operating devices and multi-device projects in the marine environment to demonstrate to all investors (public and private) that the technology works, and the future potential for the industry.

4.3 Verdant Power

4.3.1 Company Overview

Verdant Power (VP) started with a vision. That vision was to provide clean, renewable energy at its source through underwater turbines. In order to achieve that vision, the company has positioned itself as a site and project developer that specializes in the design and application of marine renewable energy using proprietary kinetic hydropower technologies. VP's technology focuses on developing and bringing to market underwater turbines to generate renewable and reliable clean energy from the natural water currents of rivers, tides and manmade channels.

The firm was founded in 2000 and headquartered in New York, NY. In 2006, VP established its Canadian subsidiary, Verdant Power Canada, to manage projects in Canada. VP employs a mix of emerging technology developers and utility industry veterans with advanced experience in constructing and operating electricity generation facilities, especially hydropower. VP is an active participant in the larger global renewable energy community. The firm's executives serve in a variety of industry organizations, as well as working alongside government and public officials to promote renewable energy worldwide. The company's Kinetic Hydropower Systems (KHPS) have been undergoing a rigorous testing regime in New York City's East River since 2002. The project progressed from an initial demonstration array of six turbines to a full field of turbines that produced more than 77MWh of grid-connected power during 9,000 operational hours — enough to supply electricity to approximately 175 homes. If operated continuously, the field has the potential to generate up to 10 MW, enough to power nearly 8,000 homes.

The vision of Ron Smith, co-founder and current CEO of VP, is to develop new technology systems that enhance important human needs, like access to clean energy. Ron has seven years of active duty in the U.S. Navy and holds an MBA from Harvard Business School and an M.S. in Systems Management from the University of Southern California. Ron has also led the development of successful start-ups and has held positions with Booz-Allen management consultants and Bendix Aerospace group.

VP's other co-founder, now president and head of market development, Trey Taylor, who has a background in political science and history, has long felt a need to be involved in

an initiative that would enable sustainable communities worldwide and empower people. Trey's academic background is in political science and history. He also has extensive experience in marketing and working for major corporations. He believes that his consulting involvement with PricewaterhouseCoopers provided him with a unique perspective, enabling him to perceive unfulfilled electricity needs and potential worldwide. Trey was especially interested in the renewable energy sector and the lack of attention paid toward technology for tapping water currents. As a result, Trey, who knew Ron as an entrepreneur, approached Ron with his idea about tapping the energy power of water currents. Ron, who had just sold his own business, was intrigued by Trey's idea. Ron liked building organizations, and he strongly identified with the overall goal of spreading clean technology practices. He saw VP as more than simply a vehicle for wealth creation and wanted through VP's technology and projects eventually to help build sustainable communities across the world. Part of VP's vision is to replace diesel generators in developing countries with VP's turbines, creating renewable distributed generation for small communities.

Beginning in 2002, one of VP's most important undertakings is a development associated with the Roosevelt Island Tidal Energy (RITE) project in the East River of New York City, where VP installed and currently operates the world's first array of grid-connected tidal turbines. Simply put, the theory behind the RITE project is to generate 10 megawatts of electricity from changing tidal flows in New York City's East River using 300 underwater turbines that resemble windmills. The project is positioned as community based project and VP has attempted to involve several local governmental and educational institutions in its efforts. The project has received key support from the New York State Energy Research and Development Authority, as well as the New York City Economic Development Corporation. New York University estimates that nearly 600 MW of electricity can be generated from kinetic hydropower in the state.

In three phases, the RITE Project seeks to develop, demonstrate and commercially deliver electricity generated from the tides of the East River using Verdant Power's Free Flow System. The Free Flow System is comprised of three-bladed, horizontal-axis turbines installed underwater to generate clean renewable energy from tidal, river and ocean currents. The electricity generated thus far has been used to power facilities on Roosevelt Island including the Gristedes Supermarket and the Roosevelt Operating Corporation (RIOCI)

Motorgate parking garage at no charge as part of a community partnership. Testing and monitoring during the pilot project will assess environmental impacts and help VP to optimize issues related to turbine spacing and power production. This second phase (RITE Project's Phase 2 Demonstration) of the project, which began in 2006, was completed in November 2008. Over this two-year period, Verdant Power operated six full-scale turbines in an array at the RITE Project (north of the Roosevelt Island Bridge, which links Roosevelt Island to the New York City borough of Queens) in an attempt to demonstrate the Free Flow System as an efficient source of renewable energy. As of fall 2010, VP was in the process of securing a Pilot Commercial License from the Federal Energy Regulatory Commission (FERC) to build-out (Phase 3) of the RITE Project to a 1 MW, 30-turbine array in the East River. This third phase or pilot project will occur through consultation with the State and City of New York and other federal agencies to provide clean, renewable power to the City. With FERC licensing, the RITE Project - Phase 3 is destined to become the world's first multi-unit commercial KHPS tidal energy facility.

Since VP began in 2000, Ron and Trey have perceived an increasingly favorable, though volatile, market. They positioned VP as the leading company that could offer communities a way to produce electricity via marine renewables. VP's founders liken using their marine renewable technologies to buying food at a local farmer's market. Using marine renewables, according to VP's co-founders, entails producing more clean energy locally, thus lessening energy loss and resulting in more jobs in the community. Additional federal support under the FOA would expand and accelerate the pilot demonstration significantly, leading to economic activity across the New York-based supply chain, including an estimated 150 jobs in the design, manufacturing, maintenance and operation of the systems.

VP claims to be the only company currently demonstrating energy in major population centers such as NYC. Once commercialized, the technology will be applicable for deployment in developing world sites and dense population centers. In contrast, the other technology developers in the marine renewable industry are focused on utility scale, large ocean energy systems, which cannot be deployed at most population centers. VP is positioning its stance on designing systems that cater to the immediate electricity needs of a mass, worldwide audience as one of their main social entrepreneurial goals.

In terms of earned recognition, the company has been featured on national media outlets and programs, including the NBC Nightly News, CBS Evening News, Fox News Channel, Discovery Channel, National Geographic Channel, PBS, and Warner Independent Pictures’ “The 11th Hour.” The company has also has been covered in various mainstream and industry publications including The New York Times, The Washington Post, The Wall Street Journal, USA Today, Newsday, Time, Newsweek, Popular Mechanics, Hydro Review, and Engineering News Record, as a cover story (see Appendix 1.1).

4.3.2 Technologies

VP’s technologies are for generating and distributing electricity and can be placed near or even directly within population centers where energy demand is high as long as flowing water is available. Furthermore, VP’s systems can also be scaled up for use in deep-sea offshore locations where often the strongest currents exist.

VP’s core technologies involve two kinetic hydropower systems — the *Free Flow System* and the *Rapid Flow System*. Each system converts the natural kinetic energy found in the currents of tides, rivers and manmade channels into electricity. Please see Table 4-2 for the main characteristics and differences between these two systems.

Table 4-2: Technology System-Key Characteristics¹⁸

	Free Flow System	Rapid Flow System
Deployment Stage	Scale up/Production Design/Manufacturing	Beta Testing
Application	Tides, Rivers (Natural Waterways) Population Centers, Deep-sea/Offshore	Canals, Aqueducts (Constructed Waterways)
Scalability	By Unit: 5m/35kW-11m/1MW (rotor size/power) By Number: Clustered into Fields (similar to wind)	By Unit: 1m/10kW-5m/1MW (rotor size/power) By Number: Successive Units Along Waterway
Projects	1) East River- New York, NY (2006-Present) 2) St. Lawrence River-Cornwall, ON (2007-Present) 3) Puget Sound-Seattle, WA (May 2008-present)	1) Dow Chemical Company (1Q 2010)
R&D	US National Renewable Energy Laboratory, Sandia Labs, New York University, US Navy David Taylor Model Basin, Ricardo	The Cooper Union for the Advancement of Science & Art, NY

¹⁸ Author generated table based on the various interviews conducted with key stakeholders at VP.

Free Flow System (for Natural Waterways)

The *Free Flow System* uses three-bladed, axial-flow turbines that are installed underwater and connected to onshore equipment via subsea cabling. The core Free Flow System design is based on research carried out by Dean Corren, VP's Director of Technology, at New York University in the 1980s with funding support from the U.S. Department of Energy and the New York Power Authority, among others. The NYU work covered initial theory through to extensive model testing of several designs at the U.S. Navy's David Taylor Model Basin (USNSRDC) in Carderock, MD, in the Circulating Water Channel. This research was carried out in NYU's Applied Science Department. Although the University eventually pulled the plug on the project, Dean continued to have faith in the project to take it forward. The work was featured in a 1995 U.S. Department of Energy report, "Kinetic Hydroelectric River Turbines: Preliminary Market Analysis" by the Idaho National Engineering and Environmental Laboratory (INEEL), which recommended advancing the design approach.

Resembling wind turbines, *Free Flow System* turbines are rotated by the currents of tides and rivers. They operate automatically without attendants, and they also do not require any impoundment (i.e. the collection and confinement) of the water body. In tidal settings, the turbines are designed to pivot 180 degrees in order to generate power on both the ebb and flood tides. In river settings, the turbines are stationary and generate continuous power from the unidirectional flow of the river.

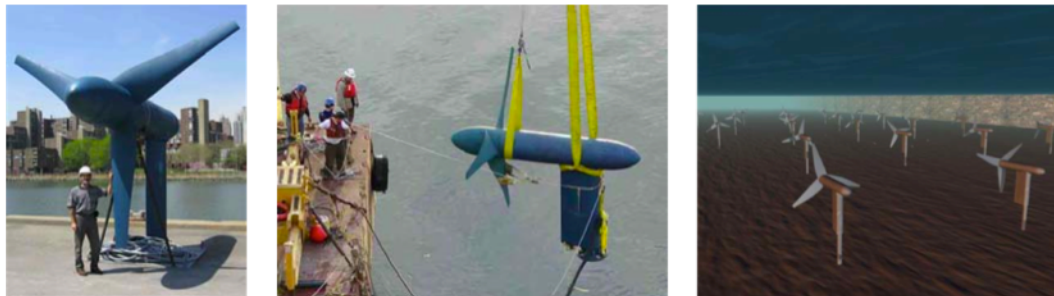


Figure 4-2: Free Flow System¹⁹

The turbine rotors are designed to rotate at a slow and fixed speed (~35 rpm) over a wide range of water velocities (patented process), making the system supposedly safe for fish passage and delivering steady, efficient electricity to the grid. The topic of the effect of the

¹⁹ This image was retrieved from the Verdant Power website 04/03/10 World Wide Web, www.verdantpower.com

turbines on the river's aquatic life, particularly fish and the regulations associated with it, has however been a huge challenge for VP to address. The East River is home to an estimated 54 fish species, of which the striped bass is popular among sport anglers. Conventional hydro turbines, which turn at 600 to 700 rpm, are known to entrain fish, and the fish have little room to escape. VP has claimed that its five-meter, blunt-tipped tidal turbines, on the other hand, turn at 32 rpm, allowing fish plenty of time to move aside.

The company had initially budgeted about \$750,000 for fish studies but that number is now in the millions of dollars. Very little direct research or observation of tidal stream systems exists. Most direct observations consist of releasing tagged fish upstream of the device(s) and direct observation of mortality or impact on the fish. A key aspect of the RITE Project's Phase 2 Demonstration was to identify any impacts of the six-turbine array on the local environment and safe fish passage. VP's strategy has been to take a slow, multi-phase approach and collaborate with state and federal regulatory agencies as well as research institutions.

Under the Federal Power Act (FPA), the Federal Energy Regulatory Commission (FERC) has exclusive jurisdiction to license hydroelectric projects, and any activity "for the purpose of developing electric power" is unlawful without a license from FERC. 16 U.S.C. § 817(b). Thus, FERC is the lead decision-making agency for the turbine project. However, the Clean Water Act, Endangered Species Act, Rivers and Harbors Act, Coastal Zone Management Act, National Historic Preservation Act, Marine Mammal Protection Act, Migratory Bird Protection Act, the Magnuson-Stevenson Fisheries Act, the National Environmental Policy Act, and applicable state water quality and related laws and regulations also apply. As a result, many agencies besides FERC were involved in the East River pilot project in one form or another, including the U.S. Army Corps of Engineers, U.S. Coast Guard, National Marine Fisheries Service, the U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, New York State Department of Environmental Conservation, New York State Department of State, and the New York City Planning Commission.

VP claims to have conducted unprecedented monitoring activities during the two-year demonstration period. The company had asked a local environmental group, Riverkeeper to monitor alongside of them to corroborate results. In this study the company utilized 24 split

beam hydroacoustic sensors to detect and track the movement of fish both upstream and downstream of each of six turbines. Their results suggested that (1) very few fish were using this portion of the river, (2) those fish which did use this area were not using the portion of the river that would subject them to blade strikes, and (3) no evidence of fish traveling through blade areas. In addition to this fixed monitoring, VP also claims to have conducted on-vessel mobile fish monitoring in the project area.

Although the results of these activities to date show no observed evidence of increased fish mortality or injury, nor any irregular bird activity in the project area, there are several parties that are questioning the practices and seeking further research and results. There are also concerns being expressed by several agencies that spent 20 to 30 years and huge amounts of taxpayer money to clean up the water in the East River and around New York City. There is apprehension about yet untested technology being implemented in the clean waters. Work is currently being conducted by the Northwest National Marine Renewable Energy Center to explore and establish tools and protocols for assessment of physical and biological conditions and monitor environmental changes associated with tidal energy development.

Technical Description

The Free Flow Systems are designed to generate renewable energy from the fast and free-flowing waters of tides and rivers. Installed fully underwater, the systems are invisible from shore and operate silently and automatically. Free Flow Systems do not require dams or other major civil works, and do not redirect the natural flow of the waterway.

Adaptable to a wide variety of sites, Free Flow Systems are comprised of varying numbers of modular axial-flow turbines, or Free Flow turbines. Free Flow turbines resemble and operate similarly to present-day wind turbines, with a three-blade horizontal-axis rotor. The rotor of the Free Flow turbine uses a unique design that accomplishes several simultaneous objectives: It has high power conversion efficiency; fixed pitch for simplicity and scalability; and can operate at near-constant speed with high load-matching efficiency, even in waters with shifting velocities. This allows the turbine to directly drive a high-reliability, low-cost, direct grid-connected induction generator. This is necessary for the low-cost and reliability of the system, allowing for competitively-priced electricity.

The Free Flow System was first operated in New York’s East River in 2007 for an industry-leading 9,000 hours. Made up of six full-scale turbines (specs below), this system stands as the world’s first grid-connected array of tidal turbines and also delivered to customers the world’s first electricity from such a technology.

Functionality

Free Flow Systems operate in river and tidal currents with a minimum flow of 6.8 ft/sec. The current of the waterway rotates the blades of the turbines at a slow and steady rate (~32 rpm). This rotating motion drives a speed increaser, which in turn drives a grid-connected generator. Energy from the generator is transmitted via underwater cables to shore-based switchgear for grid connection or for stand-alone, onsite electrical power.

The speed increaser and generator are both encased in a waterproof streamlined nacelle and mounted on a streamlined pylon. Pylons on the tidal versions of Free Flow turbines are assembled with internal yaw bearings, which allow the units to pivot 180 degrees with the changing tide and capture energy for the majority of the day. River-deployed Free Flow System turbines are designed to remain fixed and generate power on the single, continuous flow of the river throughout the day —nearly “24-hour power.” Depending on the site, various types of devices can be used to anchor the turbines under water.

RITE Project Free Flow Turbine Specifications (East River – New York, NY)	
Power Rating	35 kW
Rotor Diameter	5 meters (16.4 feet)
Max Height	6 meters (19.7 feet)
Resource	Tides

Rapid Flow System (for Constructed Waterways)

VP’s *Rapid Flow System* is designed to generate electricity from flowing waters found in constructed waterways, including irrigation canals, aqueducts, wastewater facilities and industrial plant channels. While the water in these manmade channels contains natural kinetic

energy from continuously flowing water, it moves too slowly to generate power in a cost-effective manner. To compensate for this, VP's *Rapid Flow System* accelerates the velocity of the water just before it passes through a vertical-axis turbine. The system is also designed so that it does not create back flows that could interfere with the basic purpose of the waterway.

The *Rapid Flow System* presents the potential to provide a “24-hour power” since it operates in continuously flowing water. The system design also allows it to be easily integrated with water purification units. Thus, the *Rapid Flow System* can generate clean energy and potable water simultaneously from the same resource. After conducting two years of extensive lab testing of the *Rapid Flow System* at Cooper Union for the Advancement of Science and Art in New York City, VP is planning to launch a field demonstration project of this integrated water and clean energy systems in early 2011, which is scheduled to take place in a canal at the Dow Chemical Company's Freeport, Texas facility. (In fact, VP is also developing an application based on both of its core technological systems that incorporates reverse osmosis technology. Under this application, VP will offer an integrated clean water energy system that generates clean energy and potable water.)

Both of VP's core systems can also be used as a base power source for integrated and hybrid renewable energy systems that also offer, for example, wind and solar power. Furthermore, unlike conventional hydropower, VP's systems do not require dams. The company's tests and prototyping also indicate that its modular systems have minimal impact on fish passage. VP has found no cases of fish mortality.

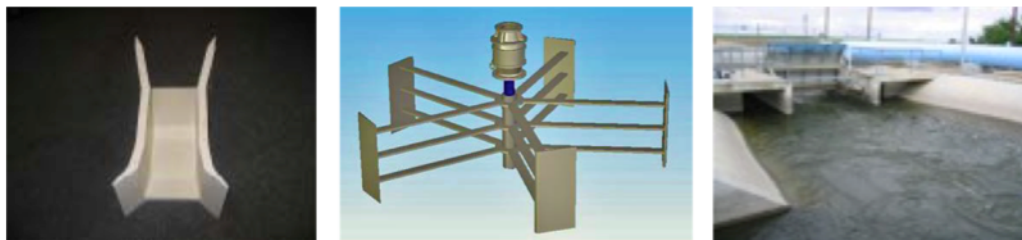


Figure 4-3: Rapid Flow System²⁰

²⁰ This image was retrieved from the Verdant Power website 04/03/10 World Wide Web, www.verdantpower.com

Technical Description

The Rapid Flow System is designed to generate electricity from flowing waters found in manmade waterways, including irrigation canals, aqueducts, wastewater facilities and industrial plants. While these channels contain continuously flowing water, it is moving too slowly to generate power cost-effectively. To compensate for this, Verdant Power's Rapid Flow System accelerates the velocity of the water just before it passes through a turbine installed in the waterway. The system is designed so that it does not create back flows that could interfere in the basic purpose of the waterway.

Like the Free Flow System, the Rapid Flow System does not require dams or major civil works. It operates silently and automatically via underwater turbines and is nearly fully submerged and out of sight, with only the overhanging turbine supports visible from shore.

Functionality

Similarly to the Free Flow System, the Rapid Flow System converts the mechanical energy of a rotating turbine to electrical energy via a speed increaser and grid-connected generator. The Rapid Flow turbine is a vertical-axis with five blades and enters the water from above. The vertical nature of the unit allows the gearbox and generator to be housed out of the water and secured by easily-accessible support structures.

Via a patented Verdant Power device, water passing through the turbine rotor is accelerated to supercritical speeds necessary to generate cost-effective power. The integrated turbine and accelerator device will be standardized to fit most canals and channels, as well as work in slow-moving rivers.

Product Development Timeline

Verdant Power has conducted two years of extensive and successful lab testing of the Rapid Flow System at The Cooper Union for the Advancement of Science and Art in New York City, under the direction of Dr. Jameel Ahmad, director of research at The Cooper Union Research Foundation.

Verdant Power plans to conduct a field demonstration of the Rapid Flow System in a canal at The Dow Chemical Company's Freeport Texas facility. All elements of the system will be monitored and adjusted as required during the field demonstration to advance the technology's status from observed- laboratory success to field-tested reality.

Intellectual property coverage for these technologies (Free Flow System and Rapid Flow System) includes eight filed U.S. patent applications; international applications in Europe, Canada and Japan; three disclosures in development; and 12 technical concepts in patent development.

4.3.3 Project Management Approaches

VP has developed a resource assessment capability to determine commercially viable sites for project development. A crucial feature of this method is that it is based on actual experience, i.e. operating turbines (established through the RITE project), rather than simply computer models. VP's methodology involves a number of interdisciplinary approaches, from harmonic tidal constituents, hydrology, hydrodynamic and fluid dynamic analyses to mechanical and civil engineering methods.

In terms of operational experience, since its founding in 2000 and as of January 2010, VP has deployed 17 tidal and river turbines in three locations in the U.S. and Canada. In addition, below is a list of the key operational milestones that the company has stated to have achieved:

- *Establishment of Commercialization Platform*
 - Initiated three pre-commercial marine renewable energy projects (one river and two tidal) with seven associated government awards for a total of \$8.5 million.
- *Demonstration Full System Capability and Continued Overall Technology Development*
 - Logged more than 9,000 operational hours of grid-connected electricity, generating and delivering over 80 MWh of electricity to customers in less than six months from five underwater Free Flow System turbines.
 - Successfully completed testing and re-installed Free Flow System turbines with redesigned 5th- generation blade/hub mounting system.
- *Creation of New Technology to Expand Markets for Energy from Flowing Water*
 - Developed new Rapid Flow System technology, which was successfully tested at the Cooper Union Research Foundation's laboratory in New York. The system is designed to extract energy from constructed waterways, such as canals and aqueducts. Secured an agreement with The Dow Chemical

Company for a field demonstration and test of the system at its facilities in Freeport, TX (August 2009).

- Engaged relations with California water agencies and authorities, including Bureau of Reclamation for building engineered systems in engineered waterways, using the Rapid Flow System.
- *Catalyze Marine Renewable Energy Regulatory and Industry Developments*
 - Submitted Pilot License Application to Federal Energy Regulatory Commission (FERC) for commercial build out of the RITE Project.
 - Worked to establish and guide industry trade groups to successfully lobby for inclusion of marine renewable technologies (natural and constructed waterways) in an expanded Federal Production Tax Credit (PTC).
 - Worked with company lobbyists and industry trade associations to obtain U.S. Congressional appropriation in the amount of \$10 million to the U.S. Department of Energy to support the growth of the U.S. marine renewables industry.
- *Engaged Agents around the World for International Development*
 - *Brazil:* Working with both the Todo Trading Company and Future Trends, the Company has identified through the Brazilian government and its relationship with Petroleo Brasileiro S.A., a desire for rural electrification, beginning with the Amazon Basin, where there are more than 1,000 diesel villages.
 - *China:* American Sino, on behalf of Verdant Power, has initiated favorable discussions with Guangdong Electric Power Development Company for the development of projects, using both Free Flow and Rapid Flow Systems throughout the province of Guangdong and Hong Kong.
 - *India:* Through the International Clean Energy Alliance and Globally Managed Services India, Verdant Power has developed interest from several Indian states for project development.
 - *South Korea:* With support from Gyeongbuk Provincial Government, Verdant Power has an MOU with the Institute of Renewable Energy and Environment (IREE) for developing integrated offshore wind and tidal power systems in the world's largest renewable energy industrial park.

- *New Zealand:* New Zealand Trade and Enterprise is working with the Company and the Ministries of Research, Science & Technology, and of Agriculture and Forestry to help meet the country's goal of 90% of electricity production from renewable resources by the year 2025.
- *United Kingdom:* U.K. Trade & Investment is working with VP, the Department of Business Enterprise and Regulatory Reform (BERR) and Scottish Development International (SDI) to help the U.K. triple its renewable energy production within the next 10 years.
- *Turkey:* The Company has an LOU with Society Development Corporation and its affiliate Havasu Enerji Sistemleri to develop projects in Turkey.
- *Malaysia:* The Company has an LOU with GTS Power Ltd. for projects in Cambodia.

4.3.4 Projects

North America

VP is working on three demonstration or pre-commercial projects as a first phase toward deploying commercial projects, which are set to begin in 2011. The US projects and their main details are displayed in Table 4-3.

Table 4-3: Projects (North America)²¹

Project Name	Location	Source, Capacity	Key Characteristics
RITE/NAVY	East River; New York, NY and Puget Sound; Seattle, WA	Tidal Power, Projected 5MW Capacity	<ul style="list-style-type: none"> -World's first grid-connected field of tidal turbines - 80 MWh + energy delivered to customers (first in word) -9,000+ operational hours (world leader) - Partnerships with New York State, New York City, US Department of Energy and US Navy
CORE	St. Lawrence River; Cornwall, ON	River Power, Projected 15MW Capacity	<ul style="list-style-type: none"> -Would demonstrate Free Flow System in river setting -Had commenced Verdant Power international operations -Would demonstrate capacity factors more than double those of wind and solar (80-90%) - Partnerships with Canadian Federal and Provincial Governments
ACE	Dow Chemical Plant Canal; Freeport, TX	Canal Power, Field (Beta) Test	<ul style="list-style-type: none"> - Would demonstrate Rapid Flow System in field setting - Would demonstrate highest capacity factors; triple those of wind and solar (90-100%) - Partnership with Dow Chemical Company

The United Kingdom (U.K.)

VP is one of a very limited group of companies eligible to apply to an RFP that was announced by the U.K.'s Department of Business Enterprise and Regulatory Reform. The RFP is targeted towards qualified developers for a unique program that will provide 25% of the capital funds (up to \$3.24 million) for a tidal energy project along with a power purchase rate of nearly \$0.38/kWh. The RFP's criteria for qualification require that the applicant must have demonstrated that its technology had been operating in the water for at least three months.

VP is also in talks with the Scottish Development International (SDI), which is slated to provide financial project support in return for commitments to utilize local manufacturing and related capabilities. VP's potential partners in this effort include Oceaneering

²¹ Author generated table based on the various interviews conducted with key stakeholders at VP.

International, which has an operating unit in Aberdeen Scotland, Hatch Renewable Energy, and possibly Mott MacDonald, which is also based in the U.K.. VP's forthcoming U.K. subsidiary, which was planned to be incorporated in the U.K. during 2010, has identified potential project sites that are being reviewed by Crown Estates for the purpose of securing seabed site leases.

4.3.5 Market Potential

Some of the potential markets the company's projects aim to serve are grid-connected and base-power supply; industrial self-generation; distributed generation (DG); rural electrification; additional capacity at pre-existing impoundments (e.g., incremental hydro); water discharge flumes found at power plants, water treatment facilities, and flood-control dams; other manmade channels, such as irrigation canals; and those needing to reduce fossil fuel dependency by replacing old with new power projects and by relegating technologies such as diesel generators to back-up status.

VP plans to locate its projects near or in load centers, including major urban areas (such as NYC). The firm initially is targeting market projects at suitable and profitable sites close to grid connection, generally in water depths of less than 35 meters. The company has concentrated its development at ten sites, which appear to have the greatest long-term incentives, first in North America and then in the U.K. The ten projects are forecasted to have a potential installed capacity of 1 GW by 2018. The potential for sales to commercial and industrial customers seeking a low carbon footprint is enormous. The systems also can be used as base power for integrated and hybrid renewable energy systems, when combined with wind and solar power. Unlike conventional hydropower, the company's systems do not require dams. Verdant Power's systems are positioned to be scalable. This greatly simplifies infrastructure, financial and system planning, and leads to lower unit cost. Prototyping to date indicates that these modular systems have minimal impact on fish passage.

While coal has been largely relied upon to fuel growing electricity demands, it has also been identified as the leading contributor of carbon dioxide, which has been linked to climate change. In order to control these emissions, carbon dioxide is likely to maintain a significant economic price in the near future. If the price is very high, as some economic models suggest (from \$50 to \$100 or more per ton emitted), and if a liquid secondary market

emerges for trading emission allowances, this could raise average energy prices 30 - 60% or more.

Combined, these scenarios have created a hugely expanding market for clean and renewable energy technologies globally. The World Bank forecasts that within the next 40 years there will be a \$5 trillion global industry in renewable energy technology. Policies such as the Kyoto Protocol and aggressive renewable energy requirements have made sustainability a global imperative. To support growth in the sector, public economic incentives have been adopted worldwide including Production Tax Credits, Investment Tax Credits and grants seeking to advance sustainable technologies.

Total Addressable Market

As indicated in the Industry overview section, the total addressable market (TAM) for kinetic hydropower²² is estimated by the US Department of Energy to be 250 GW. This figure is comprised of an estimated 63 GW from tidal, 137.5 GW from river and approximately 50 GW from constructed waterways resources.

More than 20% of the market, or 50,000 MW, is to be found in developed countries. This is Verdant Power's initial primary target market. The total North American market easily exceeds 25,000 MW. According to the New York State Energy Research and Development Authority, there is more than 1,000 MW of kinetic hydropower potential within just the state of New York.

The National Research Council of Canada concluded that: "a vast resource of energy exists in [Canada's] flowing waters. If [free-flow] devices currently under development prove sufficiently economic to place in the general areas identified by this study, then the impact on Canada's future energy demand could be very significant." The analysis continues: "For just three main river reaches in which consecutive cross-sections may be exploited, and for only thirteen tidal current cross sections, over 110 TWh/year of kinetic [free-flow] energy have been identified."²³ At an 80% capacity factor, this translates to more than 15,000 MW of potential installed capacity.

²² General term used to describe hydropower derived from the kinetic energy found in rivers, tides, channels, etc without the use of dams. It is also referred to as hydrokinetics (FERC).

²³ An Evaluation of the Kinetic Energy of Canadian Rivers & Estuaries was prepared for the National Research Council Canada, Hydraulics Laboratory, Ottawa, Ontario, Canada—March 1980

The potential for tidal power around the world may be even greater than has been previously estimated. Great Britain has identified tidal power to be of such significance that the government has allocated more than \$100 million for the accelerated development of tidal power technologies, including construction of the European Marine Energy Center (EMEC) testing facility in the Orkney Islands. (In September of 2008, the United States, through its DOE Advanced Water Power Projects solicitation, has also provided funding for two national marine renewable energy test centers, to be located in Hawaii and the Pacific Northwest). The Carbon Trust estimated in its 2006 Future Marine Energy report that “tidal stream energy could become competitive with current base costs of electricity within the economic installed capacity estimated for the U.K., 2.8 GW.” Verdant Power has identified more than 120 North American potential tidal locations alone, each with multiple development sites suitable for the company’s systems.

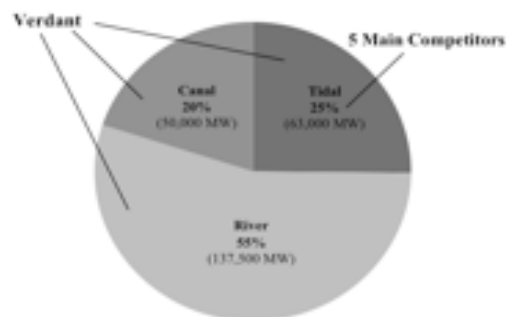


Figure 4-4: Total Addressable Market²⁴ (Verdant Power vs. 5 Competitors)

Serviceable Addressable Market

Verdant Power has developed systems that can generate energy in three kinetic hydropower resource areas (tidal, river and canal), unlike its main competitors, which have focused solely on the tidal portion (25%) of the total addressable market. VP estimates that the serviceable addressable market (SAM) for marine renewable energy in developed countries to be 15 GW. The total global SAM is estimated to be 75 GW with projections that 80% of SAM, or 60 GW, will be found in developing countries. It is targeting a 30% global market share of 22,500 MW. Employing its Free Flow and Rapid Flow Systems, the company will begin

²⁴ Figures derived from US Department of Energy, Ocean Energy Council (tidal), World Energy Council (river), and an estimate based on existing and planned constructed waterways (canal).

commercial operations in developed countries for a projected total of 4,500 MW, following, nearly in parallel, with 18,000 MW of exponential growth in developing countries.

4.3.6 Competition

In the marine renewable energy industry, Verdant Power is positioned between upstream conventional hydropower facilities, including dam and run-of-river systems, and downstream kinetic hydropower, or ocean energy technologies, including offshore tidal power and wave energy systems.

The majority of the ocean energy technologies are extremely large, measuring tens of tons, and up to 30 meters tall at full scale. They also have much larger single unit capacities than Verdant Power's units, with several developers claiming that their single units will generate between 300 kW and 1-2 MW. However, in order to attain this output they are designed to operate in waters of up to 35-45 meters deep, typically far offshore and/in remote regions, thus requiring long transmission lines and highly specialized installation equipment/supporting infrastructure found only in selected regions of the world. The primary differentiating factor of VP's technology is that it is specifically designed for shallow waters (less than 35 meters deep) and its unique design is scalable for locations around the world.

Based on operational experience to date, there appears to be five direct competitors to VP. These competitors are all targeting tidal sites generally in water depths of more than 35 meters at remote locations, requiring new and additional transmission connection. These competitors are listed in Table 4-4.

Table 4-4: Key Competitors²⁵

Competitor Name	Location
Marine Current Turbines (MCT)	United Kingdom
OpenHydro Group	Ireland
Clean Current Power	Canada
Lunar Energy	United Kingdom
Hammerfest UK	United Kingdom (formerly Norway)

All of VP competitors have designed prototypes and are at various stages of development of their technology (comparison of operating experience provided below). For example, Marine Current Turbines has deployed a single rotor prototype off the coast of Devon (1,623

²⁵ Author generated table based on the various interviews conducted with key stakeholders at VP.

operational hours since 2003) and has recently deployed a twin-rotor device off the coast of Ireland, logging-in an additional 1,380 operational hours. Open Hydro deployed its first working prototype (Quarter Scale) at the European Marine Energy Centre (EMEC) in the Orkneys, Scotland. It will soon deploy a demonstration of its 1 MW prototype in the Bay of Fundy. Lunar Energy is also hoping to test its prototype at EMEC. Clean Current tested its prototype at Race Rocks, British Columbia; and is planning on testing its next generation prototype in the Bay of Fundy. All of these technologies are designed for the deep, offshore tidal waters that are found primarily in Scotland and the Maritime Provinces. Voith Siemens is planning on testing its 110 kW (one-tenth scale) tidal stream system technology in South Korea. Table 4-5 displays a competitive comparison based on the parameters described above.

Table 4-5: Competitive Comparisons²⁶

Company	Operating Hours	Energy to Grid (Location)	# of Devices Demonstrated	Demonstrated Units in Array	Demonstration Size
Verdant Power	9000+	80+ MWh (New York, US)	17	Yes	175 kW
Marine Current Turbines	3000+	Test Transmission (N.Ireland)	2	No	1.2 MW
Open Hydro	Yes Amt. Unreported	Test Transmission (Scotland)	1	No	250 kW
Clean Current	Yes Amt. Unreported	0	1	No	65 kW

Three of VP's key competitors are based in the U.K. As a result, they benefit from E.U. and U.K. government financial and technical support. For example, in 2005, the U.K. government invested £50 million in a program to nurture wave and tidal projects through a combination of direct grant subsidies to developers, funding of a specialized test facility to accommodate field demonstrations of pre-commercial units, and regional and national resource assessment mapping and surveying. This financial advantage is also supplemented with a collaborative relationship with environmental regulators, which seems to have resulted in minimal environmental entanglements during the initial pre-commercial testing phase of the U.K.-based operating units. The combined financial, technical and environmental assistance appears to be an extraordinary advantage when compared to U.S. regulatory

²⁶ Author generated table based on independent online research about the companies listed.

standards. VP sees its U.K. competitors, therefore, as bearing less development costs than VP has had to shoulder.

The company also faces competition from “other renewable energy systems and fuel sources.” Fossil fuels, especially coal, have continued to be relied upon to meet the world’s growing demands for energy. However, they are already beginning to maintain an economic premium via public mandates seeking to regulate their greenhouse gas emissions. With fossil fuel costs escalating and those of renewables declining as technologies are adopted and economies of scale come into play, renewable energy, including Verdant Power systems, will be competitively priced with fossil fuels in the near future.

Within the renewable market, Verdant Power systems will enter the market at a rate higher than current wind and solar per kWh costs, though these cost disparities will continually decrease as the company’s technologies mature and are more widely adopted. Moreover, because of the predictability and greater capacity factors available from its systems, Verdant Power believes that it will surpass other forms of renewable energy in terms of cost-effectiveness, as well as attractiveness as clean and reliable sources of renewable energy (see Table 4-6 for a detailed comparative table of various fuel sources).

Table 4-6: Comparison of Fuel Sources

	<u>Supply Outlook</u>	<u>2005 Cost/kW Installed</u>	<u>Cost/kWh (US Cents)</u>	<u>Supply Outlook</u>	<u>2008 Cost/kW Installed</u>	<u>Cost/kWh (US Cents)</u>
Coal Fuel costs have risen by 30-50% over the past two years. Cost of coal plant construction has doubled in four years. Financing of facilities has come under threat in US via major bank redlining, suspension of some US Government loan guarantee programs, and environmental pressures at the State level.	Plentiful	\$1,500	4 - 6	Tightening	\$3,000 – \$3,200	5 - 8
Natural Gas Increasingly imported from more distant sources, at greater and greater costs, including added transport, storage, processing facilities, and supply chain vulnerabilities. US fuel prices hit a two-year high in March 2008 at \$10+, and kept increasing, while some competing LNG importing countries are signing new purchase contracts at \$14-18.	Costs Escalating	\$1,800 – \$2,000	5 - 7	Costs Escalating	\$2,000 – \$2,200	7 - 11
Wind Component scarcity seems to be the main immediate problem, resulting in increasing system costs. Turbine costs are up \$400/kW since 2001, resulting in higher delivered system costs. Growing concentration of industry results in 85% of US market now controlled by four firms. Listed prices do not reflect required additional transmission system upgrades (ranging up to an additional 50% of capital costs) to bring the wind energy from generation areas to ultimate users.	Sustainable	\$1,400 – \$2,000	4.5 - 14	Sustainable	\$1,800 – \$2,400	5.5 - 14
Solar Increases in efficiencies have not resulted in meaningful reduced costs for consumers as global pricing competition pulls much of world production into selected high tariff areas (e.g. Germany). Shortages of materials have sustained high prices, while longer term constraint is lack of adequate storage capacity to offset nocturnal generation stoppages.	Sustainable	\$8,000 – \$8,750	20 - 38	Sustainable	\$8,000 – \$8,750	20 - 38
Marine – Current Costs Industry is still at early stage with limited production volume and installation experience, similar to wind industry in the early 1980's. The relatively current production costs are offset by various government mandates and incentives directed at renewables in general and marine renewables specifically, which reduce the effective costs to early adaptors to competitive levels.	Sustainable	\$5,000 – \$7,000	15 - 26	Sustainable	\$5,000 – \$7,000	15 - 26
Marine – Future Costs Costs should decline approximately 15-18% each time production volume doubles, according to analyses of The Carbon Trust and Electric Power Research Institute. Manufacturing consultants' "should cost" studies support these analyses.	Sustainable	\$1,500 – \$4,000	5 - 11	Sustainable	\$1,500 – \$4,000	5 - 11

4.3.7 Organization

As of January 2010, the company employed 20 full-time employees and consultants with several vendors also dedicating additional full-time equivalents to company operations. The key personnel are listed in Table 6.

Once the technology has been commercialized, VP's management hopes to staff a position titled "Chief Social Officer." This person's primary responsibility will be to address the electricity needs of developing countries and communities around the world and to work with the local communities worldwide to deploy VP systems at major global, developing load centers.

VP's organization is anchored on two main teams, an in-house Resource Assessment (RA) team and the Project Development (PD) team. Both teams help VP's efforts in expanding its capacity to identify and develop potential projects, to obtain needed equipment and to secure government support for the Free Flow System and Rapid Flow System technologies. The RA team is tasked with identifying potential sites and guiding the selection of those locations that are the most promising. The PD team, which works closely with the RA team, is charged with identifying and securing commitments for potential commercial build-outs. (See Appendix 1.2 for details on the management team and list of directors.)

As displayed in the organization structure on the following page in Figure 4-5, the head of the PD team and the RA team report to the director of technology. The director of technology reports to the top management. In addition, one member of the PD team reports to the head of the RA team and one member of the RA team reports to the head of the PD team.

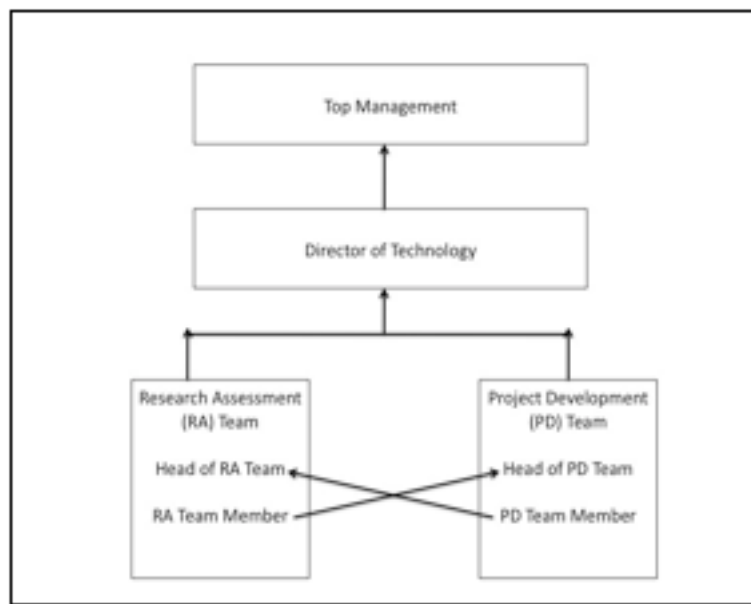


Figure 4-5: Organization Structure²⁷

VP seems to understand that engineering is a very disciplined practice and the employees need to be well informed and disciplined to ensure that the designs are locked down, precise and accurate. At the same time, the company appreciates the outlook that it is important for the engineers to be creative, to be able to think out of the box and to get new perspectives on the designs. The organization structure above is a hybrid of flat and hierarchical management decision making which gives all employees' immense flexibility, access to everyone else in the organization and the opportunity to contribute in a variety of areas. It enables employees to wear several different hats and learn from each other. The setup also provides the opportunity for employees to actively participate in every aspect of the company and to learn and grow as the company evolves.

“Any day you have no idea what’s going to be given to you as a task. I could be watching birds one day, I could be counting fish, I could be meeting investors, I could be interviewing with social entrepreneurs, I could be connecting advance technology to measure river velocity, I could be in a federal building, I could be on an airplane. It’s really interesting and that’s the beauty of small startups.”

— Jonathan Colby, Hydrodynamic Engineer, Verdant Power

This organization structure seems to cater to individuals who are fairly independent, adaptable, flexible, and creative with their tasks and working environment.

²⁷ Author generated figure based on the various interviews conducted with key stakeholders at VP.

VP also retains manufacturing, engineering and logistical supply chain consultants to help identify the most cost-effective and efficient means to manufacture and supply turbine systems and related equipment for a commercial scale.

4.3.8 Capitalization, Financial Projections and Proposed Business Models

At the time of VP's investment round in August 2006, the company's valuation was \$33.8 million. The ownership of the company's fully diluted common shares/equivalents as of January 2010 is provided in Table 4-7.

Table 4-7: Capitalization (as of January 2010)²⁸

Share Holder	Number of Common Shares/Equivalents	Percentage of Share Held	Price Range
Management	16,610,232	40%	\$.00-\$1.25
Angels / F & F	10,595,365	26%	\$.15-\$1.25
Tudor Investment Corp	8,822,606	21%	\$.85
Employees/Consultants	5,366,076	13%	\$.00-\$1.25

Most of VP's funding has come from grants that are dedicated to specific tasks and subtasks aimed at commercializing their technology — turbine design, manufacturing, materials, resource assessment. The Company has also won competitive solicitations from government entities in both the U.S. and Canada. The Ontario Ministry of Research and Innovation (OMRI) made its award in April 2008. In July 2008, the company won an award under Sustainable Development Technology Canada (SDTC) and in September of that same year, Verdant Power was awarded funding under the U.S. Department of Energy's Advanced Water Power Projects solicitation — the first award offered for marine renewable energy in the U.S. Verdant Power has also received awards from the U.S. National Renewable Energy Laboratory, the New York State Energy Research and Development Authority, and the City of New York. Over \$14 million in incentive funding has been provided to date from these various sources (see Appendix 1.3 for a list of grants received).

²⁸ This information was provided by Ron Smith in an interview conducted with him at the Verdant Power offices.

VP is now seeking \$20 million in additional equity capital, as well as up to \$50 million in project financing in order to complete its demonstration projects, license the world's first commercial tidal energy and river projects, improve its technologies, and build corporate capabilities and relationships, as well as develop a portfolio of commercial projects.

VP's plan envisions 330 MW of operating projects by the end of 2016, and more than 1,000 MW by the end of 2018, all utilizing its proprietary technologies. Projects will be developed with experienced owner/operators, who will provide VP with significant cash flows to fund further project development and growth. The company's revenue model includes a continuation of grant funding from governments in the short term in order to offset a significant portion of demonstration project costs. VP forecasts that beginning in 2012, net revenues from river and tidal projects as well as from licensing will begin to materialize. That year is supposed to be an inflection point, at which time revenues and profitability are expected to start to grow rapidly as revenue pipeline of projects begins to flow.

VP's projects will be largely governed by special purpose corporate structures, which will be established by VP and its project partners. Contributions to the company's overhead costs will be derived on each river and tidal project from pre-project cost recoveries, consulting services, as well as, and most important, from a carried interest in project cash flows from power sales. The result is a growing annuity stream reflecting the company's project development business model. VP is also developing a licensing revenue strategy for projects outside of the US, Canada, and the UK. Revenues will be derived from license fees, consulting services, and ongoing royalties from power sales.

Business Model and Project Economics

Verdant Power, as a project company, will generate commercial revenue and profit from the development of river and tidal projects in North America and the U.K. as well as, in due course, other international jurisdictions. Working closely with project partners - including independent power producers and electrical generating utilities plus local community organizations, the company will usually take a carried interest in the ultimate sale of power thus creating long term, sustainable cash flow. It will also license its proprietary technologies and know-how to power producers in selected international

markets. When attractive opportunities arise, it occasionally will sell its interest in completed projects, redeploying the proceeds towards additional project development. Unlike its competitors, VP has focused its design on simplicity and scalability, which opens opportunities to a broad range of potential sites and partners in both developed and developing countries. It has proprietary expertise in marine renewable energy systems, water resource assessment, site analysis and development, project design using its systems, and project and technology operations and maintenance. Working with regional strategic partners with local expertise in manufacturing, project development, construction, financing as well as permitting and licensing, Verdant Power will deliver and sell its projects globally.

Verdant Power's systems are designed to be the most cost-effective and widely applied technologies in the marine renewable energy market. The systems serve a multitude of natural and constructed waterways and markets including:

- Grid-connected power supply;
- Industrial self-generation;
- Distributed generation (DG);
- Rural electrification;
- Adding capacity at pre-existing impoundments (i.e., incremental hydro);
- Water discharge flumes found at power plants, water treatment facilities, and flood-control dams;
- Other manmade channels, such as irrigation canals and aqueducts; and
- As replacement technology for less economically or environmentally desirable energy technologies, such as diesel generators.

Unlike other renewable power sources, Verdant Power's systems can be located near or in load centers, such as urban areas. And, because of the reliability and predictability of water currents, they can be used as base power for integrated and hybrid renewable energy systems, when combined with wind and solar power. They are also easily scalable and can be built and installed quickly, unlike conventional hydropower, which requires dams, and competitor units, which are more complex. This greatly simplifies infrastructure, financial and system planning, and leads to lower unit cost. These modular systems have been demonstrated to have minimal impact on fish passage.

Business Model Economics

Verdant Power's profitability is a function of its ability to assess, select and permit attractive projects and build them out in partnership with established project developers/owners. The company's carried interest in projects upon commissioning assures long term, annuity type cash flows from the sale of power as well as additional consulting and re-equipping revenues.

Where actual costs and prices settle within their ranges for an individual project will be a function of the project site selected and the power-pricing regime followed by the jurisdiction involved.

Taking this analysis further, Table 4-8 illustrates what an owner operator could expect in the near term, and subsequently over the next few years as technological improvements already in the company's development pipeline are manifested in the field. The following assumes gradually increasing rotor size, from the current initial 5-meter diameter to 7-meter, then to 11 meters. Constant water velocity is assumed, similar to what is found in the St. Lawrence River at Cornwall.

Table 4-8: Future Growth Potential²⁹

	Current Status	4-5 Years Out	6-7 Years Out
	2012-3 Niagara # 1	2014 CORE Build-Out	2017 Great Lake # 4
Gross Revenue (Ontario Standard Offer) in 3rd Production Year	4,563,000	18,250,000	27,375,000
Project Size in MW	5	20	30
Turbine rotor size (Meters)	7	7	7
Name Plate Capacity (in kW)	110	110	110
Capacity Factor: River	85%	85%	85%
Capital Cost Required	\$20,473,000	\$56,081,000	\$74,219,000
Cost per MW	\$4,094,000	\$2,804,050	\$2,473,967
O&M / G&A Expense in 3rd Production Year	\$2,223,000	\$6,465,000	\$8,840,000
EBITDA in 3rd Production Year	\$2,340,000	\$11,785,000	\$18,704,000
IRR: Assuming 50% debt Pre-Tax	5.9%	18.4%	21.8%

Cost Reduction Drivers

Current cost parameters are based on the company's experience in fabricating and installing a small number of essentially handcrafted units in relatively shallow tidal areas. Key components of the overall capital cost structure include: (1) costs of manufacturing the turbine system, (2) costs to deploy and cable it, (3) regulatory costs to obtain required permits and licenses, and (4) the actual net production of the systems. This last factor is influenced by the velocity of the underlying water resource, its depth (which may allow larger turbine rotor sizes), and the duration of its flows.

Profiting from experience to date, management has identified the following significant cost reduction drivers, which are the focus of current RD&D activities:

²⁹ This information was provided by Ron Smith in an interview conducted with him at the Verdant Power offices.

- *Economies of Scale* Reductions due to economies of scale are generally predicted to be 15 - 18% each time that volume doubles. Commencing with production in 2010, volumes are expected to more than double in each succeeding year. The company's engineering studies have indicated that a significant (over 50%) cost reduction in producing the turbine units themselves is obtainable merely by increasing the lot size from 6 to 20-25.
- *Installation and Retrieval* The company has substantial field experience in mounting, deploying and retrieving turbine units using conventional marine service industry practices. Design efforts are well advanced to simplify and reduce the expense of initial deployment and subsequent maintenance. A much simplified, gravity-mounted system will be employed in Phase 1 of the CORE Project during the fall of 2009 and the following summer.
- *Regulatory Costs* Regulatory costs associated with innovation are often burdensome, particularly in the U.S. To address these issues, the company has been a leader in working with key regulatory agencies at the federal and state levels — efforts that have resulted in a number of precedent-setting rulings and structural licensing improvements. In addition, greater emphasis has been placed on establishing projects in more advanced hydropower jurisdictions such as Canada and the UK, while simultaneously continuing to develop hydro systems that operate in less regulated manmade waterways. The company has been successful in mobilizing a larger coalition of industry supporters to carry more of the expense of longer-term reform efforts.
- *Increased Power Production* Increasing the net output of each system is being addressed using world-class techniques by Verdant Power's internal site assessment team to better qualify potential sites for optimal power generation. In order to expand its capabilities to exploit selected sites, especially those with deeper and or more rapid flows, the company has just been awarded a two-year, \$1.2 million grant from the U.S. Department of Energy to develop bigger, cheaper and more durable rotors. Equally or more important, as a world leader in migrating the underlying tidal technology into river environments, the company is raising the estimated capacity factors of the systems from 30/35% to 80/90%. The combination of faster natural velocities, increases in rotor sizes and increases in

capacity factors can increase net output two to three fold over the existing status, with minimal increase in system costs.

In Table 4-9, VP's projected 2010-2016 financial performance is presented. Net revenues represent contributions to overhead from various demonstration and commercial projects plus licensing. Only modest increases to overhead expenses are anticipated because a significant amount of the company's costs will be absorbed by the special purpose structures established for project development.

Table 4-9: Summary Forecast 2010-2016 (US 000's)³⁰

	2010	2011	2012	2013	2014	2015	2016
Net Revenues	(2,831)	(169)	11,166	9,130	18,646	24,672	47,429
Overhead Expenses	5,276	5,000	5,438	5,990	6,558	7,227	8,018
EBITDA	(8,107)	(5,169)	5,728	3,140	12,088	17,445	39,411
Net Equity	12,901	7,732	13,460	16,601	28,688	46,133	85,544
Cash on Hand	11,051	5,747	10,776	14,127	25,475	42,476	80,079

(See Appendix 1.4 for the corporate forecast). Backing this is an extensive model detailing individual projects within the project pipeline, the returns they offer and the impact they have on Verdant Power's revenue growth. These projections do not take into account other incentives available in many jurisdictions and advantageous to investors and project developers. These possible complementary revenue streams are listed below:

- Systems Installations, Sales and Leasing
- Electric Power Production
- Intellectual Property
- Renewable Portfolio Standards
- Renewable Energy Credits
- Revenue Support/Feed-in Tariffs
- Federal and State Income Tax Credits
- Carbon Emissions Trading
- Capacity Payments/Capital Cost Buy-Downs
- Subsidized R&D Support

³⁰ This information was provided by Ron Smith in an interview conducted with him at the Verdant Power offices.

(See Appendix 1.5 for a summary of the complementary revenue streams.)

4.4 Observations

4.4.1 Company Evolution

VP started with a vision, not a specific technology: to provide clean, renewable energy using underwater turbines, including replacing diesel generators in developing countries with VP's turbines and creating renewable-based distributed electricity generation for small communities. In order to realize this vision, VP's founders chose to concentrate on marine renewable technology.

However, although VP management seems unanimous in adhering to its overarching vision, its main focus must be on the business challenges of commercializing marine renewable technology and generating a revenue stream. Thus, the company is in the process of funding, building and testing different concepts. Furthermore, over the ten years since its inception, the company has progressed from a technology developer to a project developer.

When VP began, the management's goals were to survey existing technology and identify the most viable of the technologies. It studied and developed four iterations of renewable marine energy technology. The company is at a stage where it needs to be totally focused and professional in striving towards its objectives and mission, which are to advance technology and to develop a commercial project to fruition while at the same time continuing to attract sufficient investment, either through governmental or private investors.

In 2008, a team of students from Columbia Business School carried out a field project at VP that focused on the possible need for VP to join forces with a larger and wealthier partner. Categories of possible partners identified included, local governments, traditional utilities, renewable energy producers, project developers, large industrials, wind turbine manufacturers, major oil companies and engineering/construction firms. Also considered were wealthy individuals.

With the above as background, VP is now focusing on the following:

Technology Development

VP intends to apply the lessons it learned from the RITE Project in NYC, as well as other field tests, and incorporate them into the development of next-generation Free Flow Systems. The advancement to the next generation (Generation 5) focuses on overall parts reduction to facilitate commercial manufacturing and further reduce potential operations and maintenance costs. VP is also in the process of developing enhanced blade designs for its Free Flow System turbine in partnership with the U.S. Department of Energy, the U.S. National Renewable Energy Laboratory and Sandia National Laboratories. The purpose of these new designs is to enhance structural strength and streamline manufacturing, as well as to scale up turbine rotors to 11 meters or more for use in deeper, faster waters.

VP's technology development plans also include expansion of the Free Flow System into river settings. In fact, river operations possess a huge advantage over many other forms of renewable energy because rivers constitute highly predictable and generally constant sources of energy. Through the CORE Project in the St. Lawrence River, VP aspires to deploy a 5th Generation Free Flow System for the first time in a continuous-flow (non-tidal) river setting. VP anticipates that its river Free Flow System could reach capacity factors of 80-90% — double those of wind, solar, and tidal systems.

Concurrent with advancing and deploying its Free Flow System, VP plans to refine its implementation and anchoring techniques for cost-effectiveness. The company plans to employ a much more simplified gravity-mounted system that will allow service providers to plug in turbines in and out of the water much like changing light bulbs. VP also envisions bringing its Rapid Flow System from the lab into the field. This involves significant new steps related to system deployment and overall efficiency in producing electrical power.

During the next five years, VP plans to build two demonstration and ten multiple-phase commercial projects with a goal to possibly further refine its technology and project development capabilities for commercial operations. Table 4-11 provides a summary of the VP's plan to realize its initial goal of 330 MW of installed capacity in North America and the UK (see Table 4-10 for a detailed project pipeline listing).

Table 4-10: Project Pipeline³¹*November 2009*

Technology	Location	2011	2012	2013	2014	2015	2016	2017	2018	Total Estimated MW	Total by Technology
Tidal Free Flow	Canada (4) Bay of Fundy			5 MW	20 MW		30 MW	40 MW		95 MW	
	UK (6) SW England					15 MW	30 MW	35 MW	45 MW	125 MW	
	UK (2) NW Scotland		5 MW	5 MW	30 MW		30 MW	55 MW		125 MW	
	UK (7) SW England					15 MW	30 MW	40 MW	80 MW	165 MW	
	UK (9) Northern Ireland						20 MW	45 MW	135 MW	200 MW	
	UK (8) SW England						15 MW	30 MW	35 MW	80 MW	790 MW Tidal
River Free Flow	Canada (1) St. Lawrence	3 MW	2 MW			20 MW				25 MW	
	Canada (3) Niagara			5 MW	5 MW	5 MW	10 MW			25 MW	
	Canada (5) Great Lakes					10 MW	20 MW	25 MW	30 MW	85 MW	
	Canada (10) Maritimes							15 MW	60 MW	75 MW	210 MW River
TOTAL MW	10 Commercial Projects	3	7	15	55	65	185	285	385	1000	1 GW

This project pipeline reflects the company's plan for scale up, production design and manufacturing of the Free Flow System. (The Rapid Flow System is sidelined to Beta tests.) VP's focus is on lowering costs of its technology, installation and project development. Thus, VP's strategy is to remain focused on core activities, while also remaining alert for exploring and possibly exploiting opportunities that emerge.

³¹ Based on data provided by VP Management

Table 4-11: 2011-16 Project Pipeline (in MW)³²

	2011	2012	2013	2014	2015	2016	Total
Tidal	0	5	10	50	30	155	250
River	3	2	5	5	35	30	80
Canal	0	0	0	0	0	0	0
Total	3	7	15	55	35	185	330

VP also plans to take greater advantage of improving Internet, networking and software design technologies. For example, VP aims to gather information more quickly and to hire the best and brightest people from different parts of the world. Also, with the progress in engineering and design knowledge and 3D CAD/CAM systems and modeling, VP plans to create virtual engineering systems and place them in “virtual waterways.” These IT-based technological innovations will help VP maintain a more global organization, a more dispersed body of personnel and an increased number of offices worldwide.

A simple “Horizon Dashboard” is utilized as a planning and monitoring tool for establishing where the major focus lies at a given point and which other projects are worthy of pursuit (see Appendix 1.6 for a description of this priority setting horizon analysis).

4.4.2 The Future: Dual Motivations and Objectives; and the Challenges of Growth

VP juxtaposes its business and technical professionalism with its adherence to its overarching mission. On the one hand, by commercializing its technology, the company aims to have its systems used in communities worldwide and to empower citizens by providing a reliable and clean source of electricity. VP’s management believes that access to reliable electricity from a local source will help developing countries grow exponentially, stimulating economic development and wealth creation. For example, access to affordable local and reliable electricity would enable countries to set up cell phone towers, put computers in schools, and use satellite-accelerated Internet for distance learning and telemedicine. Eventually, such developments would begin to level the playing field between communities all around the world. VP’s management believes that

³² This information was provided by Ron Smith in an interview conducted with him at the Verdant Power offices.

it could help make the world a better place by spreading wealth through infrastructure and education to empower people. The company wants to provide this infrastructure.

“I think about central Asian young girls and African young girls. The reason they are not in school is because they spend a lot of time during the day gathering water and firewood. If instead, our systems could help pump clean water to electrify schools then these young girls could be in schools too.”

—Trey Taylor, President & Head of Market Development, Verdant Power

“I do a significant amount of educational outreach as part of my job. I work with students on many levels of science, trying to get more students active in science and engineering.”

—Jonathan Colby, Hydrodynamic Engineer, Verdant Power

It is, therefore, apparent that VP’s management’s motivation is not just to create a marine renewable technology, but also to really help change the world, uplift people, and create sustainable communities. The chosen channel to accomplish this task is marine renewable technology. For example, here are some representative comments from key personnel:

“My motivations were a combination of business and social aspirations. My career orientation has never really been focused on getting extremely wealthy but more in the work and the creation of something unique.”

—Ron Smith, Chairman and CEO, Verdant Power

“It is the passion and the desire to empower people with electricity and clean water and the power to make decisions that keeps me up at night.”

—Trey Taylor, President & Head of Market Development, Verdant Power

“I was enrolled in a PhD program in Aerospace Engineering at Georgia Tech but I left after 3 years with my Masters. I did not believe in the heavy military application of the industry. My colleagues in school did not have the same ideology as I did. Quitting and joining the renewable energy sector was the best decision I have ever made.”

—Jonathan Colby, Hydrodynamic Engineer, Verdant Power

On the other hand, VP possesses an explicit, multidimensional and well-documented strategy for revenue generation and growth. Its management understands full well that in order to achieve its social goals and bring its ideas to fruition, it is important to be commercially successful and to generate revenue. Its operations must be effective and it must invest for further growth. VP’s strategy includes implementing what it sees as best business practices and adopting professional management and technological approaches.

“Our current focus is primarily on commercializing our technology by raising money and attracting investors. If a for-profit company like ours are presenting to institutional investors, they have very low interest in the social aspect of it. They want to hear from us that our sole objective is in making big money for them and everybody else. So that there is a tension there between how an organization like ours has to communicate with the investment community.”

—Ron Smith, Chairman and CEO, Verdant Power

The firm also plans to generate commercial revenue and profit from the development of river and tidal projects in North America and the UK as well as other international locations. VP also aims to work closely with project partners, including independent power producers and electrical generating utilities plus local community organizations, and to take an interest in the ultimate sale of power, thereby creating long-term, sustainable cash flows. VP also hopes to license its proprietary technologies and know-how to power producers in certain international markets and to fund additional project development by possibly selling its interests in completed projects. VP also hopes to explore opportunities by focusing its design on simplicity and scalability and aspires to deliver global projects by partnering with regional strategic partners that have local expertise in manufacturing, project development, construction, financing, permitting, and licensing.

Marketing is also a key component of its overall strategy. VP’s initial sales strategy focuses on its primary target market in the U.S., Canada, and the U.K., and within these countries on regions, states and provinces with strong natural resources and the most favorable economic incentives for development. VP plans to act initially as an independent power producer in an effort to commercialize its Free Flow System by building pilot or pre-commercial projects that demonstrate the cost-effectiveness of its technology as applied to tidal channels (e.g. in New York, New Brunswick, and the U.K.), to river currents (e.g., Ontario and New York), and to constructed waterways (e.g., Texas and California). These demonstration and pilot sites are located where VP has met or thinks it can meet all regulatory requirements or where there is less stringent overall regulatory regime (e.g., constructed waterways in the U.S.). Each site has been carefully surveyed using the company’s unique resource assessment capabilities approach to determine market viability for commercial build-out, which includes scaling-up and developing nearby sites. Each site is also coupled with VP-nurtured business and

community partners, which also helps provide a constant flow of favorable news articles about the company, its technologies, and its projects.

There is also a strong global component to its strategy. VP plans to build an international supply chain network in an effort to attract strategic partners around the world. The company has plans to create a global Intranet so that say “Verdant Power China” could communicate with “Verdant Power India,” sharing ways to refine VP’s technology. In such a way, communities globally could help support each other. VP believes that up to 80% of its business could soon be in developing countries.

VP’s global strategy has an important regulatory element. Company executives believe that not only are they developing multiple technologies and deploying them in strenuous conditions, but they along with their competitors maybe paving a path to regulatory reform. The firm believes that the U.S. Congress and the DOE must act to break a regulatory policy stranglehold on development and commercialization of its technologies. VP executives claim that the current regulations around environmental concerns are stifling innovation in North America. At a time when it is important to encourage innovative energy technology, the FERC declined VP’s invitation to create a three-to-five-year study license for new technology.

To VP, there is a significant danger that the marine renewable energy industry will not be successful in the U.S. due to adversarial and exceedingly risk-averse regulatory policies. VP even claims to have spent more money on environmental studies and assessments than on building products or developing technology. As part of obtaining a demonstration permit, VP had to perform studies examining the ecological, navigational, recreational, hydrodynamic, and historic preservation impacts of the project. To do this, VP had to conduct many studies, including benthic habitat characterization; a water quality assessment; an East River hydrodynamic survey; a mobile hydroacoustic survey; a fixed hydroacoustic survey; an assessment of impacts on any rare, threatened, or endangered species; a biological survey of the East River; a recreational resources assessment; a navigational and security assessment; and an historical resources assessment. Only two years after having completed the studies could VP return to FERC with an application for a license to build and operate a commercial scale project in the East River, which will proceed according to FERC regulations.

In contrast, according to VP, countries such as Canada and the U.K. have in place what seem to be more favorable policies. Also, VP and its competitors claim to be able to obtain funding from Canada much faster and more easily than from the U.S.

“Clearly, we cannot approve permits blindly and must evaluate the environmental and human impacts of new projects before they are installed; however, we must be able to balance the need for new renewable energy technology against the laudable policies and values embedded in our environmental laws.”

—Ron Smith, Chairman and CEO, Verdant Power

There appears to be a need to rethink all of our environmental laws from a climate change perspective so that environmental law does not stifle our response to a larger environmental problem.

VP’s top management sees another significant challenges as acquiring sufficient and appropriate financial resources and human resources. In terms of raising capital, there is a tension between how an organization like VP should communicate with the investment community.

Apart from transitioning from a technology developer to a project developer, another transition for VP is going from a startup to a growth company. It is well known that the nemesis of any growth company is cash flow. The company does not have a revenue stream and is not making any profits. Since it has no revenue yet it is at the mercy of private equity investors or the government. Most government funds require matching funds, which means that it has to find suitable investors. Most investors are risk averse and do not want to invest in technology; but they do invest in projects, implying that a reliable technology is going into the projects. Almost all of VP’s funding now comes from grants that are dedicated to specific tasks and subtasks aimed at commercializing its technology — turbine design, manufacturing, materials, resource assessment — and that will eventually lead to an array of turbines that produce renewable energy.

The company is also making plans to leverage California Governor Schwarzenegger’s effort build a “hydrogen highway,” which involves the use of fuel cell cars on the highway that runs from Los Angeles to San Francisco to Sacramento. VP sees an opportunity to use the massive canal systems on either side of this highway to build fueling stations for these fuel cell powered cars.

In terms of human resource strategy, VP intends to nearly quadruple its employee headcount during the forecasted period. The company now attracts employees who are fairly independent and not used to the security of larger corporations. These people are used to working in dynamic environments or in small to medium size firms where they can contribute in a wide variety of areas. VP realizes that it is important to have some flexibility while at the same time maintain focus and expertise. The company understands, however, that if it is to grow, it may have to change somewhat in terms of HR. Growth may require more consistent and professional processes and structures and more specific job descriptions.

Trey and Ron are deeply concerned about fundamental and difficult issues. For example, how they can maintain the best of what has been accomplished and built while making the necessary changes for growth in the future. They also want to succeed as a business while not losing sight of their overarching social goals.

Chapter 5. Case Study – Green Map System

5.1 Introduction

This chapter focuses on Green Map® System, a nonprofit organization that develops “Green Maps” that employ icons to indicate sustainability and related sites on its maps. It is a product-service system combining a universal iconography, adaptable tools and local leadership, offering access to a global collection of sustainable maps.

In this chapter, I will begin by providing relevant overall external context and an overview of maps in general. Subsequently, I will provide a detailed and substantive description, analysis and a set of observations about Green Map System.

The organization was founded in New York City by a group of environmentally conscious, community-oriented and highly-motivated individuals to address the need for greener, healthier cities, towns and communities both locally and worldwide. Each locally-led Green Map project has a unique way of involving people of all ages in discussing, assessing and highlighting green living resources as well as sites of natural, social and cultural value.

Involving youth, designers, social entrepreneurs, NGOs, universities, governmental and tourism agencies, these community-based Green Map projects attempt to build skills as they organize, design and promote maps as well as interactive workshops and tours in cities, towns and villages around the world.

The organization section will be structured into the following two parts:

- Description of the company from personal observations and third party research.
- Analysis of company (with research questions in mind). This section is based on the several on site and phone interviews conducted with various stakeholders at Green Map System.

5.2 Maps Overview

Maps are graphic representations of our inner and outer worlds (Lydon, 2003). Maps have been used in the exploration of spaces and places since the early days of human civilization. Early humans developed mental maps as they developed language and spatial consciousness. In both oral and written traditions they named symbols, place

names, individuals, and actions. Maps are seen as powerful navigating tools that can help guide our way in the world (Makower, 1992).

“Maps are graphic representations that facilitate a spatial understanding of things, concepts, processes or events in the human world.”

—Harley and Woodward, *The History of Cartography*, Volume 1, 1987

Recent years have brought some incredible maps, illustrating issues such as how the earth's carbon cycle works which then unveiled new understanding about how carbon emissions from one country affect other parts of the planet; or how wilderness is disappearing, which pointed out some surprising conclusions about how little space humans actually inhabit while still impacting massive amounts of the globe (Heimbuch, 2010). Maps are being increasingly used as a tool to highlight and visually represent critical issues such as the effects of climate change across the globe via geographic representations of rising sea levels, melting glaciers, draughts, etc. (Akerman et al, 2007). Having local information such as rainfall level, distribution of wildlife, or demographic data integrated within the map allows for more efficient analysis and better decision-making. As of the last quarter of the 20th century, the functionality of maps had been greatly advanced by technology simplifying the superimposition of spatially located variables onto existing geographical maps. Maps depict spatial features through the mapmaker's eyes (Short, 2003). Though they may not be purely objective representations of the space, this subjectivity enables us to mold and shape the map to suit our needs. In the last 50 years, the advent of Geographic Information Systems (GIS) has multiplied the possibilities for customizing and analyzing spatial features.

GIS is a computer system that contains location data. It is customizable in terms of data type, analysis and displays (USGS). Maps and its layers can be overlaid, projected and modeled to give a different output each time. The features can be tweaked according to their hue, shape, size, transparency, scale, etc. As such, it gives the mapmaker great autonomy in the choice of theme, area and representation. The cartographic aspect of early maps and the technical aspect of data storage are the two building blocks of GIS. The earliest use of GIS was by John Snow, a physician in London, who mapped the distribution of Cholera cases (Aberley, 1993). After analyzing the incidences and frequencies, he deduced the problem-causing water pump. Subsequently, GIS was used all over the world from the first GIS network in Canada to map the land capability, to its

use in educational institutions like Harvard whose spatial laboratory pioneered a few of the earliest GIS systems. Like many other inventions, NASA also utilized GIS. Its early forays into Landsat and Earth Observing System spacecrafts paved the way for the recording of surface data digitally.

Nowadays, GIS data is captured through high-resolution satellite images, Global Positioning System data, digital elevation models, census data, hydrologic data and other forms of collection. Given the skills needed to use GIS, the professional market is dominated by the Environmental Systems Research Institute (ESRI) with its software, ArcGIS. However, with increasing computer literacy, open-source software such as GRASS GIS, GIS has become more accessible to the masses and in doing so, encourages community mapping. Community mapping is a graphic learning, development and planning tool that connects people to one another and their home places. Community maps are the collective representations of geography and landscape, and community mapping is the process to create such representations. Going forward, a fully accessible and editable representation of sustainable green resources could likely be one of GIS's future pathways.

Based on the GIS model, an important recent player in the mapping industry is Google Maps. Google Maps (for a time named Google Local) is a basic web mapping service application and technology provided by Google that is free (for non-commercial use) and powers many map-based services, including the Google Maps website. According to one of its creators, Lars Rasmussen, Google Maps is "a way of organizing the world's information geographically." In the recent past, Google has created the Google Maps application programming interface (API) to allow developers to integrate Google Maps into their websites with their own data points as a free service. Programmers around the world have created new applications using the code behind Google's map service. They mix Google Maps' API with other data. These new sites let users specify points such as free WiFi hotspots in New York City as an example.

Thus the industry seems to have evolved from a static, two-dimensional representation of geographic areas to a dynamic, interactive and three-dimensional view, which can be used to promote sustainability and community participation. An iterative process that builds capacity and skills, it can also help give familiar places a fresh perspective and act as a guide to promote greening efforts underway in communities

around the globe. This is illustrated in a unique form of community mapping, the Green Map System as explained on the following pages.

5.3 Green Map System

5.3.1 Organizational Overview

“Green Maps give people a fresh perspective on their own community by highlighting the emerging green economy, celebrating the uniqueness of home, including its biodiversity. Each Green Map is locally created and all share a lively universal iconography so residents and visitors can discover and get involved with farmers markets, community gardens, bike lanes and much more.”

—Wendy E. Brawer, Founding Director, Green Map System

Founded in 1995 by eco-designer Wendy E. Brawer, Green Map System (GMS) Inc. is a U.S. registered 501(c)(3) not-for-profit organization. It received independent non-profit status in 2000.

Working with community leaders worldwide, GMS generates Green Maps that show points associated with sustainability in the broad categories of nature, culture and society. Each of these Green Maps attempts to identify and highlight sites such as wetlands, wildlife habitats, safe drinking water, public parks and forests, bike lanes, community gardens, community foraging sites and spaces for outdoor recreation in the local community. They also point out sites of significant social and cultural value such as museums, performance spaces, historical sites, and community centers, among others. Just as importantly, they also pinpoint areas of hazard such as landfills, brown fields and pollution.

To understand the purpose of GMS, one needs to comprehend how GMS sees the central and multifaceted role of maps in society. The organization does not view maps simply as neutral and objective information sources. Instead, GMS sees maps and mapmaking as strategic tools that have the potential to enlighten, engage and mobilize communities. To spur inclusive participation, GMS empowers communities worldwide to chart their progress toward a sustainable future. In GMS’s view, maps and mapmaking can help provide skills, resources and overall awareness of possibilities for citizens to find ways to live more sustainably in their communities, by locating and shopping at a store that sells organic products for example, or finding and eating at a restaurant that sources its kitchen with locally-grown food.

By encouraging this process on a global scale, Green Map System strives to promote a sustainable global environment, healthier climate and help individuals discover their communities from a fresh perspective, engaging with local assets and issues and supporting green jobs and a low-carbon economy. With 55 countries involved since 1995, the synergistic strategy is “Think Global, Map Local.”

It was back in 1989 that Wendy began thinking of how to address the effects of globalization. She states, “We were losing our sense of place, and along with it, a healthy environment where each individual and species could thrive with dignity and sufficiency. With the desire to design a green product in terms of the need it fulfilled, the materials used, and how it was produced and distributed. I opened my eyes and looked around my community, NYC, for inspiration.”

With delegates from the United Nations swarming into NYC for several weeks of preparation for the 1992 Rio Earth Summit, Wendy aspired to find a way to highlight the city's eco-features. Focusing on New York City's signs of progress toward sustainability, she created the very first Green Map in 1992. Named the Green Apple Map, it was designed to help tourists, relative newcomers and native New Yorkers develop a personal interest in sustainability, along with the natural sites and culturally significant places that make New York City's environment unique. Published by her eco-design company, Modern World Design, this paper-based map was created with the support of local residents, and informed by their knowledge of the city. Debuting on the first day of spring in 1992, 10,000 copies on 100% recycled paper were distributed locally.

Universally understood, resource efficient, and easy to carry or mail, the Green Apple Map gave many users an epiphany. It highlighted everyday greener ways to get around, dine, shop, learn, work and recreate. Along with sustainable living resources, the map charted biodiversity and nature, social innovations and local cultural sites that contributed to the community's sense of place. As the original first Green Map, it sparked broad attention and engagement, building networks and new relationships within the city's unique environment.

Encouraging reactions to and community acceptance of the Green Apple Map spurred development of locally-led Green Map projects around the world — today over 650 cities, towns and villages in 55 countries are involved. Responding to inquiries, Wendy began to consider how to link the locally-led projects to create a cohesive global

network. She realized that a universal iconography was a simple solution with multiple benefits, and began thinking about how to create it.

Not knowing about open source development or the Internet's potential, but in the spirit of collaboration and with a sense of urgency, Wendy brought this concept of a locally-led global network to Copenhagen, Denmark during a visit. There, she collaborated with the O2 Global Network, an informal network of sustainable designers, NGO members, academics and members of private institutions to flesh out the creation of a Green Map global network. They used the original map as a template to create a set of open-source tools and icons. This marked the start of Green Map System, and set a precedent for the international collaborative efforts, augmented by the World Wide Web, to follow.

GMS partners with the creators of every locally-led map, learning from their best practices and developing an adaptable suite of mapmaking resources to help each project determine the way forward in their own community and enable capacity building among the members of that community. With multiple aims and a diversity of needs to fulfill within each Green Map project, Green Map System strives to help each community effectively manage the full process, particularly in the areas of context setting and criteria development; research, interviews, and observation; data collection, editing, and illustration; map composition and design and finally, publication, marketing and dissemination. Many of the projects develop an ongoing program that engages different sectors in creating diverse comprehensive, thematic, tourism-oriented, neighborhood and special purpose Green Maps.

The year (1995) that GMS was created also saw the creation of GreenMap.org, the digital (web-based) platform for Green Map System. It is important to note that the rise of digital platforms permitted new forms of technological innovation to take place, in which the community leaders and citizens alike increasingly contributed to content and in which development is at times carried out by a disparate collection of individuals linked together by the Internet so that low-transaction collaboration can occur on a worldwide basis (Tapscott and Ticoll, 2003). This digital outlet dramatically expanded accessibility to the archive of locally-led projects, thereby increasing awareness and inviting even greater community participation. One of the first 18,000 domains ever registered, the organization grew steadily, and increased the number of new locally-led projects each

year. By 2000, Green Map System had a network of 100 locally-led projects, and 36 published Green Maps.

Since then, GMS has made continued efforts to recognize the digital network's potential to expand development and outreach. In an effort to leverage the emergence of Web 2.0 technologies and social networking outlets in the early twenty-first century, GMS launched its own social mapping platform, the Open Green Map, in June 2009. The Open Green Map is a digital map informed by the public audience and it enables individuals worldwide to collaborate on mapmaking in a decentralized and efficient manner. Anyone can suggest a site on the map, which uses open source content. By eliminating financial and location barriers to data sources, OGM benefits from a wider number of participants, accessing a greater degree of information and local knowledge. The most recent endeavor is the release of a series of widgets, intended to make the Green Maps and multimedia available within other websites.

As of June 2010, the Green Map movement had spread to over 670 cities, towns and villages in 55 countries. Hubs in Indonesia, Japan, China, Cuba, Europe and key Mapmakers worldwide are vital collaborators. The movement has engaged and elevated the creativity, initiative and devotion of a great diversity of youth, designers, social entrepreneurs, NGOs, universities, governmental and tourism agencies who have collectively published over 400 unique Green Maps and 125 Open Green Maps.

(See Figure 5-1 for a detailed timeline of the GMS evolution.)

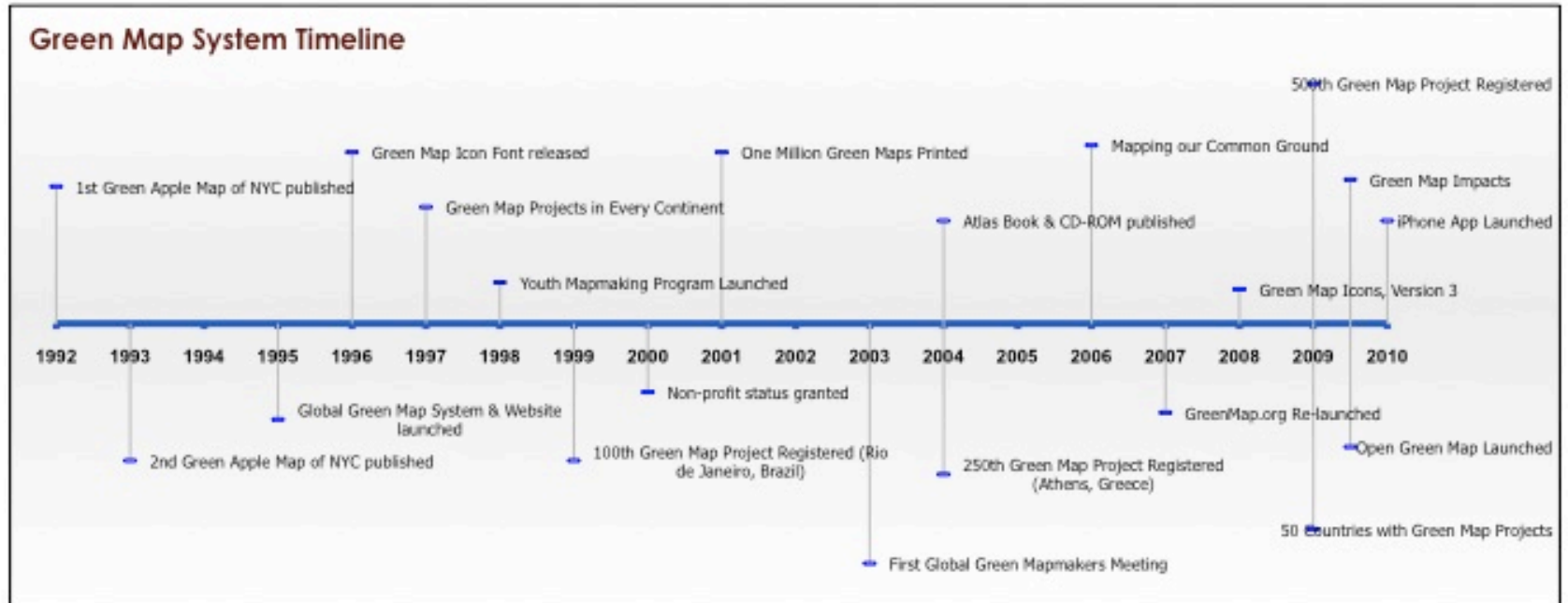


Figure 5-1: Green Map System Timeline

Each of the 500+ published Green Maps helps bridge the gap between how community members and governmental agencies perceive community well-being and take action on opportunities for social inclusion. Green Mapmaking incubates new skills in critical assessment, collaborative project management and communications for the emerging green economy. Utilizing social networking and an approach to media that is simultaneously local and global, Green Map System can alert more communities and decision-makers about the opportunities provided by Green Maps and the local impacts the organization has supported worldwide. The organization also provides tools and training for skill building and leadership through Green Mapmaking. The process of Green Mapping could be an effective educational tool where collaborative decision-making, project management, production and community organizing skills are built. Green Map's global office continues to develop a local Green Map project for New York City as well. The Green Apple Map was originally conceived to help visitors and residents connect with the emerging sustainable network in New York City. While the city housed many sustainable initiatives, there was a lack of unity amongst these various projects, resulting in inadequate communication that subsequently inhibited the development of a sustainable city. By documenting every site engaged in sustainable practice, environmental consciousness, and cultural and societal growth, the Green Apple Map was the first step in proposing a solution to these problems.

More than a dozen unique editions have since been published charting the city's energy, composting, youth perspectives, and comprehensive views. Each of these efforts tests out a new theory and results in a new model to share worldwide. Bicycle tours, exhibitions, community-engagement planning processes, train the trainer workshops and other applications piloted in New York have similarly been replicated. This continued work in the site of the original Green Map has fostered invaluable relationships with other organizations, and such locally oriented cooperation has fostered preexisting means and highlighted new ways for New York to make progress as a sustainable city.

As example, consider the “Powerful Green Map of NYC.” Published in 2006, this was Green Apple Map’s fifth edition and the 225th Green Map published by the worldwide Green Map movement. It was also the first to have energy use as its focus.

The Green Map illustrated the city's energy footprint, with icons for energy impacts, conservation projects and renewable resources.

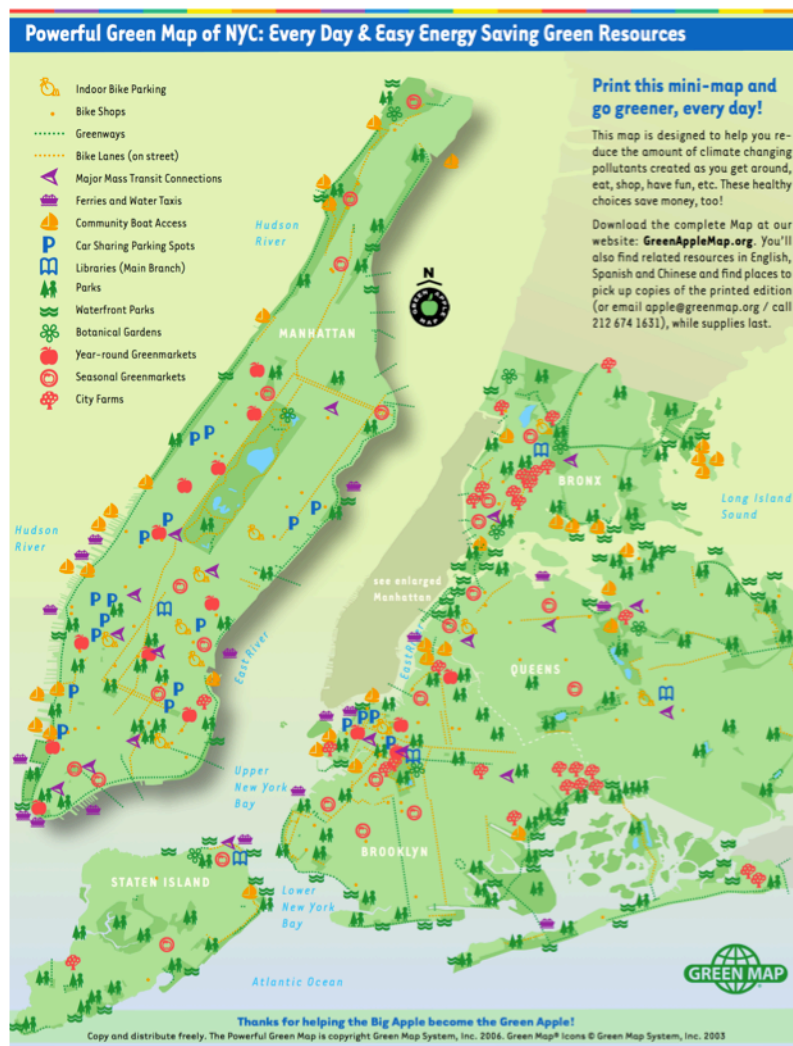


Figure 5-2: The “Powerful Green Map” of NYC (Everyday and Easy Sites)³³

5.3.2 Technologies

Green Mapmaking

The production of each Green Map employs a unique research method, reliant on place-based knowledge and community support. Informal resources are another way of expanding participation and diversity among the mapmaking community. This promotes local knowledge while illustrating the significance of place-based expertise. Each locally-led project is offered access to collaboratively developed technologies, including the

³³ Source: <http://www.greenapplemap.org/page/power>. A wide range of Green Maps can be downloaded from the Maps section of GreenMap.org

Green Map icons, online tool center, the Open Green Map social mapping platform, mobile website, and iPhone app. These local projects can opt to involve Green Map System staff or regional support hubs in strategy development or training, a launch celebration, promotion or network building event. As a model, Green Map is based off the “gift economy,” in which services are rendered without expectation for concrete reciprocation of goods. Instead, outcomes (where they be new tools, methods or text) are shared. Whether they are distributed freely or sold, a Green Map is intended to increase community participation.

In order to participate as a Green Mapmaker, interested community leaders (e.g., member of an NGO, urban planner, student, city agency, university or social entrepreneur) need to undergo an online approval and registration process. The first step in this process is for the individual to check if a Green Map project is already underway in his/her area. If it is underway, the individual is encouraged to contact the registered mapmaker and check if and how he can get involved. If there are no existing Green Map projects or if the individual's specific project scale is different, he or she can begin the registration process. After having read and accepted the Terms and Conditions, the mapmaker is routed to the first page of the registration form.

At this point, the mapmaker can preview the fee structure or read about services that can be contributed instead of a fee. The fee is based on three metrics: the type of organization, the country's average income and number of years being paid for. There is a calculator for this in the online registration form. As an example, when I input University/College, India and one year in the online calculator, the yearly fee came up to be \$128. For the mapmakers who cannot pay this fee, some of the accepted services that can be contributed, are language translation, outreach or support to other mapmakers, technical help, among others. The mapmaker can indicate the type of service that can be provided in the registration form. Please see Appendix 2.3 for a summary of the service support fees.

After clicking the "next" button on the first page, the mapmaker is automatically logged in and taken to the profile page. Once the mapmaker completes the profile and submits the completed application, GMS management will review it and the mapmaker will be contacted within two business days. Once contacted and the mapmaker pays the fee, he or she is given full access to Green Map System's collaboratively developed

toolkit of youth, community and professional mapmaking resources, the right to use copyrighted Green Map icons in their registered area, and the trademarked brand. Green Mapmakers are also entitled to join the mapmakers listserv, which enables participants to engage in ongoing support discussions and helps Green Mapmakers worldwide collaborate. Green Map System offers additional support to each locally run project by offering sample Green Maps, books and multimedia guides, training resources and technical support. This is combined with an online content managed presentation and resource center, as well as a new multilingual social mapping platform.

The globally designed Green Map icons link all of the Green Maps together and function as an inventory tool for green living sites, local natural, cultural and social resources. Provided as a font usable with any computer program, as images, or as stickers for youth projects, at present, there are 170 universally adaptable icons that form the basis for all Green Maps. The creation of the latest version (v3) of the icons has been a long and iterative process to ensure understanding and development of new local icons that will harmonize with the global set. (See Figure 5-3 for the latest GMS iconography set.)



Figure 5-3: Green Map Icons, Version 3³⁴

This set of 170 Green Map Icons debuted in February 2008. It reflects an inclusive process initiated five years ago at Italy's Bellagio Centre during the first Global Green Mapmakers Gathering, and continued in local and global settings as well as in online forums.

After registration, each mapmaker receives a welcome email with login instructions to the Tool Center. Each mapmaker gets access to this Tool Center and once logged in; she has the freedom to decide her own next steps. She can use any of the tools pertaining to

³⁴ Source: <http://www.greenmap.org/greenhouse/about/iconintro>

professional, grassroots and youth tools, Open Green Map, and more in accordance with the audience, boundaries and format of the projects they wish to develop. These Green Map projects may also adopt several different approaches to develop content. Some of the approaches that have been adopted are as follows:

- Advisory council creation
- Partnerships
- Direct surveying of community stakeholders
- Review of existing literature
- Setting of context

Open Green Maps

In the progression to a digital platform, Green Map developed a social mapping platform, the Open Green Map (OGM). This open source platform removed the technological, financial and geographic barriers to the mapmaking process and enable audience with a wide array of backgrounds to collaborate, exchange information, and further participate in the sustainable development of their community.

When OGM launched on June 5, 2009 (World Environment Day), OGM events in 13 cities in 10 countries were locally organized. As of June 2010, more than 125 Open Green Maps have been created. The U.S. has the most Open Green Maps online accounting for approximately 50% of the total.

OGM is built on open source software, the Google Map, Green Map Icons and local knowledge. OGM is designed to make the Green Map experience even user-friendlier by permitting community members around the globe to explore, customize and enhance Green Maps online. Open Green Maps incorporate public insights, images and impact assessments for each site on a map, and each can be rated, updated, translated, compared and shared. The data can be repurposed for different formats and uses.

In February 2010, with over 9000 sites on the platform, GMS launched a mobile OGM that works on any Internet-enabled mobile phone and version 1.0 of the Green Map iPhone app.

By entering GreenMap.org on any WiFi and/or 3G enabled mobile phone, users will be able to view the “Alpha” version of the mobile website and a clickable list of "What's Green Nearby"™. When clicked, the phones built-in map feature will locate and

highlight the green site's location. Anyone in the world is invited to add this functionality to his own website by incorporating the Green Map widgets. Additionally, the Green Map iPhone app adds the ability to select a Green Map icon, and then perform a proximity search of the green sites.

Openflows Community Technology Lab, which also happens to be GMS's next-door physical neighbor, has been GMS's primary technology partner since 2009. The Lab focuses on open source content management systems, such as Drupal, the platform on which OGM is built. Utilizing Drupal for its content management system, the OGM platform is based on Google Maps. GMS appreciated how this familiar base-map makes participation relatively easy and significantly increases the usefulness of a map's locally sourced data for users.

5.3.3 Projects

As of June 2010, GMS had a network of 670 locally-led projects in 55 countries worldwide. (See Appendix 2.1 for the list of Green Map projects worldwide.)

As can be seen in Table 19, the number of new projects started to grow exponentially beginning in the year 2008. GMS anticipated the surge with a new content managed registration process, presentation and tool center at their website (GreenMap.org) in 2007, and completed the third iteration of the Green Map icons update in 2008 (a five-year collaborative effort that assured the network that the visual language that connects all Green Maps and mapmakers represents updated understandings of sustainability).

Because each project is directed and staffed with local participants, it is difficult to determine precisely the total number project leaders and participants in the entire GMS network. Some have produced several editions focused on different discussions, themes or audiences and others may not have completed any. Many of these locally-led efforts involve local schools and community groups and evolved over the years, alongside the leaders' related projects.

Table 5-1: Green Map Projects

Year	# of new projects	% Increase
2009	119	35.22
2008	88	31.34
2007	67	0.046
2006	64	0.049
2005	61	0.070
2004	57	0.096
2003	52	0.333
2002	39	0.218
2001	32	0.032
2000	31	

GMS's maps vary immensely in terms of participants and purposes. Participants include NGOs, city agencies, social entrepreneurs, universities, CRS programs, local governments, community organizations, and youth groups. All hope to find practical solutions to fulfill their missions. Municipalities use Green Mapmaking to assist in land-use and environmental planning. For example, Washington DC will soon publish printed and interactive Green Maps created by the district's Environment Office. At the same time, youth mapping efforts at EL Haynes Public Charter School in the Columbia Heights and Petworth neighborhoods in Washington, DC are also getting underway.

GMS creates NYC's Green Map and works with partners throughout the city on the development of their own Green Maps or as contributors to the ones they publish. It is interesting to note that although GMS started as a local organization and then went global, it have very much kept the local component intact.

5.3.4 Green Mapping in Action

An illustrative Green Map project is the "Stop Global Warming" initiative in Thailand, which involves a partnership of Thai municipal staff and schoolchildren and started in 2005. In this project the Thailand Environment Institute (TEI) works with local agencies at the municipal level aiming to increase awareness about climate change. The project emphasizes cooperation between local governments and schools, with students representing city residents. Participants provide ideas to improve their cities, such as bike lanes, public spaces, waste banks, recycling points etc. This project encourages municipalities to work closely with schools and the community to initiate activities that

reduce energy consumption and greenhouse gas emissions (Green Map Impacts, 2009). The project employs Green Mapmaking as a situation analysis tool to identify a city's strengths, weaknesses, opportunities and threats, using GMS icons to visualize four main areas: waste minimization, sustainable transport, urban greening and energy efficiency. The process of developing a Green Map involves community and youth groups through workshops that are organized by a municipality. Teams of students, teachers and municipal staff are formed, and TEI workshops train adults and activate camp for youth. Thus far, TEI has introduced GMS to more than 60 Thai cities.

As a case in point, Tungsong, a city located in the south of Thailand, started its Green Map in 2005, charting green sites and pollution sites throughout the city. People of all ages participated. A year later, Tungsong developed the second version of the map using an aerial map as a base map, which shows all the physical characteristics of the city such as parks, roads and waterways, etc. Through the Green Map, environmental issues were prioritized and local action plans were developed to address traffic, solid waste management, increasing green area, flood prevention and urban planning.

Trang Municipality, a tourist town on the Andaman Sea, used Green Map to promote “green restaurants” that avoid using non-degradable materials such as Styrofoam and plastics. It is hoped that more restaurants will join the initiative to reduce the waste going to landfill. Using Green Map as a tool has helped local governments, NGOs, communities, and youth find realistic solutions, which often involve field research and input from the community. Municipalities can use Green Mapmaking to assist in their land-use planning and environmental local action plan to make their city a more sustainable place to live.

Another example of Green Mapping in action is in Indonesia, which has a very decentralized network of Green Map projects. A good example of this is the mapping of important cultural sites such as Borobudur, which is a world heritage site, built in the 8th and 9th centuries and is the largest Buddhist temple in the world. Green Map Mandala Borobudur aims to explore the relationship between the temple and the living environment surrounding it, contribute a record of the area's natural and cultural diversity, and inspire more curiosity and reverence.

Begun in mid-2005, residents of Borobudur helped determine the most important sites to chart, with their stories serving as site descriptions. Led by Jakarta and

Yogyakarta's Green Mapmakers, the ongoing participatory process is supported by the Center of Heritage Conservation, Department of Architecture and Planning, Faculty of Engineering Gadjah Mada University Yogyakarta and Borobudur Tourism Network. The Borobudur Green Map has generated important discussions about the future of the unique environment and communities around the temple. With participants' support, the Union of Indonesian Buddhist Students have demanded that the local government and investors stop exploiting the Temple with profit-oriented activities, and to protect this religious and cultural site. When completed, the Borobudur Green Map aims to introduce and offer alternative tourism options in villages around the temple, which will, in turn, increase the economic growth in the surrounding communities as well.

5.3.5 Market Potential

“Not only is Green Map System an exercise in education but it is also a tool for social change.”

—Karen Overton, New York City Partnerships for Parks (Client of GMS)

The target audiences for GMS are:

- The local residents in communities around the globe where they are creating the maps;
- Tourists;
- Newcomers;
- Researchers who are constantly exploring the community;
- Journalists;
- Decision makers;
- Community developers;
- Policy makers; and
- Students of all kinds.

Another audience are sites depicted on the map. These locations get instant visibility and good promotion. GMS also considers the mapmakers themselves as an important stakeholder and are focusing on these groups to get the funding, credibility and skill sets they need.

5.3.6 Competition

There are a number of organizations that have similar services/products as GMS. There

appear to be at least four direct competitors to GMS. These competitors are listed in the Table 5-2.

Table 5-2: Key Competitors

Organization Name	Location	Purpose
GenGreen Digital Media	Ft. Collins, CO	It is a network of hyper local web sites offering communities a powerful new grassroots resource to share information and help build their local green economies. The iPhone app, Find Green (formerly 3rd Whale Mobile) is a location based service which identifies green and sustainable locations and is leading provider of mobile solutions in the Lifestyles of Health and Sustainability (LOHAS) space.
Communitywalk.com	San Francisco, CA	It is a website that is dedicated to providing a powerful yet simple and easy to use interface for creating informational, interactive, and engaging maps.
Habitat map	Brooklyn, NY	To maximize the impact of community voices on city planning and strengthen ties between organizations and activists working to build greener, greater cities with the help of their online mapping and social networking platform.
Sundance Channel's "ecommunity map"	Bethpage, New York	It's a search tool for all things green. Using the tool one can search for eco-minded people, green business and events on the map. One can also list favorite local green shops, markets or attractions and post stories related to sustainability.

The key features that differentiate GMS from its competitors are:

- A design that invites broad public participation;
- Locally-sourced data contributed by experienced Green Mapmakers, based in communities around the world;
- GMS's network contributed knowledge and involvement to development of the organizations and its tools;
- An emphasis on collaborative development;
- Reliance on a unique iconography, which helps users regardless of linguistic backgrounds and supports technology transfer; and
- A globally recognized and respected brand.

According to Wendy, for a sustainable future, many more organizations need to be involved in offering such services. She notes that instead of looking at it strictly as competition, it would be more beneficial to partner with these other organizations in a collaborative agreement and understanding.

5.3.7 Organization

“We have thrived by developing a bootstrap, scrappy approach that made good use of donated time, pro-bono help and a reciprocal attitude. What we have given back to people in terms of guides, promotion, mentoring and inspiration has worked in hundreds of diverse communities.”

Wendy Brawer, Founding Director, Green Map System

The New York global office is run by people from diverse nationalities and backgrounds, supported by interns and volunteers, board of directors and the international mapmaker advisory council, supplemented by virtual staff, pro-bono supporters and consultants (see Appendix 2.2 for details on the management team and staff).

5.3.8 Financial Projections

GMS’s budget for 2010 was approximately \$277,000, including projected new grant income. Approximately 15% of the budget was estimated to be from mapmaker fees and 15% from individual donors. (See Appendix 2.3 where the company financial projections for 2010 are presented.) (See Appendix 2.4 for a list of grants achieved.)

GMS has intentions to share data for non-commercial purposes and simultaneously to develop a revenue model that helps to sustain its nonprofit as well as local mapmakers' ongoing efforts. GMS is in the process of looking for additional funds to develop the latest social networking functions and features, multimedia and press resources needed to spark and extend worldwide participation. Increased funding will also enable GMS to reach out to and include more youth and Green Mapmakers who cannot afford its modest scalable mapmakers fee.

The organization is seeking sponsorships from companies with good track records meeting their sustainability and social responsibility goals, and working strategically to increase support. In short, for its revenue model, the company is considering a mix of sponsorships, OGM data-sharing agreements for commercial usage (with nonprofit sharing at no cost), platform customizations and fees for company social responsibility programs that utilize Green Mapmaking to transparently provide insight into improvements being made both in-house and around the community.

5.3.9 Measures of Success

“We have always believed in boot-strapping and I believe that if we were fully funded with everybody getting real salaries, benefits and pensions and things like that and got used to it, we would probably not be here today.”

—Wendy Brawer, Founding Director, Green Map System

Mapping a wide breadth of sustainability relies on informal sources, local knowledge, and personal experience. Accordingly, it follows that the methods for measuring success will take a similar form. With a wide world of media formats that can display GMS's data in different ways to meet different audience needs, data sharing could also become a key indicator of success. The extent to which the Green Maps are being accessed and utilized by the public can be concretely measured through website traffic monitoring, fans and followers on social networking outlets such as Facebook and Twitter, and the dissemination of map information via widgets and other sharing resources. Another metric by which to measure success will include consideration of accolades, press coverage, honors received by Green Map System and locally-led Green Map projects. (See Appendix 2.5 for a record of media coverage.)

The organization, its boards and network incorporate a method of continuous assessment of progress, participation, presentations, metrics and revenue model institution. With its new online service section, Green Map also aims to encourage using its portfolio of resources and skills, all of which tend to promote healthy ecosystems, enterprises and education, to enhance public understanding and opinion and to heighten impact. Reaching and engaging new sectors across the world, and transferring tools and replicable models, socially beneficial technology, experiential learning and ecological literacy are possible outcomes.

An additional method for measuring success considers temporality. Green Maps have been continually published since 1995. By observing the participating communities at periodic intervals, the level of impact each mapping project has had can be measured and evaluated to determine success. Such measurements might consist of analyzing the number of new businesses and non-profits created, changes in city infrastructure, acres of land preserved and other trends. The following are a few illustrative examples of Green Maps directly affecting the ecosystem of local communities worldwide:

- *Yarmouth, Nova Scotia* The Yarmouth Green Map serves as an archetypal example of young stakeholders and important steps in the map-making process. The Yarmouth Green Map focuses on natural areas and spaces suitable for recreation. Data was collected using volunteered services from local students, who participated in fieldwork. The Yarmouth Green Map was instrumental in raising awareness of the area's recreational importance, which subsequently led to the preservation of Yarmouth's Broad Brook riparian zone.
- *Kyoto Bicycle Route Map* In 2001, Green Map System directed the bicycle initiatives and eco-transportation of the Kyoto City Environmental Policy Department's "Miyako Agenda 21 Forum." The organization published the pocket-sized Kyoto Bicycle Route Map in the same year. This Map suggested four cycling courses and hotels that support biking. The results of the released Bicycle Route Map were the Velo Taxi and one coin bus service launch in Kyoto's central area. Moreover, KCTP, a rental bikes delivering service, started as a result of this map's influence and received the annual grand prize of Kyoto venture business in 2002. Finally, the publication of the bicycle route map helped to prompt the creation of Kyoto's light rail transit, which was implemented in 2005.
- *Green Map Cuba Network* In 2000, the Green Map Cuba (Mapa Verde Cuba) national network took shape right after Mapa Verde Cuba was initiated in the cities of Holguin and Havana by city environmental educators in 1999. It has helped create exchanges, provide different videos, as well as manuals, training and document experiences from all islands that belong to Cuba. The Mapa Verde Cuba national network's primary functions are to hold workshops and link mapmakers, students, and community leaders from different places in Cuba. All projects were based at elementary and secondary schools, universities, neighborhood and popular councils, community revitalization workshops, elder's groups or ecology centers, and each mapmaking team has its own coordinating group and its own unique strategy. The mapping process implants a cultural diversity and, for that reason, utilizes approaches like poetry, music, theater and dance. Green Map Cuba established events like Project Muraleando Elder's Map, the Cultural Personalities Map, Biodiversity Maps, and a map dealing with

disabled access. The results of this strategy yielded a countrywide network in Cuba. Professional studies have included gathered knowledge by Green Map Cuba, the results of which were used by local politicians. Furthermore, the network is responsible for partnerships between universities and schools with the community, as well as fostering broader intergenerational learning activities. The network has achieved reforestation, playground reconstruction, improvements on public parks and other spaces, restoration of cultural places, and creation of spaces for cultural performances. Green Map Cuba has introduced effective tools for the elimination of waste dumps, and additionally creates pocket-sized maps for senior citizens and has helped with the construction of community gardens that grow medicinal plants.

- *Wujiang China* Power supply manufacturer Delta Electronics at their Wujiang plant undertook Green Mapmaking as a corporate social responsibility project, resulting in significant savings of CO₂, water, waste and money. Guided by a network of Green Mapmakers based at Taipei's Society of Wilderness and the company's foundation, employees at Delta Electronics developed a mapping process that found more sustainable ways to run their factories and then documented the results. According to Bruce Cheng, the Chairman of Delta Electronics in Taiwan, "...our colleagues enjoyed a collective creative experience completely different from their everyday work. At the same time, through on-site inspections of each factory, they were able to fully explore their work environment and discover green areas they had never noticed before..." (Delta Electronics – World Wide Measurable Impacts, 2010). This program spread to all of Delta's global factories and corporate campuses. They have even created an animated *e-learning tool* that extends the principles of environmental care and sustainability discovered in the workplace to the home and communities of Delta's 50,000 staff members (Company Green Maps, 2010). Energy and other efficiencies, cultural change, and stronger links to the surrounding community are among the notable outcomes of Green Map System's CSR program.

5.4 Observations

5.4.1 Company Evolution

“It is a movement that has created a life beyond the founder’s own temporal existence.”

—Joshua Arnow, Board Member, Green Map System

During the latter half of the 1990s, “greenwashing” was becoming increasingly popular. During this period, GMS began to acquire an increasing number of projects around the globe. At that time, a management decision was made to separate profit motive on the basis that becoming a not-for-profit would potentially increase credibility and procure widespread community acceptance. The organization and network served as a fertile meeting ground for community members to discuss problems and brainstorm solutions.

Although only about 20% of the company’s money and other resources are for traditional business practices, GMS’s growth has been fueled by the incredible creativity and innovativeness of the people involved. Over time, GMS has embraced and adopted new technologies and business approaches. As of January 2010, the company had more staff that was technologically skilled and social media savvy than ever before. In addition to electronic newsletters and emails detailing recent news and soliciting donation, GMS has an increasing presence on social media outlets such as YouTube and Twitter and Facebook with a Fan page (1,702 fans as of June 4, 2010). Also, OGM technologies are pushing the envelope of technological innovation and attracting increasing numbers of people. As already mentioned, GMS has begun building mobile applications for smart phones, such as the hugely popular iPhone, and over 5000 people had downloaded it in the first 2 weeks after promotion began.

“The new web-based and mobile services are helping us reach more diverse audiences and is in effect strengthening our overall network.”

—Carols Martinez, Director of Programs and Latin American Liaison, Green Map System

GMS has been allocating increased resources and time for activities such as grant writing, competitions and conferences. As illustrative examples, GMS pitched at the 2008 Where 2.0 conference, and OGM has been recognized by seven competitions, including the Index Prize and We Media. Such efforts, in turn, help GMS attract greater attention.

From an economic and community development perspective, GMS has helped develop “green jobs,” for the people making green maps and for the people working at the green companies featured on the maps. This has led to the creation of additional business opportunities in avenues such as green consulting, communications, civic and educational work. There is also a corporate social responsibility Green Map program that has helped reduce impacts and change company culture in Asia.

Striking a proper balance between tools and participation, OGM has helped the company reach and motivate 33% more new communities (based on the rate of new Green Map project registrations). GMS is also successful at working across sectors, age and cultural barriers to find common ground, and involve local government, educators, community leaders and a diverse mix of participants to optimize outcomes. Beyond the maps, it is envisioned that OGM's resources will help spur social and eco-entrepreneurship, expertise and community building in many local communities.

5.4.2 The Future: Dual Motivations and Objectives; and the Challenges of Growth

“I'm interested in social and environmental projects and GMS has been complementing local leaders and their projects. The feeling and satisfaction to be helping others was the other motivation.”

—Carols Martinez, Latin American Liaison and Office Manager, Green Map System

Regional Green Map hub leaders help moderate and monitor the OGM and train local mapmakers on how Green Mapmaking works, how to use its team management tools as well as the adaptable youth, community and locally designed map tools. GMS understands the need to have a steady income stream and a robust leadership network. The organization has also been considering potential partnerships with a carefully considered university or large NGO.

An important growth strategy the organization has determined is to create a process that includes all stakeholders — from C-level executives to students — to collaborate during the development of a new map. The organization also plans to use OGM data for sustainable development research activities and as a robust resource for entrepreneurs.

“The organization's evolution has been from a very community driven enterprise to a technology driven enterprise.”

—Dr. Robert W. Zuber, Organizational Consultant, Green Map System

In terms of HR strategy, the company has evolved from an ad hoc network to a structure that includes a board of directors, a finance committee, a technology group, and a group of international advisors. Development of the OGM platform includes core technology partners from Colombia, the United Kingdom, United States, Japan, Romania, Finland, Israel, Indonesia, Sweden and China, numerous NGO partners, designers and others. GMS also aims to add a publicist (volunteer or intern) in the immediate future to extend its outreach across the United States.

The company also has five non-technical staff working on OGM's design, management, communications, development, strategy, outreach, assessment, and implementation. One the key goals going forward for GMS is to work in collaboration with mapmakers and diverse user groups, including schools, religious congregations, environmental groups, and others, to share the maps and encourage more public interaction, and brainstorm ways on how best to invite contributions to, expand usage of, and innovate with the OGM social mapping platform in online, offline and mobile formats.

Sparkling social entrepreneurs with diverse aims, GMS intends to draw out more of the successful local approaches with an ongoing Green Map project and apply them to the organization's revenue model as well as its adaptable mapmaking tools. In 2010, GMS expected to earn income from advertisements on its mobile OGM and iPhone app. In addition, GMS expects to be generating income from sponsorship and “premium user” fee options, which the organization aims to incorporate soon on the OGM platform. As a possible growth strategy, GMS has created a services component and is in the process of offering consulting services to companies, schools, and universities, among other institutions.

Additionally, the company plans to add interfaces in multiple languages. The system already supports French, German, Spanish, Portuguese, Dutch, Swedish, Japanese, Indonesian and Chinese. More language interfaces are in the works.

The organization aspires to incorporate new technologies and techniques on a continual basis in its effort to support communities worldwide. Although Wendy approaches her organization's activities from both a socially oriented as well as a business approach, GMS overall is still appears primarily social-impact oriented in its goals.

“In effect, the business is not to maximize the end margin but to create an environment by which you become business savvy which will in turn help our social cause. We leverage every opportunity to not only help our opportunity but also to help global mapping.”

—Wendy Brawer, Founding Director, Green Map System

The organization has become increasingly global, has embraced new technologies and has incorporated new business approaches. As GMS expands further into business-focused activities, Wendy has several fundamental and critical issues to deal with. For example, how can GMS maintain the community-oriented sense and grassroots image while making the necessary technological and business changes for growth in the future. Wendy and her team realizes that it will be critical for GMS to succeed as a business while not losing sight of their overarching social goals.

Chapter 6. Comparative Discussion of the Two Organizations

6.1 Overview of Comparative Discussion

In this chapter, I will offer a comparative discussion, with the overall research focus in mind, on Verdant Power and Green Map System, the two representative clean technology organizations chosen for the purpose of this dissertation according to the criteria that was outlined in Chapter 3. After completing this comparative discussion, I will attempt to put in context the “movement” of the two organizations, based on the identified critical dimensions of diversity in contemporary entrepreneurship in the clean technology sector.

Based on my research, I concluded that a comparative discussion requires viewing these two companies using varied perspectives. My research approach is also necessarily an iterative one. It involved first familiarizing myself with the information I received in a continuous fashion (this information came in the form of interviews, documentary evidence and observation notes in both formal and informal contexts). In addition, as I attempted to develop frameworks and perspectives in order to categorize this information, I consulted relevant literature according to the categories that I was creating in order to discern the critical general dimensions that helped explain the phenomenon that I was studying.

Finally, I developed and settled on the final set of nine dimensions based on analyzing information received, my coding of the interview transcripts, my observation notes of the two organizations, and consulting relevant academic literature. Given this iterative process of conceptualization, as well as reviewing both data and relevant theory, discussing my data and ideas with advisors and experts, I developed my critical dimensions (listed below) and placed the two organizations on spectra for each of these dimensions. I am also providing in rather extensive endnotes a discussion of additional literature that I consulted in developing each of these dimensions.

The nine critical dimensions that I developed and found most useful are as follows:

- Motivations and Goals
- Decision-making Approaches
- Characteristics of the Founding Entrepreneur(s)

- Technology Regimes and Development
- Structure of Organization
- Capitalization and Proposed Business Models
- Project Management Approaches
- Strategic Orientation
- Impact of Regulation and Public Policy

Please note that I realize that other researchers have also written about similar dimensionsⁱⁱ and that it is certainly possible to provide an even deeper discussion of the literature associated with each of the dimensions. However, as a matter of style, I wanted this chapter to be an elucidation and an analysis of the two case studies by presenting them within the context of each of the critical dimensions and not to have the reader become distracted with a general theoretical discussion (hence my decision also to use rather extensive literature and theoretical endnotes for the support of the dimensions used). Moreover, although there may conceivably be additional or different perspectives that are useful for understanding entrepreneurial companies in the clean technology sector, I believe that the dimensions are valid and seem to be supported by relevant literature and ideas, which are discussed in each of the relevant endnotes.

I will present the critical dimensions that emerged from my research within a framework that represents contemporary entrepreneurship, as shown in Figure 6-1.

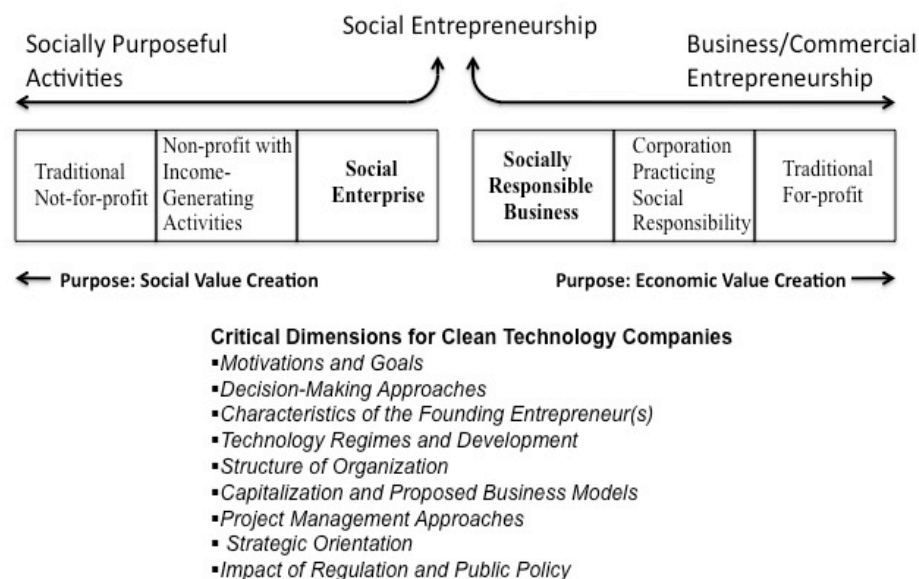


Figure 6-1: Overarching Representation of Contemporary Entrepreneurship

6.2 Comparative Discussion

Based on the above-identified dimensions, I will now offer a comparative discussion of Verdant Power and Green Map System. To do so, I will discuss the identified dimensions separately and explain how these two organizations can be located within each dimension and in how each organization will evolve (“move”) according to each dimension.

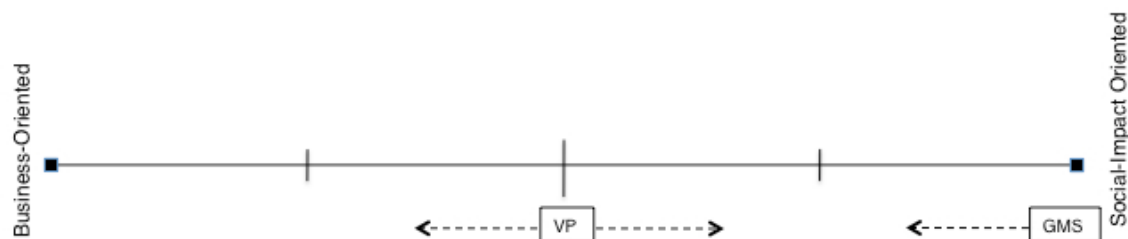
1. Motivations and Goalsⁱⁱⁱ

It can be observed that VP’s major goals are primarily business-oriented. The firm aims to generate wealth for its founders and investors. At the same time, it is apparent that VP’s top management concurred on forming a company in the marine renewable energy space with socially inspired goals in mind. In fact, VP’s founders might not have even established the company had they not have been excited by the potential to provide clean, renewable energy at its source through underwater turbines to populations worldwide. The management sees the company as more than simply a vehicle for wealth creation, and wanted through VP’s technology and projects to eventually help build sustainable communities across the world. In order to achieve this vision, and unlike conventional deep sea ocean energy developers, VP is focusing on designing systems and deploying them in developing world sites directly in dense population centers which cater to the immediate electricity needs of mass audiences worldwide. Unlike its competitors, the company has focused its design on simplicity and scalability, which opens opportunities to a broad range of potential sites and partners in both developed and developing countries. Thus while wealth generation is an important priority, “doing good” is also strongly embedded in the culture of the organization. The force of the latter for maintaining commitment cannot be discounted and is in fact a critical driving force for the individuals involved with the company.

For GMS, almost the inverse exists. GMS’s primary purpose is specifically social goals. GMS founder Wendy Brawer states this explicitly. The company management is associated with GMS first and foremost because of the potential for Green Maps to encourage local community development and the creation of more environmentally educated and sustainable communities around the globe. That being said, it is interesting to note that over time, GMS has embraced and adopted new technological innovations in a desire to be a “better business” oriented company. Wendy realizes that there is a need

for implementing improved business practices at GMS. New systems and more effective fund raising approaches have been introduced. Wendy herself recently entered an executive education program (the Cleantech Exec's program offering at NYU-Poly) to improve her professional skills. The ultimate goal for GMS is to inform and enable communities worldwide about sustainable areas and practices in their region and, in effect change the way people perceive their environment and their manner of performing routine activities.

Motivations and Goals



As represented in the spectrum above, although VP was founded with a mix of business and socially oriented goals, over time, these dimensions seem to have shifted. The motivations of VP's founders and employees seem to have become even more socially oriented as they see the technology as a way to change the world, uplift people, and create sustainable communities worldwide. On the other hand, VP management and its board of directors seem to understand that in order to achieve their social goals, the company must first successfully demonstrate and commercialize the technology within the United States. In this respect, VP seems to have become even more business focused and explicit in their immediate goals in terms of strategy for revenue generation and growth than when they were formed.

In the case of GMS, the motivations and goals of the founder and the stakeholders in the company seem to be slowly shifting from a very socially oriented outlook to a more business and technologically focused approach and goals.

2. *Decision-Making Approaches*^{iv}

In the case of VP, the company operates like a site and project developer. Constrained by resources, its structure is quite defined and rather centralized. The company's procedures for making decisions, especially with regard to the technology development are rational,

increasingly well-defined and laid out. The main skills needed include careful and detailed project management, engineering and technology project development.

GMS, on the other hand, represents a more fluid and decentralized enterprise. The decision making process is rather non-rational and organic. Local community leaders worldwide are empowered with the right to make individual decisions in the best interest of the community being served. Membership changes and indeed, GMS at any point in time is not even certain as to the precise number and types of activities on its system. Growth can occur rapidly and change can take place fast as well due to the hyper-distributed and decentralized nature of the decision-making. At the same time, as the organization has become increasingly global, has embraced new technologies and has incorporated new business approaches they are now facing the challenge of being accountable for all decisions made and keeping tighter control on the type and number activities being performed worldwide. In order to so, GMS has been increasingly paying attention to and adopting professional best practices in an effort to create better defined procedures and decision-making policies especially with regard to the technological development of the organization.

Decision-Making Approaches



As can be seen in the spectrum above, VP seems to have shifted to become even better defined, explicit and rational in terms of its decision-making than before. This could be a result of the urgency for the company to be focused on raising capital and support for its goal of licensing and building-out the RITE Project in the East River of New York City.

GMS seems to be in the process of evolving from an organization that was very much driven by non-rational factors such as intuition, personal judgments and emotions to a more rational decision making organization focused on advancing the core mission

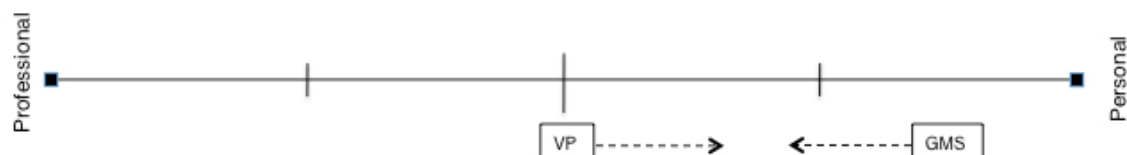
and at the same time keeping a tighter control and track of the number and type of activities performed worldwide.

3. Characteristics of the Founding Entrepreneur(s)^v

From the case study we see that the founding entrepreneurs of VP appear to be socially motivated and driven and at the same time extremely professional in their approach. Aside from the fact that they are funded by NYSERDA and there are advantages to working in New York City, the founders seem determined to commercialize their first project in the United States rather than elsewhere although locations outside the United States appear a lot friendlier and progressive in terms of regulations and policies. The founders seem to be placing the company and its vision of providing clean renewable energy to communities worldwide ahead of the trials and tribulations they are currently facing. They are not looking at generating vast amounts of wealth for themselves but instead are focused on growing the company in pursuit of their goal of building sustainable cities worldwide and spreading clean technology practices. The entrepreneurs seem to be driven to be successful in their vision while adhering strictly to their inherent values, beliefs and ethics about sustainability in general.

The founder of GMS set up her organization as a non-profit in order to separate the profit motive and procure community acceptance. The entrepreneurs involved seemed to have a high degree of personal commitment and tenacity with a high tolerance for risk and experimentation. They relied on a bootstrapped and flexible (sometimes even scrappy) approach that made good use of donated time and pro-bono help. As the organization has evolved, the founder does seem to have become more technologically savvy, business-oriented and professional in terms of management style and approach.

Characteristics of the Founding Entrepreneur(s)



In the case of VP, the founders seem to have chosen the marine renewable energy space due to their dual business and social aspirations. Over time, the company management

seems to have become even more personal in sticking to its core values and beliefs about how and where VP should first be in operation. The determination, persistence and to some extent adamancy of the entrepreneurs involved is evident since they would rather wait and continue to fight the U.S. regulatory system and environmental policy rather than take their technology elsewhere. This could be a key deciding factor on the eventual success of the entrepreneurial initiative since countries such as the United Kingdom and Canada seem to have in place much more favorable policies which would welcome VP's technology and aspirations. However, the background, affiliation and loyalty that Ron (a former carrier pilot for the US Navy), Trey and the other VP entrepreneurs have towards the United States seem to be driving them to continue to aspire and stake the claim for the need of a more progressive national regulatory policy. They would rather build out and license their first project in New York City than anyplace else since they believe that projects such as this will help NYC maintain its position as a world leader of diverse and innovative technologies. In fact, due to their unique characteristics, these entrepreneurs may be carving the formation of the entire renewable energy industry in the United States.

GMS has thus far been very closely tied to the personal tenacity and vision of its founder, Wendy Brawer. Her commitment and bootstrapped approach has kept the organization going. Over time, Wendy seems to have identified the need for GMS to adopt an increasing number of technological innovations. Accordingly, she seems to have become more professional in terms of resource allocation, management style and approach. Her personal characteristics seem to have a profound impact on the evolution of the organization.

4. Technology Regimes and Development^{vi}

I observed that VP represents an engineering based project and infrastructure development company, which deals significantly with physical/ "hard" technologies in order to build demonstration and commercial projects. The company is also beginning to take greater advantage of IT-based technological innovations such as 3D CAD/CAM systems and modeling which would represent the digital/ "soft" technology spectrum. However the company overall is still primarily "hard" technology based. The company is at a stage where it needs to be totally focused on advancing its core technology and developing a commercial project to fruition while at the same time continuing to attract

sufficient investment either through governmental or private investors. Due to the “hard” technology regime, VP’s timeframe is rather extensive, and, while the time to commercialization can possibly be shortened (e.g. via computer simulation and other digital/ “soft” technologies), reaching completion takes a long time and considerable funding.

In contrast, GMS’s core web-based technology (OGM), smart phone apps and widgets stitch together a highly digital/ “soft” technological platform. As a result, the organization eliminates financial and geographic barriers to data sources and benefits from a wider number of participants, access to a greater degree of information and local knowledge. This network allows GMS to operate in a rather informal and highly adaptive manner, where explicit rules are juxtaposed with great flexibility for meeting the diverse demands of the GMS marketplace. Due to the core “soft” technology regime, the GMS network has grown rapidly and reached a worldwide audience in a relatively short period of time. Also, this growth has occurred at a very low cost due to the cost-effectiveness of digital networks and the voluntary nature of the GMS workforce.

Technology Regimes and Development



Although VP is primarily physical/“hard” technology based, it does seem to have over time, adopted virtual tools and computer simulation programs as part of the development process as indicated in the slide rude above.

GMS has primarily focused on paper-based maps (low-technology) and the core web-based OGM, widgets and apps all of which strongly represent digital/ “soft” technology regimes. The organization is thus at the other end of the spectrum as compared to VP in terms of technology regimes and development.

5. *Structure of Organization*^{vii}

From the case study, it can be inferred that the “hard” engineering based technology of VP requires an advanced and technically skilled workforce, an explicit organizational structure and stated operating routines. The company employs a mix of emerging technology developers and utility industry veterans with advanced experience in constructing and operating electricity generation facilities, especially hydropower. The company seems to attract individuals who are fairly independent and not used to or care for the security of large corporations. The structure of VP’s organization appears to be a hybrid of flat and hierarchical management decision-making, which encourages employees to be flexible and contribute in a wide variety of areas, while at the same time maintain focus and expertise. The company plans to nearly quadruple its employee headcount during the next six years. As part of the overall recruiting strategy (and long term vision), once the technology has been commercialized, VP management hopes to staff a position titled “Chief Social Officer” whose primary responsibilities will be to address the immediate energy needs of developing countries and communities’ worldwide.

In the case of GMS, the organization is comprised of individuals from diverse nationalities and backgrounds, supported by several interns, volunteers and pro-bono supporters. The organization operates in an extremely organic fashion and at any point in time, GMS is not even certain as to the precise number of mapmakers involved worldwide. The organization is hyper-distributed and decentralized in nature. As a result, the organization seeks to mobilize talent quickly as new opportunities present themselves. As a recruiting strategy, the organization has been increasingly staffing technologically skilled and social media savvy individuals. The company seems to understand that in order to control the rapid growth, it may have to change somewhat in terms on internal organizational structure. The widespread growth may require more consistent and professional processes and structure and more specific job descriptions.

Structure of Organization



As seen above, VP seems to operate with mix of flexible but focused personnel and organization structure. This structure is indicative of the company's evolution thus far which has attracted individuals who are driven by personal vision and goals rather than by the need for security and instant wealth.

GMS has primarily grown in an organic and decentralized fashion that has catered to empower local leaders worldwide to solve sustainability related community problems. However, as the organization has evolved and the number of projects worldwide have grown almost exponentially, GMS management seems to be in the process of specifying primary job descriptions and roles to staff personnel. The organization seems to be getting more explicit in its internal organization structure and selective in terms of staff and interns hires.

6. Capitalization and Proposed Business Models^{viii}

From the case study, in the case of VP, we see that the process of resource assessment and then actually building the demonstration turbines is extremely capital intensive. VP's two main technological systems have been in development for nearly ten years, and have not yet reached commercialization. The company has been primarily funded in the form of grants and at the time of VP's investment round in August 2006, the company's valuation was \$33.8 million. VP's plan envisions 330 MW of operating projects by the end of 2016, and more than 1,000 MW by the end of 2018, all utilizing its proprietary technologies. In order to achieve these goals, the company is currently seeking \$20 million (series B funding) in additional equity capital, as well as up to \$50 million in project financing in order to take their development plans to fruition. At the same time, there seems to be an inherent tension in how an organization like VP should communicate with the investment community. Although the company has high societal aspirations, it needs to urgently commercialize its existing technology by raising money from private equity investors who view the company primarily as a business initiative that will provide them with a high return on investment. Eventually, VP's profitability will be gauged to be a function of its ability to assess, select and permit attractive projects and build them out in partnership with established project developers/owners. Working with regional strategic partners with local expertise in manufacturing, project development, construction, financing as well as permitting and licensing, Verdant Power

will be aiming to deliver and sell its projects locally in the United States as well as globally.

In order to achieve its capitalization goals, it appears that VP will have to work closely with the US DoE with support from the City and State of NY. The organization will also need to find established local partners such as Con Edison to distribute the generated electricity to the local populations. Further, VP will need to find a way to tap into existing energy grids for distribution of the power generated by its underwater turbines. Hence its business model maybe primarily focused on selling to government agencies (B2G), the government agencies will in turn provide electricity to consumers through the existing grid structure (G2C).

In the case of GMS, widespread growth can be carried out at a relatively low cost due to the cost-effectiveness of the “soft”/digital technological networks and the voluntary nature of the GMS workforce. Due to the open source nature of the technological platforms (OGM, apps and widgets) used, the organization can reach a far-reaching audience for a fraction of the cost as compared to a company like say, VP.

GMS has been primarily funded through grants and individual donors. GMS’s budget for 2010 was approximately \$277,000, including projected new grant income. In terms of raising additional financing, the organization is seeking sponsorship only from entities with good track records of meeting their sustainability and social responsibility goals. The organization aims to earn revenue through mapmaker fees, OGM data-sharing agreements, advertisements and “premium user” fees. The company has also created a services component by venturing into lucrative business avenues such as green consulting and communication services to companies worldwide. The GMS model thus seems to have evolved from a grassroots business to consumer (B2C) model wherein the organization was providing green maps to educate the public about sustainability related sites near in their neighborhood to a consumer-to-consumer (C2C) model. In this model, local leaders worldwide are empowered to take on projects that they believe will be valuable to the local community as a whole. These local leaders will then use the GMS platform to create awareness, champion their idea and be changemakers in their local community. Going further, they will recruit others from the community to also be changemakers. This multiplicative effect of local leaders is critical since they will provide a large part of the long-term grassroots leadership for their newly adopted field.

In addition, as mentioned earlier, of late GMS is also starting to adopt a business to business (B2B) model by seeking to enter into consulting agreements with companies worldwide who are seeking advice on green and sustainability practices and communications. Thus the business model itself while still primarily not for profit and volunteer based is showing signs of movement to a more business oriented for-profit model as the company continues to make technological advancements catered towards a business and technologically savvy audience. The company claims that it will allocate the revenues it will generate from its more lucrative activities to its overarching social impact causes and outreach to communities worldwide.

Capitalization and Proposed Business Models



As represented in the spectrum above, VP still remains highly capital and cost intensive with a model focused on partnering with the government and/or other public/private entities to generate substantial revenues to sustain the organization.

GMS as explained above, seems to be adopting sophisticated technologies with higher costs of development than before. This requires the organization to seek additional funds in the form of grants and sponsorship. The business model is shifting from a primarily business to consumer and a consumer to consumer model to also include a profit oriented business to business model (while continuing to maintain the not-for-profit model) as the organization seeks to increase its revenue and to balance the cost of technological advancements being proposed within the organization.

7. *Project Management Approaches*^{ix}

I have observed that VP operates like a site and project developer. Its procedures for making decisions especially with regard to the technology development, are well defined and laid out. The company's project management approaches are detailed and carefully planned. VP at any point in time possess a finite number of undertakings/projects, all of which need to be individually identified and managed by the VP staff. Thus, the market (consisting largely of projects at potential sites) is relatively constrained and defined.

Each project is backed by an extensive model detailing the returns they offer and the impact they have on VP's revenue growth. The company is hoping to partner with government agencies and various cities and states with the US to manage and deliver the projects.

As a project management tool, the company employs sophisticated planning and monitoring resources (such as the "Horizon Dashboard") to establish where the major focus for the company lies at a given point in time and to help management and staff decide on the projects that they consider worthy of pursuit by computer simulation techniques.

GMS, from my observations, can be viewed best as a hub of a large and ever-changing network of activities related to sustainability taking place around the globe. This global hub is quasi-linked together by open source digital networks. Due to the rather informal and highly adaptive nature of GMS networks, the organization is highly flexible for meeting the diverse demands of the GMS marketplace. As a result, the organization operates in a very nimble manner without explicit project management approaches. Unlike VP, GMS's market is almost boundless and ever expanding as GMS attempts to promote Green Mapmaking and associated activities around the globe. GMS largely succeeds because much of the actual work is carried out by local mapmakers and volunteers who follow procedures stipulated in the Green Mapmaking rules of GMS.

At the same time, as the number of projects worldwide continues to grow exponentially, GMS was faced with the need to develop a method to keep track of these projects, measure their impacts and be accountable for the activities carried out by local leaders. As an initial step towards attempting to fulfill this need, in 2007, GMS staff conceptualized the "Green Map Impacts" book in order to help audiences worldwide read and understand the many tangible results that can stem from the Green Map System. The book emphasized that the publication of a Green Map is not the end of the process; rather it is the starting point for a new appreciation of and engagement with community sustainability. The purpose of this book was to make the public aware of the various Green Mapping initiatives worldwide and the impacts on the local community and neighborhoods. Each story is written by local experts and provides first-hand insight into how their Green Map projects impacted biodiversity, education, community building, public planning, workplace practices and more.

As the organization continues to become more globally recognized, there may be a need for GMS to be even more explicit on their project management approaches, build online tools that will enable members to accurately enter data and create an industry standard model for measuring the impact of each and every project.

Project Management Approaches



The spectrum above depicts that the VP project management strategy has had to remain detailed and explicit. This is primarily due to the nature of the industry and the vast scale of the potential projects. GMS on the other hand, started off with very little explicit project overview and management. This may have in fact spurred the growth of the organization due to its dynamic, flexible and lack of predefined nature, which may have indeed inspired local leaders to take on projects which they think are interesting and important for the community's wellbeing.

However, as inferred to by the spectrum above, as the number of GMS projects grew, the organization felt the need to document the projects, keep track, and control the type and number of activities performed in a more detailed and explicit manner. Going forward, it is likely that GMS will continue to adopt more project management approaches to keep track of its activities and perform OGM project analytics that will be beneficial for future projects and for creating a future model for measuring impacts.

8. Strategic Orientation^x

I have observed that due to the potentially disruptive nature of the marine renewable energy industry within the renewable energy industry space and the industry's promise as a long term cost-effective solution to the world's growing demands for sustainable energy, there appears to be an urgent need among the various marine renewable energy companies to be the first to market (commercialize) their respective technologies. The primarily business oriented approach of these companies seem to be focused on capturing

the market and becoming the dominant player in the field. There is a tendency for such companies to behave autonomously as they work towards competence building.

VP claims to have five direct competitors that have also designed prototypes and are at various stages of technology development. There appears to be a race among the competitors to gather the required amounts of financial and technical support to shoulder the development costs of the technology and begin generating electricity to audiences worldwide. In such a scenario, the national governmental support, policy and the regulatory environment seem to have a profound impact on the company's path to commercialization. The primary differentiating factor of VP's technology is that it is specifically designed for shallow waters (less than 35 meters deep) and its unique design is scalable for locations around the world.

Due to strictly business approach, factors such as organizational size and growth will also play a role in deciding who will be the first to market. This could potentially create unhealthy competition and a win-lose scenario strewn with political lobbying and other activities that could take the company's focus away from their main goal advancing their technology and creating a low cost solution for the world's electricity needs.

VP also faces considerable indirect competition from "other renewable energy systems and fuel sources" such as wind and solar which are at a relatively more mature level of technological development and adoption.

As opposed to VP, which operates in an industry with intense competition that relies on significant factors that are out of their immediate control, I observed that in the case of GMS, the organization does not perceive other firms involved in the sustainable mapping practice as strictly competition. In fact, GMS views these organizations as potential partners to collaborate and work together with to ensure a sustainable future by way of competence leveraging. One of the primary reasons for this outlook could be due to the relatively less capital-intensive nature of the initiative and the reliance on core web-based technologies that eliminates the barriers of financial, geographic and political boundaries. Also, since GMS is an initiative in an already mature industry (mapping), the race to be the first to market does not exist to a degree as critical as for VP. In fact, in the case of GMS, it would be beneficial if the various sustainability mapping organizations worked together to create synergetic awareness and outreach about their respective

platforms and outlets for offering information about eco-sites and sustainable activities, and events in the community.

For such initiatives to be eventually successful, it might require a huge critical mass of users to be involved and the more collaboration, mutual help and understanding hosting organizations such as GMS and its competitors can create amongst themselves, the more powerful they will be and the easier it will be for all of them to gain broad public participation.

Strategic Orientation



As represented above, VP and GMS are at opposite ends of the spectrum when it comes to their strategic orientation.

9. Impact of Regulation and Public Policy^{xi}

In the case of VP, the strict and rigid regulatory environment in the United States has thus far been a major roadblock for the company's path to commercialization. Particularly, the controversy surrounding the effects of the underwater turbines on the river's aquatic life, specifically fish and the various regulations and agencies associated with it has been profound and it is not an exaggeration to say that they have maybe brought VP's commercialization aspirations to almost a standstill. The firm believes that the U.S. Congress and the DoE must act fast to break the regulatory policy stranglehold if there is any chance for marine renewable energy companies like VP to succeed in the U.S. Further, the company founders seem to question the very foundation of the U.S. energy industry and have been vocal in advocating the need for us to rethink all of our environmental perspectives and laws so that the currently status quo and exceedingly risk-averse regulatory policies do not continue to stifle innovation in North America.

From the case study we see that, GMS, on the other hand, due to its worldwide presence and increasingly digital based platform leveraging the Internet and social media

outlets is more or less immune to local, national and global regulations and policies. The network seeks to eliminate geographic and policy barriers and in effect democratize information related to sustainability and make it available to all communities worldwide. The organization operates in an informal and highly adaptive manner, where explicit rules and regulations are juxtaposed with great flexibility for meeting the diverse demands of audiences worldwide.

Impact of Regulation and Public Policy



As represented in the spectrum above, the local and global regulatory and policy effects impact VP and GMS very differently. They are likely to be key factors that may decide VP's eventual success or failure in the United States.

6.3 Putting it All Together

It can be observed from the case studies and from my subsequent comparative discussion that VP and GMS started out as very different organizations, almost at opposite ends of the overarching representation of contemporary entrepreneurship (See Exhibit 1). VP was founded as a purely business/commercial entrepreneurial venture and GMS was founded as a primarily socially purposeful organization and later was incorporated as a not-for-profit.

My thesis research clearly indicates that over time both of these organizations have shifted stance and while they have some contrasting approaches in dealing with the critical dimensions, they also seem to partially converge with regard to at least a few of the dimensions. Specifically, it can be inferred from the comparative discussion that the two entrepreneurial organizations have contrasting approaches in their technology regimes and development, the capitalization and proposed business models, strategic orientation and the impact of regulation and public policy. At the same time, they seem to be partially converging with regard to their motivations and goals, the decision-making processes, the personal characteristics of the founding entrepreneurs involved, project management approaches and the structure of organizations.

As can be observed in Figure 14, VP seems to have shifted positions from quadrant 1 to quadrant 3 and GMS seems to have shifted position from quadrant 4 to quadrant 2. The shaded area in Figure 6-2 depicts the territory of social entrepreneurship.

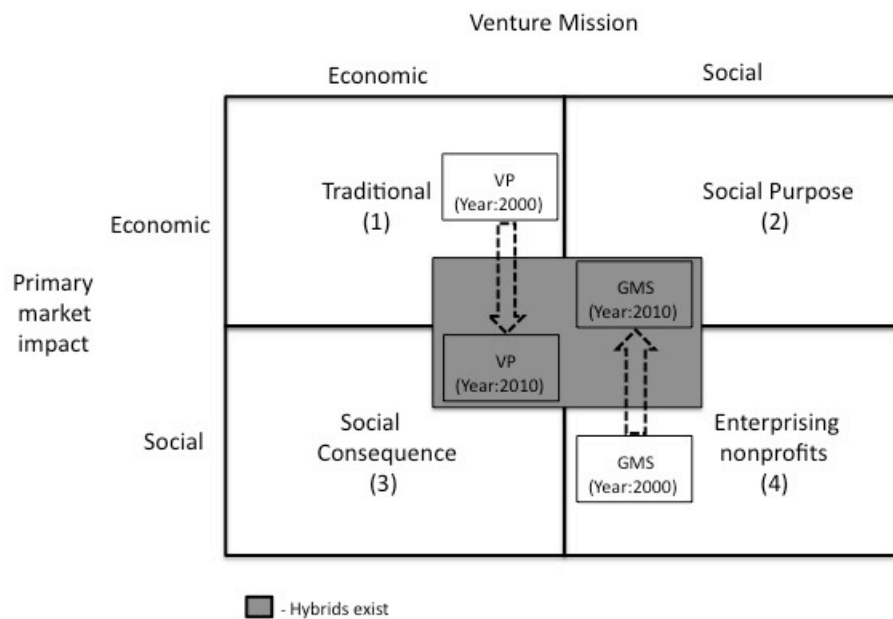


Figure 6-2: Shifting Positions of VP and GMS with Respect to the identified Typology of Ventures³⁵

On observing closer, the nine identified dimensions in the comparative discussion above can further be clustered into four main categories. These categories can be titled Management, Values, Technology and External dimensions. Specifically, I organize these categories as follows:

- **Management Dimensions**
 - Decision Making
 - Structure of Organizations
 - Capitalization and Proposed Business Models

³⁵ Adapted from Timmons and Spinelli (2009, pp. 247). "New Venture Creation: Entrepreneurship for the 21st entry"

- Project Management approaches
- Strategic Orientation

- **Values Dimensions**
 - Motivations and Goals
 - Personal Characteristics of the Founding Entrepreneur(s)

- **Technology Dimension**
 - Technology Regimes and Development

- **External Dimension**
 - Impact of Regulation and Public Policy

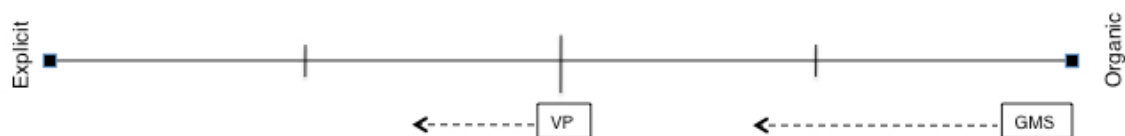
The above-mentioned categories and the shifting positions of VP and GMS along each of the identified dimensions as per the comparative discussion are represented in Figure 6-3.

Management Dimensions

Decision-Making Approaches



Structure of Organization



Capitalization and Proposed Business Models



Project Management Approaches

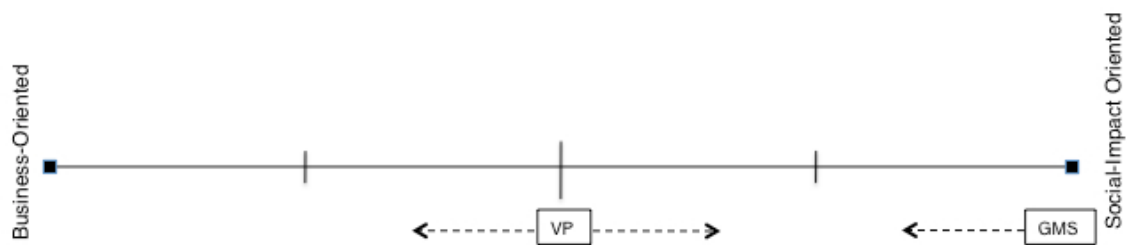


Strategic Orientation

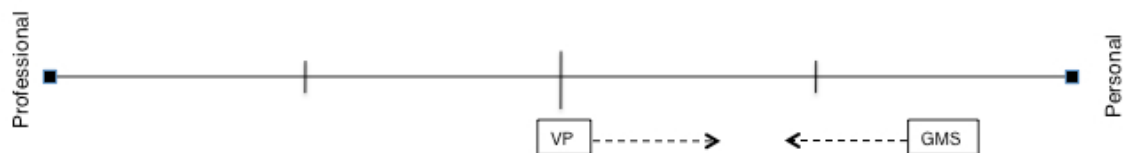


Values Dimensions

Motivations and Goals



Characteristics of the Founding Entrepreneur(s)



Technology Dimension

Technology Regimes and Development



External Dimension

Impact of Regulation and Public Policy



Figure 6-3: Representation of VP and GMS Along the Nine Identified Dimensions of Contemporary Entrepreneurship

Chapter 7: Observations, Conclusions, Contribution and Going Forward

In this chapter, I will first present some general observations and then conclusions organized generally around my nine key dimensions. I will then offer a final section that includes a discussion highlighting the potential contribution made by this study to the scholarly field and literature associated with entrepreneurship and innovation and possible research pathways to go forward.

7.1 Observations

The contrasting operations and evolution of VP and GMS indicate that clean technology entrepreneurial activities are important for sustainability overall to flourish. Without such organizations, the hard and creative work required to develop and commercialize potential renewable energy sources would move more slowly and the dissemination of important initiatives to promote clean technology would not emerge as quickly as they have. Thus, we should find ways to understand and to encourage the formation and running of clean technology entrepreneurial ventures.

As exemplified by VP and GMS, it can be observed that for entrepreneurship in the clean technology sector, there appears to be a dynamic middle ground comprising business/commercial techniques as well as not-for-profit approaches. This middle ground requires some blend of both business and social commitments. The evolution of VP and GMS indicates that entrepreneurship in the clean technology sector may be moving into this middle zone of hybrids, which, as depicted in Chapter 6, is the territory of social entrepreneurship. Organizations reaching this middle zone seek to address the inadequacies of not-for-profit activities by proactively aspiring to commercialize their products and/or services and in the process make money to cover costs and enable further growth as an organization. At the same time, they seem to be determined to take business plans one step further and actually change the way people perceive their environment and disrupt local societal patterns. In fact, the business/commercial and social outcome oriented approach may be mutually dependent on each other in the case of contemporary entrepreneurship in the clean technology sector.

In the case of GMS, although it used to be purely a not-for-profit organization, it is increasingly being transformed into some kind of “hybrid organization” by adopting business tools and practices to earn increased revenues, which can then be used to finance social causes. In the case of VP, the company was founded as a business. However, VP management increasingly views VP's products and services as more than simply vehicles for wealth creation. VP also aims to build sustainable communities across the world by designing systems that cater to the immediate electricity needs of mass audiences worldwide. Thus, there appears to be, in varying proportions, business/commercial and not-for-profit approaches at play in both of these organizations, although in GMS there is greater emphasis on the latter (not-for profit) and in VP on the former (business/commercial). But both organizations fall within the zone of hybrids that seem to characterize contemporary entrepreneurship in the clean technology sector.

In effect, social entrepreneurship could be seen at least partially as a process of solving explicit social problems with professional management and business efforts. It can also be conceptualized as a life cycle — transforming new ideas into development, development into implementation efforts, and implementation efforts into scale-up expansion activities. It can also be observed that there seems to be an increasing need for partnerships between government, private capital, social entrepreneurs and the public in order to spur innovation, diversity and responsiveness to social problems such as those prevalent in the clean technology sector.

7.2 Conclusions Based on the Key Identified Dimensions

7.2.1 Management Dimensions

- *Decision Making Approaches* Entrepreneurial ventures change. They are dynamic. In particular, as entrepreneurial ventures evolve, they often require significant scaling up and new decision making skills. This is the case in both business and social entrepreneurship. It appears that a distinction needs to be made between emotion-driven personal commitment and tenacity, and risk taking versus the same commitment employing more rational and professional management approaches. Generally speaking, entrepreneurial ventures begin with the former and, at some point migrate, at least partially, migrate to the latter as they grow bigger and become more structured. Modern entrepreneurial firms need

to be able to analyze problems systematically (with the aid of the modern arsenal of analytical tools provided by management science and operations research) and also to respond to situations rapidly, a skill that requires the cultivation of intuition and judgment. Contemporary entrepreneurial firms do not have the luxury of choosing between "analytic" and "intuitive" approaches to problems. These firms need to have a command of the whole range of management decision-making skills and applying them, as they become appropriate. Hence, I think it is useful to emphasize the need to operate effectively in the zone of hybrids.

- *Structure of Organization* Organization structure and recruiting strategies seem to vary depending on the size, scale and type of entrepreneurial initiative involved. It appears as if a hybrid structure of explicit and organic elements could work most effectively for modern entrepreneurial organizations. Such hybrids empower employees to think in creative ways and contribute voluntarily in multiple areas, while at the same time to have overall focus and commitment to the primary task at hand and to the entrepreneurial venture's long-term goals.
- *Capitalization and Proposed Business Models* The process of raising financing and the associated business models of entrepreneurial firms seem to vary vastly depending on the type, size and nature of the associated venture. Increasingly, entrepreneurial organizations seem to be focusing their business models on being able to reinvest their profits in social cause activities and/or business growth and development rather than in pure for-profit or not-for-profit activities. Thus, certain contemporary business models aim to achieve financial success while at the same time aim to create local and/or global social impact and adopt sustainable practices. This dimension has played a major part in transforming those few highly successful entrepreneurial initiatives that evolved from a minor experiment to a complex, multinational enterprise.
- *Project Management Approaches* The project management approaches of entrepreneurial firms seem to change as the companies evolve and it is a dimension which maybe a vital indication of an organization's growth. Entrepreneurial organizations with elements of both explicit and flexible project

management approaches may be best suited to create impact as they continue to evolve. Such a hybrid approach would spur growth by encouraging new projects to be developed in a dynamic fashion without in any way predefining the number and type of projects, while at the same time, maintaining control by adopting processes to manage and keep track of the projects.

- *Strategic Orientation* The threat presented by competitors and approaches to address them seem to differ markedly depending upon the type of entrepreneurial initiative involved. The strategic orientation of entrepreneurial firms can be highly dependent on the type and nature of the initiative, the specific industry sector in which the firms operate and the specific stage at which the initiative is operating relative to its competitors. In a world defined by change and given how centrally important it is for the entrepreneurial ventures to be successful, it appears as if a collaborative effort among competitors could in fact help spur the growth of the industry with more far-reaching impact rather than just individual success. This would encourage sharing of resources, ideas and brainpower while at the same time creating a stronger and more convincing advocacy for the potentially disruptive ideas that the entrepreneurial venture are trying to promote. Contemporary entrepreneurial ventures may need to think as much about cooperation as they would about competition. Accordingly, successful entrepreneurial ventures may benefit by focusing their strategy not only on competitors but also on the broader economic and social environment in which the company exists. This entails redefining success from competing effectively against a rival to adding value to an overall ecosystem. In fact, the clean technology industry may be a good example of this ecosystem concept, where an entire industry intermingles to spread sustainable practices to a worldwide audience.

7.2.2 Values Dimensions

- *Motivations and Goals* Motivations and goals in entrepreneurship are diverse and complex. They play a key role in the strategic evolution of the entrepreneurial organizations involved. While not exaggerating the shifting motivations and goals as depicted in the cases of VP and GMS as any kind of rigid convergence, it does

appear that contemporary entrepreneurship requires some blend of both kinds of commitments. As entrepreneurial organizations, the immediate business goal for both VP and GMS is to commercialize their products and/or services. However, their overall vision is to enable the creation of sustainable communities. This mix of business-oriented and social-impact oriented motivations and goals may best characterize entrepreneurial firms in the clean technology sector.

- *Characteristics of the Founding Entrepreneur(s)* This dimension seems to have a profound impact on the strategy and management practices adopted for organizational evolution. The personal characteristics of the founding entrepreneurs seem to influence the organization's culture, nature of employees involved and the path to organizational growth. It appears as if a balance of professional and personal attributes works best for entrepreneurial organizations. Such hybrid attributes enable the founding entrepreneurs to maintain a professional management style and approach while adhering to their inherent values, beliefs and ethics in general.

7.2.3 Technology Dimension

- *Technology Regimes and Development* The method by which entrepreneurial enterprises manage diverse forms of technological innovation is of paramount importance. Entrepreneurial diversity is only becoming more complex as newer technology regimes enter this arena. Technologies can differ markedly, which result in the need to create strategies and organizations that enhance the nurturing of such technologies and the enterprises they support. Some technologies are radical; others are incremental. Some are “hard” such as construction, manufacturing and infrastructure-based technologies; others are “soft” or digital-based technologies such as financial products, online auctions, games, software, social media platforms, etc. It can be inferred that generally speaking the permanence and distinctiveness of core organizations, the timeframe for development, and the cost of development are greater in the case of “hard” physical technology regimes rather than for “soft” digital technologies.

7.2.4 External Dimension

- *Impact of Regulation and Public Policy:* The national regulatory and public policies seem to have a profound effect on the evolution of entrepreneurial ventures. In fact, in some cases, this dimension may eventually decide the success or failure of these initiatives. Pure engineering and “hard” technology based entrepreneurial ventures such as VP are possibly prone to be directly influenced by the regulatory policies in the region that they are trying to operate as opposed to firms which are web and digital technology based that leverage the Internet and Web 2.0 techniques. This may in fact be a dimension that is out of the entrepreneurial organization’s immediate control but an area that the organization need to be prepared to address in a professional and sophisticated manner in order to succeed in their goals and aspirations. With the increasing focus on social innovation, there appears to be an urgent need for policymakers to create an environment that is conducive to the vision and growth of social entrepreneurial organizations such as VP and GMS. The government and regulatory agencies need to be able to tap the ability of private sector, for-profit and non-profit sectors, to deliver policies supportive to “disruptive, transformative innovation.”

7.3 Suggested Contribution and Going Forward

My thesis is a contribution to the field of entrepreneurship within the general innovation literature. As a starting point, I was able to apply and extend the concepts that I learned as part of my doctoral coursework in innovation into non-traditional sectors such as the social sector.

This thesis highlights the clean technology industry as a venue where diverse and complex forms of innovation and entrepreneurship are taking place. The thesis discovered a dynamic and hybrid middle ground of entrepreneurial activities in this sector punctuated by the nine identified dimensions. I believe that this process further helped identify the role and nature of social entrepreneurship relative to not-for-profit activities and business/commercial entrepreneurship. The thesis also provided insights about the structure, characteristics and evolution of Verdant Power and Green Map System.

I believe that the diverse constellation and evolutionary dynamics of clean technology entrepreneurship initiatives, which the thesis uncovered, needs to be

recognized, better understood and nourished in order for contemporary entrepreneurship to play fully its varied roles in launching and sustaining a robust and powerful clean technology sector.

This study encourages us to rethink the definition of social entrepreneurship. On evaluating the various definitions of social entrepreneurship, it is quite evident that there is currently considerable debate and conflict on what social entrepreneurship means. In fact, it can be stated that there is no one single, definitive view of social entrepreneurship. I believe that the most significant opportunity resides in a better understanding of the distinctive nature of the mission, processes, and resource leveraged in a social entrepreneurial context. What is also important to understand is the key differentiating factors between social entrepreneurship and traditional business/commercial entrepreneurship. The major difference between traditional entrepreneurs and social entrepreneurs is the intended mission. Traditional/commercial entrepreneurs are focused on traditional business objectives such as capturing a market, becoming a dominant player and making profits. Social entrepreneurs develop ventures with a mission to solve a pressing social problem. What distinguishes social entrepreneurs from everyone else is that they see their job as to change the overall patterns and systems of society. To this extent, unlike conventional entrepreneurs, social entrepreneurs rarely allow the external environment to determine whether or not they will launch an enterprise.

Based on my case studies, it can be stated that social entrepreneurship is about “explicitly aspiring to solve a major societal problem and, indeed, enable the creation of widespread social change.” It can also be inferred from my case study research that in some ways, an organization is not definable as a socially entrepreneurial organization until it has actually encountered the “conflict” of balancing social and commercial objectives (i.e. managing a double bottom line), which can create a series of tensions across the businesses. The “movement” of Verdant Power and Green Map System along the identified critical dimension is evidence of this phenomenon. This apparent “conflict” between social and commercial priorities is a central characteristic of social entrepreneurship. The tensions arise about the appropriate balance between serving locations and markets with varying prospects for generating earned income. The hybrid nature of the social enterprise leads to complex and difficult identity issues. It appears increasingly clear that regardless of their commitment to their social vision, only by

operating profitably can social entrepreneurs engender sustainable social change. Based on this inference, I predict that over time upstart not-for-profit social enterprises will be more focused than before on generating a sustainable income in order to feed their social vision.

The hybrid middle ground of activities, which this thesis uncovered, is evidence that scholars and practitioners of social entrepreneurship can glean valuable insights by examining lessons from conventional entrepreneurship, such as those relating to entrepreneurial success and failure. On the other hand, there is also much for business/commercial entrepreneurship researchers to learn from the social entrepreneurship context. While it is not a distinct type of entrepreneurship, researchers stand to benefit from further research on social entrepreneurship as a context in which established types of entrepreneurs operate. Further advances in this area will extend our understanding of this valuable phenomenon and facilitate the development of managerial strategies to assist those who undertake social enterprises.

Generally speaking, in the clean technology industry, social entrepreneurial activities seem to be quite prevalent due to the primarily "doing well by doing good" attitude of the individuals involved. It will be interesting and worthwhile endeavor to test this hypothesis in other industries such as finance, fashion, information technology and others.

I arrived at the nine identified dimensions on the basis of two in-depth case studies. The identified set of dimensions could well be collapsed or expanded but I consider them to be useful starting points for further research on the topic. There remains the possibility that other factors, unknown to me, might have been at play. Thus, the thesis offers a lens, a potential means to analyze reality, rather than an assertive account. Going forward, we may need to apply increasingly deeper levels of analysis to each of the identified dimension using a multi-method qualitative approach to define and demarcate the phenomenon with its antecedents and socio-economic impacts.

It can also be stated that the nine critical dimensions of contemporary entrepreneurship in the clean technology sector seem to be interdependent and integrated with each other. The *strategic orientation* of entrepreneurial organizations may be an important starting point since it potentially drives the *structure of the organization*, *decision making approaches*, *project management approaches* and the *company*

capitalization needs and business models. It is likely that the movement of Green Map System towards increased capitalization and for-profit business models could have transformed the organizations over time via a process of “professionalization.” It would be interesting to test the hypothesis whether the influence of capital venture money or grant awards is likely to have intentionally or otherwise created pressures and incentives for the entrepreneurial organizations to foster increased professional behaviors among the founders, rational decision making approaches, explicit structure of organization and explicit project management approaches. So far, scholars seem to have paid only passing attention to the causal mechanisms that account for how capitalization needs might translate into a new trajectory of movement activity.

Finally, I hope that this thesis will encourage scholars to go further in exploring entrepreneurship in a broad fashion due to its multi-dimensional and emergent nature as well potential importance for society as a whole.

Appendix 1: Verdant Power

1.1 Media Coverage³⁶

Highlights:

Verdant Power has been profiled in major news magazines such as:

1. Popular Mechanics

"Underwater wind turbines...it's an idea so simple you wish you'd patented it." (April 2007)

2. The New York Times

"The idea of generating electricity by harnessing the power of a flowing river – called hydrokinetic energy- is attracting growing attention." (August 2007)

3. Technology Review (published by MIT)

"[Tidal power] offers a big advantage over wind and other renewable: a precisely predictable source of energy." (April 2007)

4. The Economist

"A new generation of free-standing turbines will liberate hydroelectricity from its dependence on dams." (February 2008)

5. Esquire

"Verdant Power is one of 'America's Best and Brightest.'" (December 2004)

Major Newspapers, Periodicals, and Networks:

2009

BusinessWeek, "Alternative Energy's Little Green Dynamos;" by Peter Engardio and Adam Aston; July 27, 2009

PBS, "Innovate: Engineering Change;" airing nationally during month of April 2009

National Geographic Channel, "Man Made: Aqua Power;" March 26, 2009

Discovery Channel, "Earth: The Sequel;" March 11, 2009

Time, "Catching the Currents: Tidal Power," by Bryan Walsh; January 14, 2009

2008

CBS Evening News, "Wave of the Future: Electricity from Water;" December 14, 2008

The Wall Street Journal, "Everybody into the Ocean," by Isabel Ordóñez; October 6, 2008

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³⁶ based on data provided by VP Management

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1.2 Management Team and Governance³⁷

Ron Smith: Co-founder, Chairman and Chief Executive Officer, leads both management and operations. He is also responsible for Verdant Power’s internal regulatory compliance and permitting initiatives. He has led the development of successful start-ups and has held positions with Booz-Allen management consultants and Bendix Aerospace Group. He holds an MBA from Harvard Business School and an M.S. in Systems Management from USC.

William H. “Trey” Taylor: Co-founder, President and Head of Market Development, leads marketing and business development efforts. He was founder and President of the Interactive Marketing Institute and consulted with BGE (Baltimore Gas & Electric) and Price Waterhouse World Utilities Group, and has held senior marketing positions at Edison Electric Institute, ITT Corporation., British Telecom, Ogilvy & Mather, and Procter & Gamble. His graduate studies are in Urban Education at the University of Minnesota. He holds a B.S. in Political Science & History from Portland State University.

Kevin Lynch, CPA: Co-founder, Chief Financial Officer, manages finance, accounting, and purchasing activities. He also shares in direct project management oversight responsibilities. He has over 25 years of experience in financial consulting with fast-growing companies, including service on the Boards and as an officer for numerous privately held companies. He holds an M.S. in Taxation.

Frank E. Williams (Board Member): Mr. Williams is Chairman & principal owner of Williams Enterprises of Georgia, a holding company controlling six subsidiaries in the steel industry. He also serves as Chairman, Chief Executive Officer and 50 percent owner of Bosworth Steel Erectors, Inc of Dallas, TX, a major erector of steel products in the Southwest U.S.; and Managing Partner and principal owner of 13Structural Concrete Products, LLC of Richmond, VA - a manufacturer of pre-stressed concrete building systems. He previously served as Chairman of Capital Bank, N.A.

Dan Costin, Ph.D., PE: Chief Engineer, formerly with Northern Power Systems, has 20 years experience in design and analysis of mechanical systems; 19 patents awarded for rotating equipment and wind turbine design; and has extensive project and functional management experience.

Dean Corren: Director of Marine Current Technology leads the development of kinetic hydropower systems (Free Flow System). He has consulted on energy and technology and performed research on a wide range of energy technologies as a Research Scientist at New York University. He earned an M.S. degree in Energy Science from NYU, and a B.A., magna cum laude, Phi Beta Kappa, from Middlebury College

Mark J. Tinkler, PE: Project Manager and Business Development, an Ontario-based energy consultant, he provides project planning and technology coordination for Verdant Power Canada’s river Free Flow project near Cornwall, Ontario. Over a 29-year career at Ontario Power Generation, he held a number of senior positions including Manager of Distributed Generation R&D.

Jameel Ahmad, Ph.D.: Senior Advisor and Director of Channeled Water Technology, leads the development of Rapid Flow System. He is Professor and Chairman, Department of Civil

³⁷ Author generated table based on the various interviews conducted with key stakeholders at VP.

Engineering; Albert Nerken School of Engineering, The Cooper Union for the Advancement of Science and Art; and Director of Research, The Cooper Union Research Foundation, New York.

Mary Ann Adonizio, PE: Director of Resource Assessment has more than thirty years experience in power generation and transmission project engineering, development, and management for the electric utility industry and renewable energy projects. She has an extensive history in resource assessment and environmental analysis in the hydropower industry.

Terry Mactaggart: General Manager, Verdant Power-Canada, leads the Canadian development effort. He has experience with private venture creation, financing and growth as an investor, consultant, director, principal, chairman and president a number of companies - both privately owned and publicly traded - as well as of a private equity fund. He worked for the World Bank, leading or participating in projects, tours and market development in the US, Europe, Scandinavia, Africa, New Zealand and Asia. He holds a B.A. in Political Science & Economics from the University of Toronto and an MBA from Stanford University.

Michael Wellman: General Manager, Verdant Power-United Kingdom, leads the UK development effort. He has experience with financing and investment banking as an advisor and executive director in London, New York, and Tokyo. He worked for Industrial Bank of Japan / Mizuho, Oppenheimer & Co., Bear Stearns, Schroders, Bank of America International, and Citibank / Citicorp. He holds a B.S. from City College of New York and MBA studies at CUNY. Oversight is provided by a seven member board of directors, four of whom are independent of management. In addition, the Company benefits from the advice received from a number of knowledgeable advisors.

Board of Directors

Joe Klein - Founding Partner of KKS Securities LLC; previously a principal at Thomas Weisel Partners Group and worked for UBS AG; holds a BS in Electrical Engineering from Yale and an MBA from The Fuqua School of Business, Duke University.

Kevin G. Lynch

Peter Monaco - Managing Director of the Altar Rock Fund (formerly Tudor Investment Corp.)

TBD - Additional seat to be filled by second person from the Altar Rock Fund

Ronald F. Smith

Trey Taylor

Frank Williams, Jr.

1.3 Grants Milestones³⁸

Grants

Totals – 2008/09

Government Awards: \$10,528,351 Required Matching Funds: \$3,311, 648
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US Government

- | |
|---|
| <ol style="list-style-type: none"> 1. US Navy: \$2,881,826 (5/13/2008) - Navy Tidal Energy Project, Puget Sound; US Navy Contract N00024-08-R-3200-2; Task Order N00178-05-D-4568-EJG1 2. US Navy: \$1,949,467 (2/6/2009) - Navy Tidal Energy Project, Puget Sound; US Navy Contract N62473-06-D-3005; Task Order 0140 3. US Department of Energy: \$300,000 (6/19/2008) - National Renewable Energy Laboratory (NREL), Wind and Hydropower Technologies Program; "Cooperative Research and Development Agreement (CRADA) for the Research and Development of Systems and Components for Utility Scale Wind Turbines and Ocean Energy Technology - Structural and Manufacturing Improvements to Rotor Blades of Kinetic Hydropower Turbines"
Verdant Power Matching Funding: \$150,000 4. US Department of Energy: \$1,200,000 (9/15/2008) - DOE Waterpower R&D Program consisting of two awards of \$600,000 each over two years. Verdant Power Matching Funding over two years: \$1,200,000 |
|---|

New York State Government

- | |
|---|
| <ol style="list-style-type: none"> 1. New York State Energy Research & Development Authority (NYSERDA): \$498,344 (4/14/2008) "Kinetic Hydropower System (KHPS) Technology Manufacturing, Cost Reduction, Scale-Up, and Commercialization"; NYSEDA Agreement 10720
Verdant Power Matching Funding: \$671,173 2. New York State Energy Research & Development Authority (NYSERDA): \$248,714 (6/25/2008) "Roosevelt Island Tidal Energy (RITE) Project, Phase 2; Environmental Impact Studies, Part B"
Verdant Power Matching Funding: \$140,475 |
|---|

Canadian Government

<p>Sustainable Development Technology Canada (SDTC): \$1,150,000 (7/28/2008) - Canadian Federal Government Program; "Cornwall Ontario River (CORE) Project, Phase 1; Demonstration Phase"; 25% Matching for Two-Year CORE Project Verdant Power & Joint Development Partner Matching Funding: \$1,150,000</p>

Ontario Provincial Government

- | |
|---|
| <ol style="list-style-type: none"> 1. Ontario Ministry of Research and Innovation (OMRI): \$2,250,000 (4/11/2008) - Innovation Demonstration Fund (IDF); "Cornwall Ontario River Energy (CORE) Project, Phase 1; Demonstration Phase"; 50% Matching for Two-Year CORE Project 2. Ontario Power Authority (OPA): \$50,000 (4/15/2008) - Support Fund; "Cornwall Ontario River Energy (CORE) Project, Phase 1; Demonstration Phase" |
|---|

Pending Proposals

<p>US Navy: \$2.0M - Tidal Energy Project (FY 2010 DOD Budget), Year Three US DoE 2009 STTR: \$150K – Rapid Flow System, Dow Chemical, Freeport, TX Severn River Tidal Fence Study, Round 2; 140MW Project 2013-2017, 10/16/2009</p>
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³⁸ based on review of VP corporate documents

1.4 Financial Projections (2010-2016)

Income Statement (Annual)

	2010	2011	2012	2013	2014	2015	2016
Project Contributions							
Net Revenues from Projects							
Demonstration Projects	(1,080,625)	(251,520)	240,000	360,000	360,000	360,000	360,000
Licensing, Royalties, Equip Sales & Cnsltg	-	-	7,865,600	8,225,600	6,622,800	6,962,800	7,362,800
River Projects	(625,000)	645,000	1,020,000	142,108	5,996,776	4,759,477	9,537,213
Tidal Projects	(1,125,000)	(562,500)	2,040,000	402,341	5,666,364	12,589,702	30,169,338
Total Net Revenues from Projects	(2,830,625)	(169,020)	11,165,600	9,130,049	18,645,940	24,671,979	47,429,351
Overhead Expenses							
Research and Project Development							
Staffing	970,000	1,152,600	1,175,652	1,199,165	1,223,148	1,247,611	1,272,564
Travel, etc.	38,500	40,425	48,510	58,212	69,854	83,825	100,590
Computers, Software, Materials	30,600	31,212	37,454	44,945	53,934	64,721	77,665
Contingencies @ 15% of costs net of staffing	13,820	14,327	17,193	20,631	24,758	29,709	35,651
Total Research and Project Development	1,052,920	1,238,564	1,278,809	1,322,954	1,349,413	1,376,401	1,403,929
Marketing and Sales							
Staffing	476,500	567,630	578,983	641,500	654,330	667,417	680,765
Travel, etc.	33,000	34,650	41,580	49,896	59,875	71,850	86,220
Association Membership	20,400	20,808	24,970	29,964	35,956	43,147	51,777
Conferences, Trade Shows, etc.	45,900	46,818	56,182	67,418	80,902	97,082	116,498
Other	20,400	20,808	24,970	29,964	35,956	43,147	51,777
Contingencies @ 15% of costs net of staffing	22,943	24,617	29,540	35,448	42,538	51,045	61,254
Total Marketing and Sales	619,143	715,331	756,224	854,189	909,557	973,689	1,048,292
Operations							
Staffing	1,192,500	1,460,250	1,503,500	1,533,570	1,564,242	1,595,527	1,627,437
Travel, etc.	58,200	61,710	74,052	88,862	106,635	127,962	153,554
Premises	171,324	174,750	209,701	251,641	301,969	362,363	434,835
Website & Communications	71,340	72,767	87,320	104,784	125,741	150,889	181,067
Computers, Software, Supplies, Equipment Rentals	80,896	87,410	102,013	122,416	146,899	176,279	211,534
Intellectual Property Maintenance	163,200	166,464	199,757	239,708	287,650	345,180	414,216
Consultants - Regulatory, Lobbying, Compliance	247,600	510,400	612,480	734,976	881,971	1,058,365	1,270,039
Legal	124,200	143,010	171,612	205,934	247,121	296,546	355,855
Accounting	44,800	47,040	56,448	67,738	81,285	97,542	117,051
Insurance	55,000	57,750	69,300	83,160	99,792	119,750	143,700
Fees - Capital Accounts	1,200,000	-	-	-	-	-	-
Contingencies @ 15% of costs net of staffing	194,841	264,260	316,537	379,844	455,813	546,975	656,370
Total Operations	3,603,901	3,045,811	3,402,720	3,812,633	4,299,117	4,877,377	5,565,658
Total Overhead Expenses	5,275,963	4,999,707	5,437,752	5,989,777	6,558,087	7,227,468	8,017,879
EBITDA	(8,106,588)	(5,168,726)	5,727,848	3,140,273	12,087,852	17,444,511	39,411,472
Depreciation	-	-	-	-	-	-	-
Amortization	-	-	-	-	-	-	-
EBIT	(8,106,588)	(5,168,726)	5,727,848	3,140,273	12,087,852	17,444,511	39,411,472

Interest Income	-	-	-	-	-	-	-
Interest Expense	-	-	-	-	-	-	-
EBT (Earnings Before Taxes)	(8,106,588)	(5,168,726)	5,727,848	3,140,273	12,087,852	17,444,511	39,411,472
Taxes	-	-	-	-	-	-	-
Net Earnings	(8,106,588)	(5,168,726)	5,727,848	3,140,273	12,087,852	17,444,511	39,411,472

Balance Sheet (Annual)

	2010	2011	2012	2013	2014	2015	2016
ASSETS							
Current Assets							
Cash	11,051,145	5,747,062	10,775,808	14,126,531	25,475,251	42,476,065	80,078,981
A/R	367,058	270,212	917,721	750,415	1,532,543	2,027,834	3,898,303
Prepaid Expenses	-	-	-	-	-	-	-
Inventory	-	-	-	-	-	-	-
Other currents assets	446,269	446,269	446,269	446,269	446,269	446,269	446,269
Total Current Assets	11,864,472	6,463,542	12,139,798	15,323,215	27,454,063	44,950,168	84,423,553
Plant and Equipment (Net)	49,967	49,967	49,967	49,967	49,967	49,967	49,967
Other LT assets	5,116,956	5,116,956	5,116,956	5,116,956	5,116,956	5,116,956	5,116,956
Goodwill (Net)	-	-	-	-	-	-	-
Total Assets	17,031,395	11,630,465	17,306,721	20,490,138	32,620,986	50,117,091	89,590,476
LIABILITIES							
Current Liabilities							
Accounts Payable	672,613	440,410	388,818	431,962	474,957	526,552	588,465
Credit Card Accounts	32,559	32,559	32,559	32,559	32,559	32,559	32,559
Other Current Liab	896,876	896,876	896,876	896,876	896,876	896,876	896,876
Total Current Liabilities	1,602,048	1,369,845	1,318,253	1,361,397	1,404,392	1,455,987	1,517,900
LT Note	1,646,117	1,646,117	1,646,117	1,646,117	1,646,117	1,646,117	1,646,117
Dividend Payable	882,057	882,057	882,057	882,057	882,057	882,057	882,057
Total Liabilities	4,130,222	3,898,019	3,846,427	3,889,571	3,932,566	3,984,161	4,046,074
EQUITY							
Equity Capital	32,640,534	32,640,534	32,640,534	32,640,534	32,640,534	32,640,534	32,640,534
Retained Earnings	(19,739,361)	(24,908,087)	(19,180,240)	(16,039,967)	(3,952,115)	13,492,396	52,903,869
Total Equity	12,901,173	7,732,447	13,460,294	16,600,567	28,688,419	46,132,930	85,544,403
TOTAL LIABILITIES AND EQUITY	17,031,395	11,630,466	17,306,721	20,490,138	32,620,986	50,117,091	89,590,476

Cash Flow Statement (Annual)

	2010	2011	2012	2013	2014	2015	2016
Operating Activities							
Net Earnings	(8,106,588)	(5,168,726)	5,727,848	3,140,273	12,087,852	17,444,511	39,441,472
Depreciation	-	-	-	-	-	-	-
Amortization	-	-	-	-	-	-	-
Working Capital Changes							
(Increase)/Decrease Accounts Receivable	(91,750)	96,847	(647,509)	167,306	(782,128)	(495,291)	(1,870,469)
(Increase)/Decrease Inventories	-	-	-	-	-	-	-
(Increase)/Decrease Accounts Other Current Assets	-	-	-	-	-	-	-
Increase/(Decrease) Accounts Payable	(1,272,201)	(232,203)	(51,592)	43,144	42,995	51,594	61,913
Increase/(Decrease) Other Current Liabilities	-	-	-	-	-	-	-
Net Cash Provided/(Used) by Operating Activities	(9,470,539)	(5,304,082)	5,028,747	3,350,722	11,348,720	17,000,814	37,632,916
Investing Activities							
(Increase)/Decrease Plant	-	-	-	-	-	-	-
(Increase)/Decrease Equipment	-	-	-	-	-	-	-
Net Cash Used in Investing Activities	-	-	-	-	-	-	-
Finance Activities							
Increase/(Decrease) Convertible Debt	-	-	-	-	-	-	-
Increase/(Decrease) Common Stock	20,400,000	-	-	-	-	-	-
Increase/(Decrease) Preferred Stock	-	-	-	-	-	-	-
Dividends Declared	-	-	-	-	-	-	-
Net Cash Provided/(Used) by Financing	20,400,000	-	-	-	-	-	-
INCREASE/(DECREASE) IN CASH	10,929,461	(5,304,082)	5,028,747	3,350,722	11,348,720	17,000,814	37,632,916
CASH AT BEGINNING OF YEAR	121,684	11,051,145	5,747,062	10,775,808	14,126,531	25,475,251	42,476,065
CASH AT END OF YEAR	11,051,145	5,747,062	10,775,808	14,126,531	25,475,251	42,476,065	80,108,981

1.5 Complementary Revenue Streams Summary

(based on data provided by VP Management)

<p>System Installations, Sales and Leasing</p> <p>Verdant Power produces systems that generate renewable energy from tides, rivers and manmade channels. The Company expects that total project construction revenues from the installation of these systems will exceed one billion dollars US through 2016 based on the installation of systems capable of producing 330 MW.</p>
<p>Electric Power Production</p> <p>Verdant Power's technology and facilities produce renewable electricity, also known as green power. In recent years, the demand for green power has accelerated as a consequence of state and federal policies and the growth of voluntary green power purchase markets, along with the generally improving economics of renewable energy development.</p>
<p>Intellectual Property</p> <p>Verdant Power presently has 12 patents pending, six additional patent disclosures, and 12 additional patentable concepts under consideration, worldwide. These patents and other intellectual property represent a valuable resource to the Company.</p>
<p>Renewable Portfolio Standards</p> <p>Essentially, these standards require local utilities to purchase renewable energy from renewable energy producers like Verdant Power, at prices higher than they would otherwise pay, sometimes at a multiple of the wholesale market price for non-renewable energy.</p>
<p>Renewable Energy Credits</p> <p>Renewable Energy Certificates (RECs), also known as Green tags are tradable environmental commodities in the US that represent proof that 1 megawatt-hour (MWh) of electricity was generated from an eligible renewable energy resource. In states that have a REC program, a green energy provider such as Verdant Power is credited with one REC for every 1,000 kWh or 1 MWh of electricity it produces.</p>
<p>Revenue Support/Feed-in Tariffs</p> <p>A Revenue support/feed-in tariff is an incentive structure that encourages the adoption of renewable energy through government legislation.</p>
<p>Federal and State Income Tax Credits</p> <p>Federal and State income tax credits have been a significant stimulus to renewable energy investment in the US for over 30 years. State credits, although sometimes limited because of more restricted investment pools, can also provide instant refunds of up to 33% of total project capital costs.</p>
<p>Carbon Emissions Trading</p> <p>Carbon (CO₂) makes up 77% of the Green House Gasses (GHG) thought to be responsible for global climate change. Thus, carbon finance is emerging as a vast global marketplace providing incentives and mandates for pollution reduction and direct boons for new renewable energy technologies.</p>
<p>Capacity Payments/Capital Cost Buy-Downs</p> <p>Capacity payments/Capital Cost Buy-Downs are available in many jurisdictions under varying parameters, ranging up to approximately 25% or more of the initial capital costs of the installed system, depending on project size, location, and technology.</p>
<p>Subsidized R & D Support</p>

Subsidized Research and Development Support is another area of growing significance in North America. The net effect reduces technology development costs to the private sector, generally with no permanent reciprocal obligation to the funder.

1.6 Horizon-Priorities Analysis³⁹

Verdant Power Priorities, Plans and Programs

Two fundamentals to growing a successful enterprise are a well thought out strategy and an agreed upon set of priorities to execute. Focusing on “Doing a limited number of the right things” and “Doing these things right” is paramount.

Companies that enjoy consistent and profitable growth have developed the ability to allocate most resources in a given time period to critical core business initiatives while also devoting some resources to cultivating new opportunities for future growth and profitability.

This process can be thought of as managing a “pipeline” of opportunities concurrently. In order to make this executable, these opportunities can be listed under three horizons, namely:

Horizon 1 – Extending and defending the core businesses – where most resources are focused.

Horizon 2 – Building emerging businesses – where qualification, relationship building and prototyping are typically used to prove out and refine (or reject) an initiative before it is absorbed into core operations.

Horizon 3 – Creating viable options for the future – where other promising options are evaluated as possibilities for future development.

Within this framework, Verdant Power's current plan might be summarized as follows:

Horizon 1	Horizon 2	Horizon 3
<ul style="list-style-type: none"> Complete Current round financing - \$20 million equity; \$50 million project \$70 M Validate Free Flow Deployment/ Retrieval System (CORE Project - St. Lawrence River) Validate Submarine Cabling/ Anchoring System (Puget Sound) Reduce Free Flow System costs via Gen 5 demonstration Commercialize Projects RITE Project CORE Project (2011) UK Project (2012) Identify and develop strategic partnership for commercial projects Analyze and develop supply chain Further assess North American sites plus UK market, resources and sites 	<ul style="list-style-type: none"> Qualify and initiate additional US and Canadian Free Flow System Projects Establish UK corporate and project presence Commercialize Navy Project Qualify additional country markets and Free Flow System Projects (Turkey, Brazil, India, China, etc.) Establish Rapid Flow System market strategy and supply chain Establish supply chain and logistics for multiple international projects Prototype Rapid Flow System (ACE) at Dow Chemical 	<ul style="list-style-type: none"> Institutionalize project development and partnering for international commercial projects Rollout Free Flow System River and Tidal projects in selected country markets Rollout Rapid Flow System projects in selected country markets
Target Time Lines 6-24 Months	18-36 Months	24-60 Months

³⁹ Based on review of VP corporate documents.

1.7 Select Interview Transcriptions

Date of Interview: October 8, 2009

Name: Trey Taylor

Title: President & Head of Market Development

Q. What does your company do?

A. Verdant Power is a market driven company focused on the water + energy nexus is the focus. Water uses energy and energy uses water and the world is running out of both. We are all about helping build sustainable communities. The ability to look at any given community and to husband its natural resources to provide renewable energy as a cornerstone.

Q. When was it formed, how many employees, demographics etc

A. We have 20 full time staff. The main management is comprised of, Kevin for Accounting, Ron-Operations and myself- Marketing. We also have a lot of younger people. We are trying to find middle management.

Q. What are the type of products being developed?

A. The main products and technologies are:

- Technology that converts kinetic energy into electric power. Also, convert Kinetic energy into mechanical power. Reliability is key. Two systems: The East River and Lawrence River in Canada.
- Working with Dow Chemical Company in Texas for shallow, slow moving water. (most of the world's rivers)
- Clean Water Systems. Reverse Osmosis Technology. Integrated water and clean energy systems generate clean energy and potable water

In this regard, Governor Schwarzenegger in California has major three way system initiative that runs right to the center of California and he is calling it the hydrogen highway. His vision is to be able to run fuel cell cars up and down the hill from Los angles to San Francisco to Sacramento on the highway. It was not lost on me that on each side of that hydrogen highway were massive canals systems. So in the future there maybe Verdant Power fueling stations along the hydrogen highway. So all we are doing is extracting hydrogen from the water to fuel cell cars. The byproduct of that is water because goes right back into the system. Right now what the world is doing is taking hydrogen away from natural gas, which sort of defeats the purpose of fuel cells in the first place.

Q: What was the motivation to be involved with the company (Social or business)?

A: My background in college was in political science and history and it accorded to me that in order for the world to be a better place, we need to spread wealth and not have wealth concentrated. Wealth is spread through infrastructure and education. So now, if the focus of the company is to design electrical power systems, the clean water, electrolysis, all this off grid for getting centralized power and distributed generation, when it also could be for on-grid for the bigger place can be connected but the idea of having major systems which communities could put in their water ways and use is empowering because once you have a reliable source of electricity, it opens up commerce and trade to create wealth. But also due to the reliable source electricity, you can setup cell phone towers, you can setup computers in schools and use satellite accelerated internet for distance learning and telemedicine and it begins to level the playing field between communities all around the world. Also, my thought is that the best way for the world to comeback terrorism is with educated mothers.

I think about central Asian young girls and African young girls. The reason they are not in school is because they spend a lot of time during the day gathering water and firewood. If instead, our systems could help pump clean water to electrify schools then these young girls could be in schools too. This all begins with getting reliable electricity first in a source which is very close to where people are living. What I and our company is about is that we want help change the world and the way to do that is by spreading wealth through infrastructure and education to empower

people. I basically believe that people inherently want to be creative. After all we as a species procreate and I think people like building things and not destroying things. We want to provide this infrastructure to empower people and help support their own communities. Let the communities make the decision. Two books, 'How to Change the World' and 'The Wisdom of crowds'. It is the passion and the desire to empower people with electricity and clean water and the power to make decisions is what keeps me up at night.

Me: So your motivation to found Verdant Power, what I hear, wasn't just to create a water renewable technology but really help to change the world and uplift people, create sustainable communities. Your chosen channel to accomplish this task was the marine renewable technology but you always had a higher motivation.

Trey: Exactly. There is also a physiological phenomenon which will happen to you when you get older. Suddenly you come to terms of your own mortality, you realize life is short and here's the key thing, I want to pass you is listen to your instincts, trust your inner voices because they are taking you some places.

There is a wonderful psychological book called 'Necessary Losses' which says learning how to let go. I realized that it was now or never and I needed to do something which gave me a sense of fulfillment and worthwhile. Given my background in Marketing and working for major corporations and trade associations. I also did consulting work for PWC. That background gave me a perspective on electricity needs around the world and back to my marketing background helped me analyze the needs which were going unfulfilled out there. That intrigued me to look at the renewable energy sector and it struck me that no one was tapping water currents as they tap wind currents. That became the genesis of the idea to start a company around that notion. It was then a matter of finding a business team to drive the idea around that notion. We needed to find right spirited people who were willing to leave comfortable lives and take a risk.

The focus right now is on reliable electricity generation with what we call the free flow system. It looks like an underwater wind turbine and we are operating in New York. This free flow system is the first product we are aiming to commercialize.

Q: You started in 2000, where is the company now? Did it transition from social to business or vice versa as the product or company developed over time?

A : We began with the developing technology and by funding, building and testing for different types of concepts. We built four different working prototypes to determine which one could be commercialized fastest and in so doing we learned a lot by working with different state and government agencies. In the ten years we started off finding the right technologies and now that we found them we are transitioning from a technology developer to a project developer. They are a lot of factors which need to be cost effective in order to come together the right way. We certainly had business intentions when we started. In order to succeed in achieving goals and bring my motivations for being involved to fruition it is important to be successful. People won't listen to you unless you are successful. One way of determining success is to look out how well the firm is doing financially.

Maybe Money should not be the goal in of itself but it is the byproduct of measuring how well you are doing. We have to be able to sustain ourselves in order to succeed and at the same time we have to be fulfilling market needs in such a way in order to determine the size of the market. Also the advancement of the Internet and software design is changing everything so rapidly in terms of communication we are gathering information very fast and attracting the best and brightest people even though we are not all in the same city. Also, the advancement in engineering and design knowledge, 3D CAD/CAM systems to be able to create virtual Engineering systems to put them in virtual water ways is all very innovative. These technological innovations and advancements in a relatively short time have allowed us to grow in such a way. They also helped open up the market place. Being in NY itself has given us world visibility and there has been a number of documentaries made about what we are doing. From a marketing point of view as we transition we will be building an international supply chain network and making strategic partners around the world. We could like to create a global Intranet so that say Verdant Power China could talk to Verdant Power India and swap ideas to refine the technology. Communities globally could help support each other because communication systems are now in place.

It will be interesting to see how technological innovations changes value systems globally and for business. We believe that upto 80% of our business could soon be in developing countries.

Q: Where is the money been currently allocated, business or social side?

Trey: We think about the money allocation all the time but we are not explicitly putting any money into the social side right now. Currently, the little money we have to work with is going into ensuring that we get the technology right. The key to what causes a lot of business to fail is not staying focused. We need to first focus on step one and then step two. And we have to stay very focused on making our technology reliable. Once we have that then we can begin selling systems and building projects which could be sold. This would generate revenue and help us build the market. Once we have reached this point, we can invest profits back in the marketplace. We are not there yet. Apart from transitioning from a technology developer to a project developer, another transition is going from a startup to a growth company and the nemesis of a growth company is cash flow. Since we have no revenue yet we are the mercy of private equity investors or the government. And most government funds require matching funds which means we have to find suitable investors. Most investors are risk averse they do not want to invest in technology; but they will invest in projects, implying that a reliable technology is going into the projects. Although philosophically we all know where we are going, the focus right now is on raising the money in order to sustain.

Q. What are your profit margins?

A : Right now we have no revenues. We might argue that we are getting revenues in the form of government grants and there is some angel investor money. In order to generate profit we need to have revenues. Right now we do not have revenues so there is no profit. But my argue that, we are getting revenues in form of government grants and. We are also talking to institutional investors from private equity investment into the company.

In business parlance, those who are interested in our business after seeing our are now doing due diligence on us. Usually, such money always comes with conditions such as seats on the board of directors or stocks in the company. From a startup business point of view, we have to get the evaluation of our company up so that people invest in us but at the same time we cannot use control of the company since our vision is as I mentioned to you earlier.

Q. Are there any regulations? What is the regulatory policy for your company?

A: I am glad that you brought up. There was a book written a number of years ago by a New York lawyer about this topic and the book is titled 'The death of Common Sense'. It was about how regulations were stifling innovations in America. We have experienced this first hand, having spent more money on environmental studies and assessments than we have on building the product or the technology and there is something fundamentally wrong with that. For example, there seem to be more concerns about hurting a single fish, than about building more core hard plants that hurt the planet and environment. Putting mercury in the water which kill more fish rather than claiming that we are damaging fish in a clean environmen. The government should not put money into these claims but help us focus on getting the technology right. In America, the underlying processes seem to be adversarial. Resource agencies are afraid of being sued by one another and as a consequence there are all these regulations and it kills common sense.

In contrast, Canada is a real social democracy, the under pinning processes in Canada are collaborative and that fundamental difference between collaborative processes and adversarily processes is huge. In Canada the community comes together to create harmonized processes. In the United States it is very adversarial at the governmental level. At the community level, it is collaborative and the community is right with us in working against government regulators who are pulling us down and causing us a lot of money.

There is a fundamental difference and I think it is profound that is why I think we have a better change in the rest of world than here in the United States and it saddens me. We seem to be losing our ability to innovative as compared to countries in China and India. We also have presence in Canada and the Canadian governments have been very supportive towards us and even helping us build relationships around the world.

Date of Interview: October 14, 2009

Name: Jonathan Colby

Title: Hydrodynamic Engineer

Q. When was it formed, how many employees, demographics etc

A. I would say 15, couple of consultants. We are pretty virtual (company) employment. We have lots of conference calls and web based meetings. I started my work on October 1st of 2006. So it is literally 3 yrs. It was my 1st company and got placed out of graduate school. I have a Master of Science from college of Aerospace engineering at Georgia Tech. In undergraduate I just worked in coffee shops and as a grader and a tutor (I also worked in a number of research labs, both physics and engineering). In graduate school I was a research assistant, so I got paid to research and go to school. I moved to New York and specifically applied to Verdant. I found out through other resources and submitted my resume and they hired me. Dean Corren interviewed me. He is the Director of Technology. He is based in Vermont. I report to Dean Corren and Dan Costin who is the Head of Engineering. I also report to Mary Ann Adonizio who is the Director of Resource Assessment. Technically I am a hydrodynamic engineer. In my training, my background is in experimental fluid mechanics. I have done B S in Mechanical Engineering at Berkeley. I have done my Masters in Aerospace Engineering.

The company is organized into two groups; there is an Engineering team and a Resource team. Above them is the Director of Technology and above that we have the Management. There are 5 full time management people and they are Ron, Aaron, Kevin, Trey and Ann. There is one Director of technology who is Dean Corren. There are 5 people in engineering team, they are Jonathan Colby, Chris Gray, Doug Lessig, Matt Hayduk and Tyler Clapperton and 3 people in resource team, they are Mollie Gardner, Dean Whatmoor and Jamie Gerlaugh. I am an engineer and report to technology director and also report to resource assessment team. The engineering team has one person who reports to the resource team. Resource team has one person who reports on to engineering team. I am the engineer who reports on to resource team. Dean Whatmoor is the person from the resource team to the engineering team. Me and Dean Whatmoor work super close together and have a phenomenal working relationship. He comes from the operational and logistics background and I come from engineering and technical background. So together we make a great combination. He leaves to me to do the detailed engineering work and some of the engineering based decisions and I'll leave him to do all the logistics background and operational background which leaves me to do some of the engineering. The head of engineering is Dan Costin and the head of resource is Mary Ann. The key players of our company are Mollie Gardner, Dan Costin and Dean Corren. There are totally 16 employees in our company.

Q. What are the type of products being developed?

A. I would go with Trey's answers.

- The 1st product is the technology converting kinetic energy to electrical and mechanical power. It is reliable. The two systems are tidal (East river in NYC) and river (St. Lawrence river in Canada). The projects include identifying sites which is best working.
- The 2nd product is, working with Dow chemical company in Texas for shallow slow moving water. The technology itself is for harnessing energy from shallow slow moving water. This really is the same as the first one. It takes kinetic energy from moving water and converting to electrical and mechanical power. They use different technologies that are not the same but in principle, both the products are same. We are energy extractors.
- The 3rd product is the clean water system with reverse osmosis technology. Integrated clean water energy systems generate the energy and the end result is clean water, which is different from the other two products.

The only caveat would be, we are different from conventional hydro in the sense that it is existing kinetic energy. It can be 24*7. But this is not in case of east river because it changes its direction every 6 hours. So as the Hudson river. For 6 hours it flows to the north and for 6 hours it flows to the south. The tides changes because of the influence of the moon. The moon goes around the earth; it pulls and tugs the water around with it. That's why the turbines in New York are called tidal turbines and the ones in the Canada are more river application. The east river is misnamed; there is no fresh water in the east river. East river has all salt water.

The Hudson is salt water near New York City but it becomes fresh by Albany. So the Hudson is called as estuary because it is where the fresh water meets the salt water. The east river is called a tidal strait because all the east river does is move the ocean water from long island and deliver to Atlantic Ocean. It is generally safe for swimming. The water quality good but the currents are too fast. But there are places to swim in the east river like the beach in long island city. It has salt water and changes its direction every 6 hours. Swimming in Hudson depends on the situation and it is also polluted. The worst time in New York is after heavy rains because all the streets wash off into the rivers. In general Hudson is not that bad.

Q. What was the motivation to be involved with the company (Social or business)?

A. I was working with Aerospace and was very frustrated with the social aspect (or lack of) of Aerospace and with the implications of the work that I was doing. I went to Aerospace to do astronomy research. I wanted to develop satellites for Hubble tech telescope applications to do astronomy research and I found that the people around me knew nothing about astronomy and instead they were much more focused on industrial, military side of Aerospace. Being of fairly anti-military complex, I was very unhappy in the setting. So I decided to leave aerospace and get into the renewable energy sector. I wanted to feel that my engineering work was going towards a much more positive result. So I was in a PhD program at Georgia tech and left after 3 years with my Masters. It was the best decision I have ever made. So I left Aerospace just to join the renewable energy sector.

Fluid mechanics is my background. Air is also a fluid. So this is the same fluid mechanics as water and my background was in aerodynamics but as fluid mechanics are similar with different fluids, so I could switch from aerodynamics to hydrodynamics. Verdant was the first company I found and they had the right plans to leverage my talents. I applied to multiple renewable firms once I got to New York City. The job fit was perfect. They were looking for someone with specific set of skills and I had come along with the same set of skills that they were looking for.

I only looked at the renewable energy sector. I believe that fossil fuels and combustion are really destructive to the globe. Our dependence on oil has to be adjusted. I see our environment and climate as one of our largest problem on earth. I think the renewable energy sector is going to be essential for us to survive. There is no way to survive on this earth if we continue to consume fossil fuel at the rate we consume them. I wanted to make positive contributions to the world. The idea was purely social.

I was very unhappy in the Aerospace. I am a kind of guy who rides bicycle, I have never owned a car, I use canvas bag, I bring my lunch. My colleagues really made fun of me during my PhD program. This is because they are McCain and Bush supporters and in favor of wars, drove to work every day and went to fast food chains for lunch. They didn't have the same ideology as I did. The science was amazing. It was one of the coolest sciences I have ever done. But the science wasn't enough for me. The environment I was there was not healthy for me.

Q. Where is it now? Did it transition from social to business or vice versa as the product or company developed over time?

A. The company is more towards the business side. From my perspective I look at deliverables, billable hours and producing tangible results that can add value to the company. So I am turning out work that is making the company viable from the business perspective. I know we have a huge social aspect of our company and I go out of my way to talk, to interact with folks, to give tours, to provide information when people need it, to do the social tech pieces. The work I do is all guided in advancing our technology and making our company more competitive. We are trying to get license and to generate revenue. But I also recognize at this point it's going to be difficult to be a classically productive company. All the energy is going to be expensive which is not going to match what the market could ask for. So I recognize right away that we do not fit into the classic mould profitable company but I think we are trying to be a business oriented company. Personally I think the paradigm how you measure profitable company has some room for growth, because nothing is included like in your thesis. Like there is no inclusion of social benefit, environmental benefit, economical benefit or benefit to manufacture sector to community.

The main evolving I have seen is more towards projects. When I started we had only 1 or 2 projects and now we have 3 or 4 projects. From that perspective I can say that we have stayed on the business oriented side. We have made a constant push to develop new projects, to find new places to put our turbines and to advance the technology. I would say we have been

business driven. I am more than willing to admit that I am not very business savvy, my background is in engineering but I do so much more than a hydro dynamic engineering. I have so much of other roles and I am willing to do any role that they need me to do. That's the mentality that most of us in our company do have. Any day you have no idea what's going to be given to you as a task. I could be watching birds one day, I could be counting fish, I could be meeting investors, I could be interviewing with social entrepreneurs, I could be connecting advance technology to measure river velocity, I could be in a federal building, I could be on an airplane. You have no idea. It's really interesting and that's the beauty of small startups. It's like you have 16 or 19 people and you have 8 fires to put out. We grow with our company. At this point I exhibited level of accountability so I have been given lot of responsibility without any cross examination. So I am basically allowed to do what I need to do to accomplish the tasks in front of me without anybody babysitting me. Luckily my Master's program was just like that, I had an advisor who said you are on your own, so get it to me on time or you can go home. So I worked in the lab, independently researched and my advisor was very happy with my work. He left me alone and I did my work with great relationship and it's the same here. They are not here in New York and there is no one to check on me so it's up to me and myself to be responsible, accountable and productive. I take my job very seriously.

Yes, I definitely do social work while I am at work. The best example is the educational outreach I do. I work with students on many levels of science, trying to get all level of students more active in science and also aware of what our company is doing. I am involved with Colombia University; I am becoming involved with art collective in Brooklyn. I am encouraging the art collective to be more environmental and scientifically savvy. So my general goal in life is to get an 'un-scientist to do science' and I do it everywhere I can. So I teach in architecture department at Columbia to use architecture in engineering in their tools and to incorporate global energy. This will explain how long we are using our technology as an intra global energy development of an concept of energy consumption and energy efficiency. So that's a huge social piece that I do during my job. There are lots of conferences, lots of talks, lots of interviews, we are doing it what we believe in. I am the only engineer in New York City. I do a lot of project management for the work in the east river. So I am like super New York centric. I have been here for 3 years.

Q. Who do you see as your competition?

A. There are no real competitors in the US. The two biggest competitors are **Open Hydro** and **Marine current Turbines** (MCT). We have some competitions but they are very different from us. So there are no competitors with the similar technology. They have same concepts but not the same design. There is only handful of companies and only two or three of us have got enough technologies to even be called competitors.

Basically when Verdant began, the management's goals were to survey existing technology and identify the most viable of the technologies. They went through 4 iterations of different forms of energy captures. They tried different rotors with different blades. So they went with 4 iterations of blades and rotor design and the rotor is where the energy capture occurs. So what you use for the blade or fan for the rotor is going to determine your energy capture. So they tested 3 or 4 rotors, to see which performs the best with the energy capture and settled on this 3 blade design. So once they settled on the technology then they moved on to project development. That's how they got in New York.

Q. What are your profit margins?

A. I don't know anything about the profit margins.

Q. Are there any regulations? What is the regulatory policy for your company?

A. Yes. I do a lot of fish and wildlife monitoring, which is a part of regulatory permitting process. No, the fish is not killed. The very 1st question that arose was, "will we kill fish?" People are very concerned that we will be killing fish. So we have monitored continuously for over two years as to what the fish is doing underwater from multiple different methods. We have a zero indication of a single fish mortality over the whole two years. We have moved into more detailed questions like about fish relationships. What I mean is, predator-prey interaction. So the question has now moved into whether smaller fish is being moved out shore therefore easier to eat or smaller fish being moved inside therefore more difficult to be eaten. In other words, are you making it harder for the larger fish or easier for the larger fish?

Now we have to understand subtle impacts not catastrophic impacts. First of all our turbines turns very slowly. If a fish swims all the way up to it, it is going to go through without touching the blade. A really big fish is going to get struck more likely than a small fish. The important thing is that fish can sense that the turbine is rotating because the turbines send out pressure waves in all the directions. So fish can feel the obstruction so when they come up to it they can physically swim around it. We have done and doing analysis to prove that's the case. We have spent millions and millions of dollars to answer these questions. So that leads to regulatory process. The main regulatory agency is the fish and wild life agency. They are the one who have the biggest concerns. I have mixed emotions on this; on one hand the East river is very clean these days and these agencies have spent 20 to 30 years and a tremendous amount of tax money to clean up the water around New York City. I can totally understand their cautiousness in allowing 'some' technology to go into the clean water. I appreciate their work. But if regulations are so obscene that they are destroying technology companies then that is not really productive either. I wish the people would look into the outturn because we know fish is going to die if we are going to pollute the environment. So we have to do a comparative risk here. If we are a matured company with good revenue it's a different story. Especially for startup tech companies because we have such high capital costs, you know we have no revenue and we try to generate technology out of our own pocket.

Date of Interview: November 11, 2009

Name: Ron Smith

Title: Chairman and CEO

Q. What does your company do?

A: In my view, we are trying to create something new to support basically human needs, which is energy. So we are innovating by commercializing new energy capabilities particularly in water. Because we are in water, we have some unique potential applications that other renewable energies do not have. Basically we are innovating organization to deliver new renewable energy.

Q. ORG structure of the company?

A: Primarily, Trey, myself and Kevin. Trey and I kicked it off and Trey knew Kevin and brought him in. So the three of us were founder and then we bought a fourth person in, who joined us in the management team who was out of the financial community. He had made some money with the investment firms on the west coast in San Francisco in the 90's, his name was Matt Klein and was the fourth member of the management team for number of years but he was in and out of the company but he was a kind of the lead investment guy for us. He just passed away this summer. He was like 40 years old had some health problems. He was the fourth member, we lost him few months ago in the end of July.

Then we have next level of experienced managers which include four, five other key people in the company. We also have a Canadian engineering lead named Mark Tinkler to lead the Canadian initiatives. In addition to that we have folks who we have retained on a commission basis to assist us in raising funding and financing so we have a lead guy in London. His name is Michael Wellman and we have financial guys who are raising funds and basically working with potential strategic partners. Michael is in London and then we also have a guy named Terry Mactager in Canada.

Q. What are the types of products being developed?

A: That would be the free flow power system which came out of New York University. It is really the design of the free flow power system. When it was at New York university it was referred to as the Kinetic Hydro Power System (KHPS). It is a conversion device like a wind turbine which you put it under the water and it is designed to convert the energy from flowing water into electricity. It is called either the Free Flow Power System or Kinetic Hydro Power System (KHPS). That is the main device that we are developing and it is the main innovation what we are working to commercialize. We believe it will be a leading technology in this industry.

In terms of technologies, the third technology which Trey mentioned, the clean water system based on reverse osmosis technology would be offshoot of the two earlier mentioned technologies. It would be an application. The main two technologies are those that convert kinetic

energy into electric power and technologies for harnessing power from for shallow, slow moving water. These are the core technologies that interconnect with other applications and systems.

Q: What was the motivation to be involved with the company (Social or business)?

A: In short, it was a combination of business and social aspirations. My career included mostly working for fairly large organizations. What I came out of college, I went into the US navy. I had seven years of active duty in the navy and had two different jobs. I was a carrier pilot for one tour and then I was a management consultant for a second tour. Then I went to Business school and then I worked for Bendix Aerospace for three and half years. Then I worked for Booz Allen Hamilton which is a consulting firm for about 13 year. I got to mid career in my 40's and I had gotten divorced, I got remarried and I just decided that I don't want to spend another 20 years in corporate organizational kind of a structure. I always enjoyed entrepreneurship and consulting was really about building a business within the consulting firm. So, I left Booz Allen, and my wife and I had started a business, which we built and then sold. I was then doing some independent consulting and when Trey spoke about this opportunity, it was something that I was interested in doing. I was interested in entrepreneurship and building an organization and also identifying purpose other than just basically making money.

So as we got into this it looked like an opportunity to do something innovative, exciting and interesting and at the same time building an organization and it turned out to be building an industry, atleast in the front end of building an industry. That was interesting and exciting to me and a place I wanted to spend some time on. I was interested in the work and trying to create something new. Its tough because its not commercial yet so we don't have a stream of cash. We are continuously raising money either through the governments or individual investors. My career orientation has never really been focused on getting extremely wealthy but more in the work and the creation of something unique.

Q: Which of the two broad (and contrasting) definitions of social entrepreneurship would Verdant Power fall in or which category would it fall into?

A: I would say that it's probably a balance between the two and everybody who works here is probably right down the middle. We also do need to raise money and attract investors. So there are two different conversations and types of investors. If a for-profit company like ours are presenting to institutional investors, they have very low interest in social aspect of it. They want to hear from us that our sole objective is making big money for them and everybody else. So that there is a tension there between how an organization like ours has to communicate with the investment community. There is a match between an organization like our's and the type of investors who want to participate and it's not easy. You got to have a sense of whom you are talking to because we got a feedback a few times from some of the institutional groups whose sole purpose is in making fortunes and as we describe our company, our motivation and our direction and objectives and not totally focused on making money, that's a negative to them.

Q: From your perspective as a co- founder of the company, would you still be interested in talking with these people who are interested in funding only organizations which are completely interested in making money?

A: You have to find the right investors We need to go to the right investment communities. From our perspective we have to kind of learn that there are different types of investors who would be attracted to what we are doing and they are certainly not the traditional investors.

Q: You started in 2000, where is the company now? Did it transition from social to business or vice versa as the product or company developed over time?

A: Entrepreneurship is pretty much taking advantage of the opportunities that emerge Only briefly have we been in a situation where we have had more resources available, that we could make those kinds of decisions. What has evolved is, early on the first few years, we were bringing into the company the kinds of people who were a right fit for the company, we were looking for people interested in working with us and who has some skills and capabilities that would help us but could do a lot of different things and as we have evolved we had to evolve our staffing strategies from those people who showed up and worked with us on a very flexible situation and not knowing what or how they are going get paid to a more focused kind of expertise where in bring in the kind of people we need to get this work get done. So simply at one level the staffing

strategies and staffing approaches have evolved. We couldn't recruit the kind of people we wanted because they wouldn't work for us since we couldn't guarantee them a pay check in three months.

They would maybe take some stock and you know they had some flexibility to be able to work with us while they had to do a few other things just like we did. When we started this, we were doing consulting to bring money in before we started getting some government awards and other financing. The big challenge is getting the right financial resources and human resources. We have consultants who are working with us who are senior people and they can do other consulting work if we have a situation where the resources are unavailable and we have a slow situation for one or two paychecks

Q: What attracts people to work in Verdant? Why do you think they choose Verdant as opposed to any other Clean Energy organization in NYC?

A: It is definitely 'type' of person. People who are fairly independent.. We did hire one person who had worked for a company for twenty years and they were getting rid of warranty department and brought the senior engineer in, but he was used to the security of a larger corporation and that kind of a structure and he only lasted with us about a year. We were too unstructured and flexible that he had a hard time adapting to the environment. Generally we are able to attract people who are used to working in a very flexible environment or smaller kinds of companies. At the junior level we have folks who are pretty excited about being involved in something new, some like Colby. We are all excited about Colby because of what he contributed but also the opportunities that he has been afforded because he is a fairly young guy and he gets into every aspect of the company and he is able to do all kinds of things around the world in this industry.

Q. How do you address the challenge of running the company professionally and at the same time not losing the entrepreneurial spark and drive that was behind the creation of the firm?

A: I have been involved in a number of consulting organizations. We currently have about 18 to 20 people who are working for us either as employees or full time consultants, so that's pretty much small. We got to have some flexibility while at the same time maintain focus and expertise. We are trying to get a lot more structured as we are getting more contracts and we have a broader scope of activity and projects. But in terms of people's ability to contribute, we are looking for people to be very flexible in their work and to be able to contribute in a variety of areas because we are just so slim in terms of numbers of people.

In my experience, if there are anywhere above 30 people, you do need to have processes in place where everyone knows what to expect, how to contribute and what the standards are. We do have those in place but we have good experienced people who can pick something up and take it and lead it and get it done.

If we get larger, we got to have more and more consistent processes in place and the ability of people to fit in and take their role and position because right now we are pretty small so we do have to be nimble but as we get larger we have to get a lot more disciplined and structured. Engineering is a very disciplined practice so you got to have the discipline to ensure that the designs are locked down, precise and accurate. At the same time, it is important for the engineers to be creative, to be able to think out of the box and get new perspectives on the designs.

Q: Where is the money been currently allocated, business or social side?

A: Right now we are totally focused on the company objective and mission which is getting a commercial project in place while at the same time continuing to attract money either through the governments or through private investors. This weekend Trey and I are going to London to meet with investors in London as well as potentially strategic partners.

Right now, we are focused only on the commercialization and as far as any of the social perspectives; they are not embedded in the mission right now. We do not have that. Ultimately, Trey is communicating with potential projects and potential developers all over the world who want to work with us but until we get an initial project in place and a technology which is totally proven and warrantable, everything else is in the future. Right now the focus is getting 6 to 20 or 30 turbines in the water and getting them running and proving them.

Q. What are your profit margins?

A: No, we have no profits. We are just managing cash day to day. We put overheads and fringes on our costs. We don't have enough revenue and cash right now to cover all our expenses and we are always scrambling for funding.

Q: What is your outlook on the regulatory policy on the US and company like Verdant?

A: The regulatory policy here in the United States is multi- level. One of the conclusions that we are coming to and I am this presenting to the US Congress and the Department of Energy is that this industry is never going to make it in the United States, because it will take too long to get it in the water. It took us 3 years to get permits to put 6 turbines in the water in the east river. It is getting a little better but the regulatory process at the top level of the regulatory commission, we got a lot of support because they have a dual responsibility. They have a responsibility for delivering electricity to the United States and they also have a responsibility for managing and showing that the environmental issues are identified and addressed. All of the regulatory agencies, the US fish and wildlife service, the US coast guard, the army core of engineers, the National geographic and atmospheric association administration, Nova. They have a fisheries group that addresses endangered species which is named the national fishery service. And all those agencies have a single perspective and they don't care about electricity. Their only concern is, if you are going to hurt fish. Their whole mission is status quo. To keep things out so that nothing happens. They would totally disagree with that but basically that way they don't get law suits. They do have a responsibility for support and moving things along, but their mission and individual people in those organizations, it is very difficult for them to make decisions because there is risk associated with it. So we are losing confidence that the United States is going to be the place that we are going to be able to commercialize.

If you look at the environmental layers at least one or more are saying that we need to rethink environmental law because we now have a threat of climate change and when environmental law was written, climate change was not addressed and now it is. There is the attention there and there is a real policy issue which the United States is not stepping up to and I suspect never will. It's one of those things that takes political will. The United States is a pretty wealthy, well off country and its going to be a long time until we seriously feel the need to do something. You can see right now with the health care stuff, nothing is going to happen!

Q: Are getting more attraction in Canada and the UK right now?

A: We were able to access funding from Canada much more quickly than United States. Both are at the prudential level and federal level they are putting processes in the place because they know that they need energy. Actually Canada is interested in producing for the United States because they see some of the bottlenecks that US has.

Appendix 2: Green Map System

2.1 Green Map Projects Worldwide (as of April, 2010)

AFRICA

CAMEROON

Buca

GHANA

Accra

SOUTH AFRICA

Cape Town*

NE Johannesburg

Stellenbosch

UGANDA

Mbale-Pont

Tororo

ZIMBABWE

Harare

Victoria Falls*

ASIA

CHINA

Beijing*

Bengbu

Changchun

Dongguan(Delta)*

Dagang

Dalian

Guangdong Coastal

MangroveWetlands

Guangzhou

Hengxian County

Hong Kong*

Lanzhou*

Mangrove

Conservation

District*

Nanjing

Ningbo*

Qinhuangdao

Shaanxi

Tianjin

Wuhan

Wujiang (Delta)*

Yunlin County

Xia'men

Xi'an

Zhanzhou City

Zhejiang Province

INDIA

Bombay

Gandhinagar*

Pune*

INDONESIA

Banda Aceh*

Bandung

Bantul

Bogor*

Borobudur*

Bukittinggi*

Buton*

Jakarta*

Makassar

Malang

Sanur-Bali

Surabaya

Yogyakarta*

JAPAN

Amagasaki

Beppu

Bishu*

Ehime Prefecture

Fukuoka

Funabashi

Hachioji

Hakodate*

Hayama

Higashi-Fukuoka*

Hikone

Hiroshima*

Hiyasiyamaku-

-Kyoto

Hotaka

Iizuka*

Kamakura*

Kameoka

Kanazawa*

Kanazawa-

-Yokohama

Kawagoe

Kawasaki

Keichiku Fukuoka

KitaKyushu

Kitayama-Kyoto

Kobe City

Kobe-Nada Ward

Koganei

Komoro

Kurashiki-

Marugame*

Kyoto*

Matsumoto

Minamikawachi

Odawara

Okayama &

Takamatsu*

Okusawa*

Osako Chuo

Setagaya*

Shibukawa

Shiga University

Shirakawa

Suginami

Suita Osaka

Tajimi

Takaoka*

Takarazuka

Tanba

Tokyo Cycling*

Tokyo Kids*

Toyota City*

Tsubame-Sanjo*

Tsuruoka

Uji

Uozu

Yamazakigawa

Yokohama* & Aoba

Wakaura

Wakayama

Aichi

Prefecture*

Chitahanto*

Inazawa*

Ise & Mikawa Bay*

Ishiki-cho

Midori-ku*

Nagakuta*

Nissin*

Okazaki*

Osu-Naka-ku

Owariasahi*

Ricoh Chubu -

Office*

Seto

PHILIPPINES

Manila*

SINGAPORE

Singapore*

TAIWAN

Chia-Yi Park

Chian Long

Changhua

Chungli

E Land*

Fa Xian An-

Ping Zhen

Hsinchu

Hualien

Nantou County

National Yang-

Ming

North Heng-

-Chun

North Pingtung

Rueili

River Restoration

Sinwu Township

Taichung Daya

S. Taiwan Science-

-Park

Tainan

Tainan Lide

Taipei*

Taoyuan*

Taoyuan Ponds

Tuh Keng

Delta Electronics*

Wen De

THAILAND

Amkoi Villages

Thailand Parks*

25 Thai Youth -

-Maps*

Trang*

Tung Song

EUROPE

AUSTRIA

Krems/Donau

Neusiedl am See

Salzburg

CZECH

REPUBLIC

Cesky Krumlov*

DENMARK

Copenhagen*

ENGLAND

Bristol*

Colchester

Cumbria

Greenhill

Haywards Heath

Irk Valley*

Liverpool*

London*

Neath Port Talbot

Oxford*

Sheffield*

Wiltshire County

FINLAND

Helsinki

FRANCE

Annecy*

Paris

Rennes

Rhône-Alpes

Region

Nord-Isere*

Villeurbanne*

Toulouse

GERMANY

Berlin*

Black Forest

Frankonia

Freiburg

GREECE

Athens

HUNGARY

Budapest*

ICELAND

Iceland

IRELAND

Ballymun

Cork*

Dublin*

Galway

Waterford*

ITALY

Florence

Rome

Torino

LATVIA

Latvia

NETHERLANDS

Amsterdam*

Breda*

Cuijk Countryside

Eindhoven*

Gouda*

Noord-Brabant*

Schinnen

Utrecht

Wyk by Duurstede*

N. IRELAND

Belfast

Coleraine

NORWAY

Kristiansand*

Stavanger*

POLAND

Gdansk

PORTUGAL

OeirasPorto*

ROMANIA

Bacau *

BistritaBucharest*

Constanta

Cluj-Napoca

Livezile

RUSSIA

Kazan

St. Petersburg

SCOTLAND

Clackmannanshire*

Dunipace Green

Edinburgh

Falkirk

Fife Glasgow*

Stirling*

SPAIN

Asturias

Barcelona*

Casc Antic

Barcelona

SWEDEN

Blekinge

Eastern Smålan

Göteborg/West SE*

Jönköping

Malmö*

Mönsterås*

Stockholm*

Uppsala*

SWITZERLAND

Grand Saconnex*

Suisse Romande

WALES

Adamsdown

Llandrindod Wells

Swansea*

Wrexham

NORTH

AMERICA

CANADA

Calgary*

Colwood

Comox Valley-

-Watershed

Craik*

Dalhousie -

-University*

Green Map Projects Worldwide (continued)

Arizona	Five Counties**	South Carolina	Suarez
Phoenix	Houghton**	Charleston**	UT de Pereira**
Prescott**	Keweenaw	Fort Valley	Yumbo
Tucson	Peninsula	Texas	COSTA RICA
California	Northern-	Austin	Finca Salverde
Berkeley**	-Michigan U	Houston**	Humedal Nacional
Burning Man**	Traverse City	San Antonio**	Téraba Sierpe
Hayward	Minnesota	Utah	CUBA
Los Angeles	Woodbury**	Salt Lake City	Camagüey
Metro**	Missouri	Vermont	Ciende Avila
Monterey	Kansas City	Vermont Healers	Guantanamo
Northern CA -	St. Louis	Virginia	Havana
-Access**	UMSL St Louis -	Elizabeth River	Holguin**
Oakland Ontario	-County	Richmond	Matanzas
Sacramento**	Webster Groves	Rockingham -	Pinar del Río
San Francisco**	Montana	-County	Sancti Spiritus
Santa Monica /	Missoula**	Washington	Santiago de Cuba**
Ballona Watershed**	Nebraska	Bellingham's -	ECUADOR
Colorado	Omaha	-WWU	Esmeralda
Boulder**	Nevada	Lake Washington	GUATEMALA
Carbondale/Basalt**	Burning Man**	San Juan Islands	Areas Portegidas
Colorado Springs	New Jersey	Seattle**	JAMAICA
Denver	Atlantic Highlands	Tacoma	Jamaica**
Durango**	Jersey City	Vashon	PERU
Salida	The Meadowlands**	Washington DC	Wacarpay
Connecticut	Somerset County**	Washington DC**	PUERTO RICO
New Haven**	New Hampshire	West Virginia	San Juan
Trumbull**	Plymouth	Wheeling	U of Puerto Rico**
Florida	New Mexico	Wisconsin	MIDDLE
Cocoa	Santa Fe**	Madison	EAST
Jacksonville	New York	Milwaukee**	ISRAEL
Orlando	Bed-Stuy	Stevens Point	Jerusalem**
Sarasota County**	Binghamton	CARRIBEAN	Modiin
St.Pete/Clearwater**	Brooklyn Maize	& LATIN	OCEANIA
Tampa	Green Schools -	AMERICA	AUSTRALIA
Georgia	-Alliance	ARGENTINA	Adelaide**
Athens**	Harlem	Buenos	Manningham
Atlanta	Lynbrook	Aires**General Pico	Melbourne**
North Georgia U	NYC DESIS Lab	La Plata**	Sydney
Hawaii	New York City**	BRAZIL	NEW ZEALAND
Kilauea**	Northeast -	Baixada Santista	Hamilton**
Idaho	-Permaculture	Campinas**	Wellington**
Moscow	Our Green Harlem	Curitiba**	
Indiana	Queens\	Itu	
Indianapolis	Rockland County	Jahu**	
Illinois	Syracuse	Instituto Tamboré	
Chicago	Utica	Medianeira	
Greenside**	Westchester -	Natal	
Chicago Action	-County**	Natura Brasil	
Guide**	North Carolina	Palmas	
Urbana-Champaign	Asheville	Parati**	
Kentucky	Triangle	Pernambuco**	
Univ of Kentucky	Ohio	Rio de Janeiro**	
Louisiana	Cincinnati	Sao Paulo	
New Orleans	Columbus**	Sao Paulo State	
Maine	Sharon	Sao Pedro	
Bar Harbor	Westlake	Soracaba	
Maryland	Oregon	Ubatuba Aoka	
Baltimore**	Portland**	World Fisheries	
Frederick	Pennsylvania	CHILE	
Howard County	19125	Santiago**	
TowsonUniversity**	Bradford	COLOMBIA	
Massachusetts	Cumberland Valley	Bogata's East -	
Cambridge -	Easton	-Mountains	
-Somerville**	Pittsburgh**	Medellin	
Quincy	Pottstown	Pereira**	
Michigan	Rhode Island	Quebrada Negra	
Ann Arbor**	Providence	Risaralda	
Detroit**	State of Rhode Is.**		

2.2 Management Team and Governance

Wendy E. Brawer: Founder and Director, she has been an eco-designer, public educator and consultant since 1990. Wendy created the first Green Apple Map of New York City in 1992 and published the 5th citywide edition in 2006. Wendy initiated the global Green Map System in 1995 and continues to lead its development. She is founder of a small eco-design firm, Modern World Design, that focused on energy generation and waste reduction. She has taught at NYU, Cooper Union and presented at more than 25 universities and conferences. Recognition includes Engaged Citizen (GreenWorks NYC 2009), Woman of Earth/Terre de Femmes (Yves Rocher Foundation 2005), Designer in Residence, (Smithsonian Cooper-Hewitt National Design Museum 1997) and a Sea Change Award (Gaea Foundation 2003)

Carlos Martinez : Green Map System's Director of Programs and Latin American Liaison. He has been connected with the Green Map movement since 2004 when he was pursuing his BS in Environmental Administration. As a Green Mapmaker, Carlos developed a NYC Chinatown Green Map for his university thesis on urban ecotourism and currently he is co-leading the Queens Green Map. He specializes in social and environmental issues in high needs population areas, especially in his native Colombia and Latin America. He is responsible for developing many of Green Map System's and NYC's Green Apple Map projects, including multimedia, translation, technology and other projects. Carlos is also a teaching artist at the International Center of Photography's community program. Using photography as a tool for social change he has supported environmental justice initiatives including National Geographic's Photo Camp and Island Academy, a program for youth transitioning out incarceration.

Dr. Robert W. Zuber: Mr. Zuber was Green Map System's Education and Outreach Specialist from 1998 to 2003. He currently works for GMS as an organizational consultant and grant writer. Bob's work with Green Map System included youth mapping resources and projects, writing and editing projects, outreach around the world and fundraising. Most recently, he spearheaded development of their youth Energy and Environment Exploration modules and has led workshops from Jakarta to Harlem on Green Mapmaking. Bob is the former executive director of the Center for Environmental Education. He has also worked with Human Rights Watch, Blacksmith Institute/Polluted Places, the Center for International Media Action, East Harlem Interfaith, and the Center for Community Action in North Carolina US.

Joshua Arnow: Board Member and investor in Cleantech. He has been primarily involved in a family run enterprise (real estate) since 1980. He is self educated and has been inspired by the work of Buckminster Fuller (described as the Leonardo of the 20th Century). Arnow's involvement in non-profit and philanthropic interests includes GMS, Buckminster Fuller Institute, and projects at www.sustainabilitylabs.org and www.designrevolution.org.

Andrew Fenster: He was technically an intern, but his work leading 7 other student interns on hands-on Green Mapmaking in Summer 2009 created a new way to engage more youth. Andrew continued development of the Green Teens Green Map project, picking up where past staffers had left off. He has also created an Open Green Map about regional permaculture.

Té Baybute: A New York based Graphic Designer and a graduate of the Savannah College of Art and Design. At Green Map, Té has worked on print promotions, web design, and most recently, the Open Green Map mobile interface. Té is pursuing a career creating advertising for socially responsible institutions and causes and has worked with Green Spaces in New York.

Akiko Rokube: A communication designer who recently graduated from Parsons Design and Technology master's program. A native of Tokyo, Akiko creates many kinds of visual elements and tools for the Open Green Map and the Smartphone mobile web application.

Openflows Community Technology Lab: This organization is a partner in technological development as well as a neighbor. Openflows is a professional network of developers, consultants and researchers committed to bringing cutting edge open source software solutions to NGOs and progressive community organizations.

Thomas Turnbull: Mr. Turnbull moved to New York in January 2007 from Scotland to work for Green Map as a trainee. As their Global Communications Manager, he programmed their website. Tom was also the chief architect of the Open Green Map through January 2009, when he changed jobs. Currently, as a member of Green Map's Board of Directors, he is centrally involved in the mobile version of OGM, designed for Smartphones.

Ciprian Samoila: He is an ecologist and PhD candidate working with GMS virtually from Romania on a voluntary basis. Ciprian is continually developing website resources and tools for Green Map System, most currently working on the link between the Open Green Map and GIS. He initiated the Harta Verde Romania Green Map Project now spreading to diverse Romanian cities.

Beth Ferguson: She has held many positions at Green Map, starting as Project Coordinator for LoMap, the 2001 Lower Manhattan Youth Green Map project, and continues her work as a part time consultant on our education projects. Beth developed the 2000 Brooklyn Waterfront Green Map project with Recycle A Bicycle, and the Holyoke Green Map (senior project, Hampshire College).

2.3 Financial Projections (2010)⁴⁰

Income	Amount
Grants	\$140,000
Sponsorships	55,000
Awards & Matching	20,000
Individual Donations	\$12,000
Events & Workshops	6,000
Mapmaker Fees	23,000
On-line Store	1,500
Rental Income	12,300
Consulting and Services	8,000
Total Income	\$277,800
Expense	
Contractors	\$55,000
Interns & Trainees	15,000
Staff Salaries	87,000
IT Services	42,000
Bank Service Charges	\$150
Accounting	1,200.00
Computer/Software	550
Copies	300
General Taxes	10,000
Insurance	15,000
Legal Fees	300
Local Meetings & Trainings	3,500
Memberships	200
Office Supplies/Equipment	850
Postage and Shipping	350
Printing and PR	2,000
Rent	32,400
Telephone/DSL	2,500
Travel	8,000
Utilities	900
Web Hosting	600
Total Projected Expense	\$277,800

⁴⁰ Based on data provided by GMS Management

2.4 Grants and Key Contributors⁴¹

1. Natura Cosméticos Period: 2008 Grant Details/ Amount: \$35,000 for Spanish & Portuguese interfaces of OGM, Latin American resources/outreach
2. Herb Block Foundation Period: 2009 Grant Details/ Amount: \$25,000 for OGM Period: 2010 Grant Details/ Amount: \$7,500 for youth OGM
3. Surdna Foundation Period: 2009 Grant Details/ Amount: \$25,000 for OGM
4. Pair Networks Period: 2006 - current Grant Details/ Amount: donated dedicated carbon neutral server
5. Google Grants Period: 2009- current Grant Details/ Amount: Map API, Google Earth Pro
6. Tele Atlas Maps in Apps Period: 2008 Grant Details/ Amount: Third place award, maps in apps-\$10,000 for OGM
7. NetSquared Mashup Challenge Period: 2008 Grant Details/ Amount: \$3,000, Finalist OGM
8. Global Giving Period: 200- present Grant Details/ Amount: \$22,865 + 30 to 50% matching + \$1,000. This is for general usage and China specific projects.
9. CDS International Period: ongoing Grant Details/ Amount: Paid interns
10. Foundation for Sustainability and Innovation Period: 2006 Grant Details/ Amount: \$3,000 Period: 2007

⁴¹ Based on data provided by GMS Management

Grant Details/ Amount: \$5,000
Period: 2008 Grant Details/ Amount: \$5,000 Period: 2009 Grant Details/ Amount: \$3,000 for Icons and OGM
11. Con Edison Period: 2008-2010 Grant Details/ Amount: \$5,000 a year for youth and community engagement in NYC
12. Patagonia Upper West Side Period: 2009 Grant Details/ Amount: \$3,000 for NYC mapping
13. Ben & Jerry's Foundation Period: 2009 Grant Details/ Amount: \$1,000
14. NYU Green Grant Period: 2008 Grant Details/ Amount: \$5,000 for campus Green Map, prep for archive acquisition by Bobst Library, education interactions.
15. Body Shop Foundation Period: 2007 Grant Details/ Amount: \$19,440 for youth tools
16. Captain Planet Period: 2006 Grant Details/ Amount: \$2,500 for Colombia projects
17. Foster's Group Community Foundation Period: 2006 Grant Details/ Amount: \$30,000 for 2 years-Icons, GM.org
18. Sappi Ideas That Matter Period: 2006-2007 Grant Details/ Amount: \$32,000 for printing grant for all their identify materials.

For the Global Program:

1. Graham Foundation Period: 1998 Grant Details/ Amount: \$10,000
2. Reynolds Foundation (Cuba Projects) Period: 1998 Grant Details/ Amount: \$2,310
3. ADPSR NY (Detroit exhibit) Period: 1999 Grant Details/ Amount: \$500

4. ADPSR National (Detroit exhibit) Period: 1999 Grant Details/ Amount: \$250
5. Citigroup Foundation (Icon poster) Period: 1999 Grant Details/ Amount: \$15,000
6. Rockefeller Bellagio Period: 2002 Grant Details/ Amount: \$10,000
7. 9-11 Fund Period: 2002 Grant Details/ Amount: \$11,600
8. JUCEE-J Nexus (Japan Hub Development) Period: 2002 Grant Details/ Amount: \$6,400
9. Five Borough Bike Club Period: 2002 Grant Details/ Amount: \$1,000
10. Christopher Reynolds Foundation (Cuba related) Period: 2002 Grant Details/ Amount: \$1,000
11. Japan Foundation Center for Global Partnership (Atlas) Period: 2003 Grant Details/ Amount: \$20,000
12. JUCEE-J Nexus (Atlas) Period: 2003 Grant Details/ Amount: \$20,000
13. Scheuer Cohen Family Fund Period: 2003 Grant Details/ Amount: \$5,000
14. Japan Foundation Center for Global Partnership (Atlas) Period: 2004 Grant Details/ Amount: \$13,000
15. Tetra Fund Period: 2004 Grant Details/ Amount: \$11,000
16. Yves Rocher Foundation (Content Management) Period: 2005 Grant Details/ Amount: \$1,500
17. Graham Foundation (Content Management)

Period: 2005
Grant Details/ Amount: \$5,000

For the Youth Program:

1. Dunn Foundation

Period: 1998
Grant Details/ Amount: \$7,000

2. Dunn Foundation

Period: 1999
Grant Details/ Amount: \$7,000

For the New York Green Apple Map:

1. New York City Environmental Fund

Period: 1998
Grant Details/ Amount: \$15,000

2. Sustainability Education Center

Period: 1998
Grant Details/ Amount: \$1,200 + \$2,400 to teachers for NYC mapping projects

3. New York City Environmental Fund

Period: 1999
Grant Details/ Amount: \$23,000

4. New York Community Trust (IoMap)

Period: 2001
Grant Details/ Amount: \$10,000

5. Chase Manhattan (IoMap)

Period: 2001
Grant Details/ Amount: \$1,000

6. Deutsche Bank

Period: 2001
Grant Details/ Amount: \$10,000

7. New York City Environmental Fund

Period: 2001
Grant Details/ Amount: \$4,600

8. Greenacre Foundation

Period: 2003
Grant Details/ Amount: \$3,575

9. New York City Environmental Fund

Period: 2003
Grant Details/ Amount: \$20,000

10. New York City Environmental Fund

Period: 2004

Grant Details/ Amount: \$17,500
11. Greenacre Foundation Period: 2004 Grant Details/ Amount: \$7,625
12. New York City Environmental Fund Period: 2004 Grant Details/ Amount: \$17,500
13. Greenacre Foundation Period: 2005 Grant Details/ Amount: \$4,200
14. New York City Environmental Fund Period: 2005 Grant Details/ Amount: \$5,000

2.5 Media Coverage⁴²

GMS has received widespread coverage in the form of blogs, newsletters, articles, and video. The organization has been generating local interest around the world and has been profiled in the following major news outlets:

- ⇒ BBC
- ⇒ Jakarta Post
- ⇒ Afrika T
- ⇒ Asia News
- ⇒ WNYC
- ⇒ Treehugger
- ⇒ The Economist
- ⇒ Youth Today
- ⇒ Israel 21 C
- ⇒ Xiamen
- ⇒ New York Times
- ⇒ Google Maps Mania
- ⇒ The L Magazine
- ⇒ Urbanist
- ⇒ Communication Arts
- ⇒ Fast Company
- ⇒ Tout Azimut
- ⇒ Brote Ecologico
- ⇒ Click2Map
- ⇒ Ecollo

Major References:

2010

Baltimore Green Map, Floura Teeter, USA, 2010
Green Maps/Politics of Change, Jdunksalot blog, Canada, 2010
Green Map of University Town Launched by Katherine Zhang and David Keyton, Life of Guangzhou, China, 2010
Crowdsourcing a presentation by Peggy, Wiser Earth, USA, 2010
10 Ways Crowdsourcing Can Save or Fail Your Business by Jen Boynton, Triple Pundit, USA, 2010
Blazing Trail for a Green Jakarta Map, The Jakarta Globe, Indonesia, 2010
Longing for Geneva by Linn Ternsjö, Linn's blog, Hungary, 2010
Open Green Maps: Comunidades Verdes y Orgánicas en Mapas by Federico Gasquet, Edunotes, USA, 2010 (Español)
Crowd Sourcing Innovative Social Change by Sarah Davies, Sarah Davies' blog, USA, 2010
Green Map data collection, CJBATES8, 2010
The Rite of Spring Break, College and Such, 2010
Scope Out Green Hotspots on Your iPhone Using the Green Map App, Built Using AppMakr by PointAbout - AppMakr, PRWEB, USA, 2010
Green is in the Air, Live at Eden, USA, 2010
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2.6 Select Interview Transcriptions

Date of Interview: August 05, 2009

Name: Wendy E. Brawer

Title: Founder and Director

Q. What does Green Maps do?

A. Green Maps is a not-for-profit that works with community leaders to map sustainable living in the broad categories of nature, culture, and society. Within that we map negatives, positives, and neutrals. There are 170+ icons that have been designed to make the maps which can be thematic, printed, digital, etc. It's really up to whoever is making the maps to decide who their audience is and how to best reach them.

Q. When was the company formed and how many employees do you have?

A. The global company got started in 1995 and the not-for-profit was founded in 2000. There was a period when we were accumulating projects around the globe when green watching was becoming more dominant and we decided that separating the profit from the projects and becoming a not-for-profit would increase our credibility.

Right now its eight full-time employees, interns, trainees, and our tech people are a separate entity that sublets from us. We also have people work with us who have expertise in different parts of the globe.

Q. Describe the demographics of your employees.

A. Most of them are younger. The oldest is probably 30. It's also a very international group and it always is, e.g., Asia, the Americas.

Q. What are you primary products?

A. Green maps, books, social network, tools and resources for map-making that can be downloaded for youth, grass-roots, and professional map-making. We're in 55 countries.

Q. Any data on your downloading?

A. One map in 2004 was downloaded 200,000 times in English and Japanese. But we don't have too many other stats.

Q. What was the motivation to start the company? (She's part of the original founders)

A. I was thinking of how to help people who want to make a change to green or sustainability in their lives see what resources already exist in their neighborhoods. Maps are universally understood, portable, give people a new world-view to change a person's perspective – there aren't many products that do that. It's all about getting local people to tell the stories about their areas.

Q. Was it more of a social or business motivation?

A. It was social, but I will say that I was looking to make a green product first. I'm an industrial designer and I made the first green NY map in 1992.

Now, while we're a not-for-profit, we have done a lot to highlight businesses. We've shinned a light on their sustainability attributes, social efforts. So we've helped develop green jobs, whether it be the people working to make the maps, or the people working at the green companies we have on the maps. And many green maps have created business, e.g., green consultants, education, etc.

Q. Do you see a transition in your company from starting as a socially-driven company to a more business-focused one?

A. Yes. The global icons are not free. When we became a not-for-profit we stop giving the tools away. The fee is based on what type of organization you are and the income of people where you live. If you can't pay, you can trade us a service. For example, you can provide translation services, or help with community outreach, or develop research papers/data.

Q. Growth cycle of these companies and see how they evolved and if their strategy for growth changed over time (possible they started out with a very social outlook but as they progressed through the 'S-Curve' of development, they had to become more business savvy and adopted more of a business oriented approach (or vice-versa!)?

A. Much more social than business but if you look at our growth since day one we have been global. The incredible creativity and innovation that we have unleashed around the world, maybe someone who looked at us from a business perspective would say that we are actually doing pretty well. If you looked at our bottom line, you wouldn't! Also, each local project has its own budget, its own management. We don't even know what its budgets are or the money they are generating.

Me: so just to iterate, you started very social, but then always had a global outlook and do you think you are transiting now to a more business outlook?

I would say a hybrid of the two approaches. We are developing now a new revenue model for our organization is based on icon sponsorship. We are hoping to roll this out really soon and document usage of this. With a 170 icons and so many different companies looking at these at ways to raise their public profile, we can create a very good possibility of sustaining ourselves and it supports our mission as an entrepreneurial company.

Q. Where is the money being currently allocated (social or business practices?)

A. Today, I would say most of the money, say about 75% of it is going on the social impact side. The remaining 25% and even that maybe a exxageration but we have been developing the icon sponsorship program and a mobile application which opens the door of all kinds of advertising, sponsorship and data sharing opportunities for a charge. These are all rather new to us and we have been training to have a level of competence to price these appropriately.

Also, I would account for that business side as grant writing. Also, over the last couple of years we have been entering a lot of competitions. The Open Green Map for example is already placed in the top of 5 different competitions. We also get to travel considerably on account of these competitions. This also gets us great press and outreach. We have also entered business plan competitions and pitched at various seminars such as Where 2.0. We see these kind of opportunities as great low cost ways to get our name out there and make great connections.

In effect, the 25 % business side of writing grants, entering competitions, conferences will eventually lead to more social impact. In effect, the business is not to maximize the end margin but to create an environment by which you become business savvy which will in turn help our social cause. We leverage every opportunity to not only help our opportunity but also to help global mapping.

In the two definitions of SE, Green Map would fall more in the first frame (social impact oriented). We are focused more on social change rather than the money. I think the exciting thing about SE is that it is bringing so many new ideas together. Even this concept of the solidarity economy. What does this mean? Am I doing well if my neighbor isn't? How do we move closer to that goal. I grew up in Detroit. It is poised to become the new paradigm. Right now it is the epitomy of everything that is bad about this country, what if it became the epitomy of everything that was good and what would it take to do that.

Our target audience is local residence in the different places where they are making the map, people who visit, the newcomers, the researchers who are trying to figure out what is working in this community, the journalists, decision makers, community developers, policy makers, students of all kinds. Another audience is the sites on the maps. They are happy to see themselves there, they are getting promotion. We also see the map makers themselves as important so we need to help these folks get the funding they need, the credibility they need and the skill sets which maybe developed locally.

Q. Who do you see as your competition?

A. They are other mapping websites. Wiser Earth is one or the Eco-community map by the Sundance channel. There is an iPhone app called the Third Whale. They have taken about 700 green business directories and mashed that together. More than competition, I think it is all about collaboration. For a sustainable future for all, we need everyone to be involved to be successful.

Q. What are your profit margins?

A. 70% is foundation funded, 15% is matchmaker fees, 15% is earned and individual donors. GreenMap became a non-profit in 2000, about a month before the .com bubble burst. We have always believed in bootstrapping and I believe that if we were fully funded with everybody getting real salaries, benefits and pensions and things like that and got used to it, we would probably not be here. I think we have really thrived by being scrappy and dependent on a lot of donated time, pro-bono help and what we have given back to people has worked. We have sort of depended on the gift economy

Q. Are there any regulations? What is the regulatory policy for your company?

A. We ask people to use at least 50% greenmap icons, we also want people to include our copyright. One major rule is that anybody who supports your map has no say over the content of the map. We also really want people to be fair and honest.

Our local icons do not need to be approved. If it is applied to a global set, a lot of people look at it and say if it is good or not

Date of Interview: October 23, 2009

Name: Joshua Arnow

Title: Board Member, Green Map

Q. What were your motivations to join Green Map? (and why Green Map as opposed to any other sustainable organization?)

A. Josh was interested in mapping and in data visualization to understand what is going on in the world and how it affects our world view. How is it a tool for making decision? Trying to develop a piece of software that was blending mapping and story telling.

Josh was impressed by Wendy. He described her one of the most connected, knowledgeable person in the sustainability network. So, he joined to expand his knowledge base and network connections. Josh was also interested in contributing something of value and bring his expertise to the table. He was looking for partners in trying to create a different world. He was interested in transforming the condition and state of the world that is now on a catastrophe course to something that is more sustainable.

Q. Could you give me your opinion on the 'conflict' between business and social practices?

A. Josh claimed that the 'conflict' exists because the fundamental accounting system is "faulty" and does not take into consideration all the costs included with its activities. Lookup Interface Carpet. In order to face conflict you need a bonafide authentic intention to do so.

Q. What is unique about Green Map?

A. Wendy has created a self sustaining/self organizing organization that will live even if she leaves. It is easy for people to realize its importance and local leaders could continue to champion it. The activity of green mapping will not go away. It also has great power as an educational tool. Open Green Map technologies are pushing the envelope of technological innovation and getting more and more people involved.

It is a movement that has created a life beyond her own temporal existence. As an organization, Green Map has created and spawned activities in the world that will always be important and thrive even if Wendy was to disappear. The concept of Open Green Map is very organic and will live on as well.

Q. What is Open Green Map?

A. This is a platform that uses Google Map as a core feature. It has other features on top of it and allows anyone to post a green entity of their community directly to the Map. This can be associated with an icon, commentary, images, videos etc. They can use Open Green Map to work with their community and become responsible for that area. Iphone development.

Q. What is your personal opinion on Green Map?

A. Green Map from the point of view of intention is going 100% in the right direction. They are innovative and are breaking new ground. Wendy even 10 years ago understood the importance of mapping as a universal culture and a mode of communication that is cross-cultural. The current icon language represents a breakthrough in co-operatively developing cross-cultural systems by grassroots organizations. Between the icon system and the power of mapping, it is a powerful system. Wendy started the 'movement' of Green Mapping.

Green Map has to make a case for how its various activities are going to make a systematic impact on the world. Currently, it seems like a fragmented effort. There is the need for a collective effort which integrates the activities of all the different stakeholders. Need to create a model or prototype to include everyone from school kids to C-level executives. This transition could be game changing for Green Map as an organization.

Date of Interview: October 26, 2009

Name: Karen Overton

Title: Client, Green Map

Q. What were your motivations to be associated with as a client of Green Map? (and why Green Map as opposed to any other sustainable organization?)

A. The Green Map system is an interesting environmental educational tools that encourage exploration. The classroom is an important way of learning but working at Green Map greatly enhances any classroom curriculum because it teaches young people how to collect raw data. As an environmentalist I liked the fact that it was focused on a theme that I believe the whole society should take more seriously.

When Wendy started Green Map, it did not have the buzz it has today. A novel approach. Important for Urban planning. I liked that it encouraged young people to do spatial and societal analysis. Introduced community members to each other. Brought together people and issues. Brought community groups working on similar issues together.

From a youth development specialist perspective, the Green Map system builds knowledge and confidence in young people. Increases self-esteem.

Q. Has the company transitioned from social to business or vice versa as the product or company developed over time?

A. The Green Map System has had a huge global impact. The ability to fulfill that vision is very impressive. The technological advance has been stellar and it facilitates the growth of Green Map. Now, there is the Google based Map. Wendy's embrace of technology has been very beneficial and lead to the growth of Green Map.

Wendy has embraced bicycling more than before and she likes to practice what she preaches. She seems to have adopted greener practices over time. Become more technology conscious. Create ideological people and behavior in the environment. Wendy has helped on the business side and social awareness. The company is still primarily social but more global. A lot more staff involved. Green Map has become better at sending out emails soliciting donations. Electronic newsletters. Competition

Q. Who do you see as competition to Green Map?

A. Habitat Map would be direct competition but they are more focused on the scientific data community.

Q. Any personal views on Green Map you would like to share?

A. Not only is Green Map an exercise in education but it is also a tool for social change. The map that young people produced in Red Hook is now in the US Congress. It can be used as an effective social and political tool to request services. Hopes that Wendy will continue to involve interns in summer projects and looks forward to working on more projects with Green Map.

Date of Interview: October 28, 2009

Name: Bob Zuber

Title: Board Member, Green Map

Q. What were your motivations to be associated with Green Map? (and why Green Map as opposed to any other sustainable organization?)

A: Green Map is my favorite not as a profit investment but because the spirit of generosity with which it was founded. It met very very simple concrete needs and it was completely flexible and adaptable so that people around the world could pick up the tool, adapt it to local circumstances and make good thing with it. When I first met Wendy, I was the director of a national environmental educational project and part of my job with project was to identify environmental issues related projects. When Wendy first started it, the project was more or less unformed and un-developed . I think one of the things that attracted me to Green Map was the deemphasize on organizational branding, which I think is less true now than it was in the past. The focus was on enabling projects in other places to do their work better. It was not on creating a funding stream and focusing lots of energy and attention on Green Map itself which is, I think the right approach.

Branding can be the death of entrepreneur activity and often it is the death of it.

In a self important place like New York there are two engines that drive people, money and credit and if you take those of the table it is amazing what you can get done in the world. You may not get credit for having done it but you can get a lot of done in the world.

Q: Your motivation was very much more on the social side than business.

A: I don't care about the business opportunity and personally I couldn't care less about that. I was not attracted to the business parts of it, although I have been responsible for most of the organizational development changes that Green Map has gone through .So, while I am not interested in the profit side of it I have been deeply involved in questions about how Green Map can become more transparent, more reliable, more sustainable etc. A lot of what I do is help not-for-profits become more efficient and better towards their resources. This is certainly true with Green Map as well. The fact that the Green Map was founded on a cannon of generosity, doesn't mean that it cannot be accountable for its resources or towards its partners.

Q: Are there any other organizations you are involved with in NYC?

A: There are several of them and the nature of involvement change obviously over time. I helped an initiative called Polluted Places get started. It works on pollution remediation in developing countries. I also worked out of a Landmark Church in Harlem, the All Saints.

I have had a number of other sort of non-profit involvements and I would say that most of them have would not been particularly satisfying it is important for us in this office to remember that in our job it is important to solve problems, not address them and the not-for-profit sector tends to grab a lot of lower hanging fruit and consider it progresses. We all have to be pushed including Green Map to make sure that we are using all resources in the most beneficial way. So, I am respectful of this sector but I am not a big fan of this sector in general.

Q: In the 12 years you have been here, have you seen a transition or organization development change in Green Map from. Do you think it is more business savvy or business focus now than before or is it even more socially impact oriented?

A: I think that Wendy has been willing to invest energy in different kinds of skill sets that are necessary to make Green Map a sustainable organization. How ever having said that, I think she will admit it herself that she has fought many of the changes instead of embrace them.. Wendy is completely identified with Green Map in a way that it is good and bad in another ways. It is good in the sense that people like her and she's generous and they understand that about her. She has a good design sense. It's bad in the sense that some of it flies in the face of good not-for-profit management principles, especially in terms of transitioning. I think Green Map would be if Wendy left tomorrow and I left tomorrow, I think that Carlos and the group can pick this thing up and make it work but there is no strategy around transition with Green Map and there is very much of a sense in which even the people who are on the board understand that this is Wendy's show and not their show.

Founder syndrome is always a disaster because the energy you need to start something is very different from the energy you need to run something. It's a very different energy and very few people can make that transition successfully. Like in my case if I am involved in founding something, I make sure that I do not run it because there is a conflict in terms of what you are putting on the table. And I think that has been a conflict for Wendy as well and to some extent it is good for Green Map and to some extent it hasn't. But is not very clear that anyone can take over Green Map with any kind of authority.

With regard to Green Map itself, there is now a board, a finance committee, a group of International advisors where there wasn't one. But the structure may or may not determine the practical engagement and I think it is probably true that those structures are weaker than they need to be in order for Green Map to get in to the next place. Having said that, in terms of the product of the Green Map, the evolution has been from a very community driven enterprise to a technology driven enterprise. Most of the energy of the Green Map over the last two or three years has gone to the technology not into engagement with communities. As a result, the people in the office now are a lot more technology savvy than community savvy. I am not sure if this is a good thing because in much of the world, the people are not as techno mediated as it is here and I also don't think it is a good thing for it to be here. What we gained is more sophisticated technological platform.

The real question for Green Map is how do you preserve the best of what it is and also push it to another level?

The question is from an organizational development stand point, when you shift your framework and your priorities, what do you get and what do you lose? And all I am saying to you is that there were people within Green Map who very much valued the one on one community engagement and the care with which Wendy primarily and others in the office gave to these local projects and I think there would be many fewer local projects if not for that personal engagement.

Personal face to face interaction should still be a very necessary part of any engagement. The question is not really whether Open Green is a good or bad idea. Open Green Map is a fabulous idea.

The entrepreneurial question is, if you move in a particular direction with limited resources and limited staff and limited time frame what do you get and what do you lose? and is it worth it?

When you move into another dimension it's not all a gain, sometime it is a loss. At times, it's a lot of loss if you make a wrong choice.

This is assessment mechanism that Wendy has to wrestle with and me and the board and everybody else to figure out whether Open Green Map should be a driving force behind Green Map? The answer turned out to be no because there were lot of people who weighed in and said that we don't want to be driven by technological tool, we want to be driven by something else. Does that affect the long time sustainability of the project? Maybe.

Does Green Map has enough of a niche that people all over the world will be plugging into phone apps and paying money to do that and getting advertisers? All that remains to be seen? Maybe yes, maybe no.

Q: So there primarily seems to be a transition from a community savvy to a more technology savvy workforce and discussions. These issues seem to have come up of late.

A: Yes. Also, if you look at the office, everyone is a techy, every single person.

Q: Do you see a renewed push on the business side maybe in terms of grant writing and conference travel etc in order to maybe get funding?

A: In my opinion, funders, mostly institutional funders are for the most part about a generation behind the times. The foundation officers are beholden to boards who for the most part have no idea on what is going on in the world and so they tend to fund old paradigms rather than new paradigms. They are not up to date in current but they do control lot of resources. So, something like Green Map has never been particularly fundable because it has not until recently wrestled with outcomes question. We made Open Green Map but what difference does it make? The phone apps is little bit different because of the possibility of kind of slapping advertising onto transactions . This may or may not be a good thing. Also one of the issues with any organization is that if it is too closely identified with an

individual, the individual becomes a litmus test for funding. Then it does really about whether Green Map is doing a good job but do we trust Wendy, do we value Wendy, do we like what Wendy is doing. To be fair, Wendy has put a lot of money into this and she has rarely taken a salary. She gets hey pay off in terms of adulation. Which may or may not be sustainable either because if either of us make ourself the issue, people are going to take us up on it. There are people who will not doing in the world I am associated with just because I am associated with it and vice versa! The main point is it is not about me and organizations have to bury their personalities to some degree in order to move through this and transition to new leadership.

Q: What are the profit margins (if any) for Green Map?

A: There's never been a profit at all. Money changes everything an only occasionally for the better. It depends on your relationship with it. How do you understand it, how much important it is to you. Green Map has been a very good steward of the money that it had. Green Map has been phenomenal steward of it and it is the most responsible, reliable place to give money. The caveat though is that as you get more money you have more responsibility, you have higher expectations, there is a need for a different kind of structure in order to guaranty the accountability of those funds. Then the question is if Green Map is equipped to make the changes it needs to make in order for that to happen?

Date of Interview: November 13, 2009

Name: Carlos Martinez

Title: Latin American Liaison and Office Manager, Green Map

Q. What were your motivations to join Green Map? (and why Green Map as opposed to any other sustainable organization?)

A. GMS' vision fulfilled my expectations. It was very attractive to work for an international organization, involving diverse cultures and projects. It was amazing to discover an interdisciplinary tool that can be adapted for local needs. I'm interested in social and environmental projects and GMS has been complementing local leaders and their projects. The feeling and satisfaction to be helping others was other motivation. Other key motivation is that as an employee you need to be very adaptable to different projects - from hands-on projects with youth to web development.

Q. Could you give me your opinion on the 'conflict' between business and social practices?

A. The organization has been looking for secure funding. GMS used to depend on grants, donations, store purchases and Mapmaker Service fees. Now is looking to diversify the income and revenues: competitions, awards and consultancy services.

From an organizational perspective: the board of directors have been more involved in the decisions and supporting more activities. Also the International Mapmaker Advisory Council is more proactive. The new internet services have been helping us reach more audiences and strengthen our network. The communication and response related to different projects has increased.

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Endnotes

ⁱ Specifically, I worked (part-time) at Green Map System as a social media consultant. As part of my role, I participated in brainstorming sessions focused on the new company website being developed in partnership with the software development company, Openflows Community Technology Lab. I also contributed my knowledge and experience as a user of various social networking platforms by providing insight on how Green Map System could enhance their newly launched iPhone app to drive more audience visibility and usage. One suggestion was to follow the “Foursquare” model (Foursquare is a social networking service that allows users to broadcast their location to friends from a mobile phone and helps users find new ways to explore their city). Accordingly, in the case of Green Map System, users could be potentially encouraged to “check-in” every time they visited a “green” location or site. These check-ins would then be streamed to their friends iPhone text message stream, Facebook feed, and Twitter feeds. Such activities would potentially help the app grow virally by providing an added reason for audiences to visit sites listed by friends and others in the local community.

ⁱⁱ Daft (1992) in his work in the field of Organizational Theory and Design organizes dimensions into categories of structural and contextual. Specifically, he organizes these categories of structural and contextual dimensions as follows:

Structural dimensions:

Centralization -the extent to which functions are dispersed in the organization, either in terms of integration with other functions or geographically

Formalization - regarding the extent of policies and procedures in the organization

Hierarchy - regarding the extent and configuration of levels in the structure

Routinization - regarding the extent that organizational processes are standardized

Specialization - regarding the extent to which activities are refined

Training - regarding the extent of activities to equip organization members with knowledge and skills to carry out their roles

Contextual Dimensions:

Culture - the values and beliefs shared by all (note that culture is often discerned by examining norms or observable behaviors in the workplace)

Environment - the nature of external influences and activities in the political, technical, social and economic arenas

Goals - unique overall priorities and desired end-states of the organization

Size - number of people and resources and their span in the organization

Technology - the often-unique activities needed to reach organizational goals, including nature of activities, specialization, type of equipment/facilities needed, etc.

Also of interest to note is Galbraith (1973) who developed his "Star Model" as an organizational design framework for analyzing organizations. The model used design policies that guide organizational decision-making and behavior. The model contained the following five categories: *Strategy*- Determines direction through goals, objectives, values and or missions. It defines the criteria for selecting an organizational structure. The strategy defines the ways of making the best trade-off between alternatives.

Structure- Determines the location of decision making power. Structure policies can be subdivided into:

specialization: type and number of job specialties;

shape: the span of control at each level in the hierarchy;

distribution of power: the level of centralization versus decentralization;

departmentalization: the basis to form departments (function, product, process, market or geography).

Processes- The flow of information and decision processes across the organization's structure.

Processes can be either vertical through planning and budgeting, or horizontal through lateral relationships.

Reward Systems- Influence the motivation of organization members to make employees' goals in line with the organization's objectives.

People Policies- Influence and define employee's mindsets and skills through recruitment, promotion, rotation, training and development.

According to Galbraith, these five factors must be internally consistent to enable effective behavior.

In another study relevant for my dissertation, Audretsch and Thurik (2000) identified 14 characteristics that distinguish the entrepreneurial economy as opposed to its predecessor (the managed economy), and provides a framework for understanding how the entrepreneurial economy fundamentally differs from the managed economy. The 14 points of consideration and comparison are *localization versus globalization, change versus continuity, jobs and high wages versus jobs or high wages, turbulence versus stability, diversity versus specialization, heterogeneity versus homogeneity, motivation versus control, market exchange versus firm transaction, competition and co-operation as complements versus competition and co-operation as substitutes, flexibility versus scale, stimulation versus regulation, targeting input versus targeting outputs, local policy versus national policy, risk capital versus low-risk capital*. Such a framework provides a possible lens through which to interpret contemporary entrepreneurship.

iii Following work done by the researchers cited below, I calibrated this scale as "business-oriented" and "social-impact oriented". Business-oriented motivations and goals are ones where the company is driven by purely business goals such as capturing market, commercialization and profit maximization. Social Impact-oriented motivations and goals are ones where the company is driven by creating social change and community involvement rather than creating profits. This is a field of further study and theories of motivation have generally given scant attention to the influence of social impact.

Urdan and Maehr (1995) had mentioned that since the cognitive revolution took hold in psychology in the late 1960s and early 1970s, a number of social-cognitive theories of motivation have emerged (Dember, 1974). Self-efficacy studies (Bandura, 1986), attribution theory (Weiner, 1985), expectancy-value theory (Eccles et al., 1983), and achievement goal theory (Ames, 1984; Dweck & Elliott, 1983; Maehr, 1984; Nicholls, 1984) are four prominent examples of such theories.

Audretsch and Thurik (2000) stated that in an entrepreneurial economy motivating employees to participate in the creation and commercialization of new ideas matter more than in simply controlling and regulating behavior. Although several researchers have suggested that the study of goals should include social goals (e.g., Blumenfeld, 1992; Ford, 1992; Ford & Nichols, 1991; Maehr, 1984; Maehr & Nicholls, 1980; Wentzel, 1991), as Juvonen and Weiner (1993) have noted, theories of motivation have generally given scant attention to the influence of social impact. As summarized by Urdan and Maehr (1995), despite the lack of direct empirical findings regarding social goals, it seems clear that one must consider a variety of factors when trying to determine the consequences of social goals. Considerably less work has been devoted to examining the antecedents of pursuing social goals.

Ford (1992) presents a more detailed description of the several types of social goals people can pursue. He includes "Individuality," "Belongingness," "Self-De Considerably less work has been devoted to examining the antecedents of pursuing social goals. termination," "Social-Responsibility," "Superiority," "Equity," "Resource Acquisition," and "Resource Provision" as separate types of social goals in his taxonomy. Ford's description of these different types of social goals highlights their complexity. According to this taxonomy, and to the work of others who have examined

social goals, the effect of pursuing a social goal on motivation, cognitions, affect, and achievement in academic situations will vary depending on the type of social goal being pursued.

McClelland and his colleagues developed a theory of motivation based on the belief that humans are motivated by certain needs (Atkinson & Feather, 1966; McClelland, 1961, 1985). Based on Murray's (1938) model of needs, these researchers identified three types of needs to examine empirically: the need for achievement (nAch), the need for affiliation (nAff), and the need for power (nPower). Crowne and Marlowe (1960) added to the research on social motives by developing a measure of social desirability to record how strongly subjects felt a need to respond to questionnaire items in socially desirable ways. Perhaps the most common way of defining goals in the motivation literature is taken by researchers who examine specific performance outcomes. For example, studies of self-efficacy often discuss the effects of proximal and distal goals, which usually refer to specific performance standards or outcomes strived for (e.g., Bandura, 1986, 1991, 1993; Bandura & Cervone, 1983; Bandura & Schunk, 1981; Schunk, 1985, 1991).

Defining goals in terms of performance standards or objectives is common in research examining motivation and performance in both education and work settings (e.g., Locke et al, 1981). This way of defining goals differs from our conceptualization of goals and what Dweck (1992) referred to as the less specific, more superordinate types of goals that can direct students toward specific performance objectives.

iv Following Simon (1987), I calibrated this scale as "rational" decision making approaches and "non-rational and irrational" decision making approaches. According to Simon, the term rational (or logical) is applied to decision making that is consciously analytic, the term non-rational to decision making that is intuitive and judgmental, and the term irrational to decision making and behavior that responds to the emotions or that deviates from action chosen "rationally." Simon was convinced that a theory of decision-making had to give an account of both conscious and subconscious processes.

In a separate work, Barnard (1938) contrasted between "logical" and "nonlogical" processes for making decisions. Barnard's thesis was that executives, as contrasted, say, with scientists, do not often enjoy the luxury of making their decisions on the basis of orderly rational analysis, but depend largely on intuitive or judgmental responses to decision-demanding situations. In logical decision-making, goals and alternatives are made explicit, the consequences of pursuing different alternatives are calculated, and these consequences are evaluated in terms of how close they are to the goals. In judgmental decision-making, the response to the need for a decision is usually rapid, too rapid to allow for an orderly sequential analysis of the situation, and the decision maker cannot usually give a veridical account of either the process by which the decision was reached or the grounds for judging it correct. Barnard mentioned, "The sources of these non-logical processes lie in physiological conditions or factors, or in the physical and social environment, mostly impressed upon us unconsciously or without conscious effort on our part"

Allison (1971) constructed three different ways (or "lenses") through which analysts can examine events and make decisions: the "Rational Actor" model, the "Organizational Behavior" model, and the "Governmental Politics" model. Structured decision-making processes, even though they may appear to be straitjackets, have merit insofar as they are appropriately implemented and integrated into the decision-making routines of an organization (see March, 1994).

v Following research work done by Roberts (1991), Carroll and Mosakowski (1987), Kihlstrom and Laffont (1979) and Doktor (1978), I calibrated this scale as "professional" and "personal". By "professional" I mean that the entrepreneurs aim to run the organization in a streamlined process adhering to industry best practices and are analytical in their approach. By "personal" I mean that the entrepreneurs rely on a high degree of personal commitment and tenacity with a high tolerance for risk and experimentation. These entrepreneurs are more intuitive and flexible in their approach.

Roberts (1991) have stated that individual-level factors, such as the psychology of entrepreneurs affects new firm formation. Carroll and Mosakowski (1987) extended this work to include career experience of the individual entrepreneurs.

Individual-level arguments hold that when the individuals who discover opportunities are more experienced in firm creation (Carroll and Mosakowski 1987), more creative (Schumpeter 1934), more imaginative (Shackle 1979), more risk tolerant (Khilstrom and Laffont 1979), higher in need for achievement (Roberts 1991) or more tolerant of ambiguity (Begley and Boyd 1987), they tend to form new firms to exploit opportunities.

Carroll and Mosakowski (1987) show that entrepreneurship involves a significant component of learning-by-doing. This finding means that whoever obtains decision rights over a new technology can influence the mode of commercialization.

Doktor (1978) in his research work suggested that there is some evidence for the very plausible hypothesis that some people, confronted with a particular problem, make more use of intuitive processes in solving it, while other people make relatively more use of analytical processes.

vi Following Winter (1984) and Ciborra (2004), I calibrated this scale as “physical/hard” and “digital/soft”. Physical/ “hard” technologies refer to engineering and infrastructure based high tech regimes. By digital/“soft” I refer to core web and mobile-based technology regimes.

Schumpeter (1976) mentioned that technology is a major force in the process of creative destruction of capitalism. According to Winter (1984), technology regimes is an important industry-level factor influencing new firm formation. According to Ciborra (2004), digital technologies diffuse and enmesh with the structure of markets under this encompassing grid infrastructure, creating virtual enterprise networks and affecting more than ever the personal lives of workers, managers and consumers. Any breakdowns of these networks becomes potentially devastating for business and private lives, precisely because of the higher levels of integration and standardization achieve by the new technical platforms.

Utterback (1993) wrote about the relationship between the behaviors and strategies of firms with respect to technological innovation and long term survival. He mentions how new technologies have made industrial giants out of once small, upstart firms, invigorated those older ones that were receptive to change and swept away those that were not. To sustain success requires mastery of the infrequent discontinuities as well as mastery of the constant competitive and customer demands for rapid incremental improvement. Shane (2001) mentioned that the type of technology regime has a profound effect on the path taken by the new firm for commercializing its invention.

vii Following work done by the researchers listed below, especially, Burns and Stalker (1961), Galbraith (2001) and Cohen et al. (1972), I calibrated this scale as “explicit” and “organic”. By “explicit”, I refer to a structure that has well-defined tasks and a rigidly hierarchical system of decision-making. By “organic”, I refer to a structure in which tasks are flexibly defined and participants cooperate on the basis of expertise and not on hierarchical positions.

Several researches have looked at broad topic of how organizations are structured and its effect on their overall operation. Researchers such as Kenneth and Edwards (2005) have argued that there when it comes to observing the structure of organizations from a management perspective, the differences in structure, staffing, and goals are better treated as continuous variables rather than rigid conceptual distinctions.

Galbraith (2001) explained that the structure of the organization determines the placement of the power and authority in the organization. He explained that the structure policies fall into four areas viz. specialization, shape, distribution of power and departmentalization. Specialization refers to the type and numbers of job specialties used in performing the work. Shape refers to the number of people constituting the departments (that is the span of control) at each level of the structure. Distribution of power, in its vertical dimension, refers to the classic issues of centralization or decentralization. Departmentalization is the basis for forming departments at each level of the structure. The standard dimensions on which departments are formed are function, products, work flow processes, markets, and geography. Galbraith goes onto mention that hierarchies, albeit flatter ones, will still be around for some time. They are used to reach decisions among large numbers of people in a timely fashion. They provide a basis for an appeals process for conflict resolution. But

they are being implemented much more sparingly and in conjunction with alternative structures viz. specialization, shape, distribution of power and departmentalization.

Burns and Stalker (1961) stated that different structures of organizations are suitable for particular environmental conditions. An organization with well-defined tasks and a rigidly hierarchical system of decision-taking is argued to be appropriate for stable environmental conditions. Where the environment is changing, an organic form of organizational structure is deemed more appropriate, in which tasks are flexibly defined and participants cooperate on the basis of expertise and not on hierarchical positions. Jacobides (2007) mentioned that the structure of the organization provides the frames through which individuals see their world. It determines which individuals participate in particular decision-making processes, and thus to what extent their views shape the organization's actions.

As an example, Simon (1962) and Baldwin and Clark (2000) have explained how the division of labor not only enhances the ability to learn, but also allows more local experimentation. Lawrence and Lorsch (1967) mentioned that for all the problems of coordination and compartmentalization, divisionalization enables discrete aspects of reality to be tackled separately. They noted that the most effective organizations achieve a degree of differentiation and integration in organizational boundary-spanning functions that is compatible with environmental demands.

On the other hand, Henderson and Clark (1990) argue that divisionalization has short-run benefits, but inevitably leads to a loss of perspective. They suggest that, "as a product evolves, information filters and communication channels... emerge in an organization to help it cope with complexity. They are efficient precisely because they do not have to be actively created each time a need for them arises...[Yet] the channels, filters, and strategies may become implicit in the organization," and as such prevent some types of information from reaching the organization and restrict the innovations pursued.

Cohen et al. (1972) investigated how organized anarchies, i.e., organizations with ambiguous goals, reach decisions. Their model clearly implies that different ways of structuring the organization affect its ability to navigate its environment and effectively tackle its challenges. Singer (1986) stated that rather than generating centralization or decentralization, the new organizational media show signs of a kind of "social disassembly" of organizations, of the breakdown of social organization as we know it, carrying with it a dissolution of the authority based upon it, bred by omni-interconnectivity and by the speed of the new media.

In a related line of research highlighting hierarchies and structure, Garicano (2000) stated that hierarchies have the ability to allow those "lower down" in the organization to deal with the routine issues, reserving more unusual issues for the specialist problem solvers (managers). Bower (1974) mentioned that hierarchies have the power to change the direction of the organization through substantive decisions on "what should be done," or through asset allocation. Jacobides (2007) opinioned that, hierarchy can also help provide some real-time control of the organization's routine mode of operation, at the level of both actions and cognition.

Marschack and Radner (1972) and Radner (1992) argued that hierarchy, reporting structures, and divisionalization affect the speed and cost of information transmission in an organization. Several researchers such as Daft and Weick (1984), Dutton (1993), Ocasio (1997), Thompson (1967), Baldwin and Clark (2000), Siggelkow and Levinthal (2003), among others, have mentioned about the need for a dynamic view and rather than partitioning organizations on the basis of what types of activities tend to interact with each other, we should consider how any partitioning will affect an organization's ability to "see" parts of its environment.

viii Following work done by Shane (2001), Gaston (1989) and Gompers (1999), I calibrated this scale as "For-profit" and "Not-for-profit". By "For-profit", I refer to a primarily profit seeking business model which also requires high financing and capital investment. By "Not-for-profit", I refer to community driven and sponsored activities that require relatively low external financing and capital investment.

The topic of raising money via private investments and/or grants and foundation patronage is a well-researched topic. Shane (2001) in his research work on new firm creation has stated that a vital source of capital to start new technology companies is venture capital. Cohen and Levin (1989) mentioned that entrepreneurship is less likely to take the form of new firms when capital

market imperfections make it difficult for independent entrepreneurs to secure financing. Bartley's (2007) research work mentioned about how capitalization and/or foundation grants and patronage channels social movements away from radical activities toward moderate goals. He stated that foundation-led "field-building" activities might embed social movement organizations (SMOs) in new contexts and enrolls them in new projects, thus channeling protest in subtle ways.

Jenkins (1998) stated when it comes to capitalization and funding companies many foundations are more likely to select professional organizations than "indigenous organizations" for funding. Gaston (1989) and Gompers (1999) emphasized the role of venture capital, which has traditionally been a form of finance for high-risk, innovative new firms and the informal capital market as critical for the entrepreneurial economy.

^{ix} Following research work done by Mats Engwall (2003), Gaddis (1959) and Middleton (1967), I calibrated this scale as "explicit" and "flexible". By "explicit" I refer to project management approaches that are well structured, centralized and sometimes even rigid. By "flexible" I refer to approaches that are informal and highly adaptive in nature. Clegg (1990), Ekstedt et al (1999) and Whittington et al (1999) stated that projects are one of the most significant characteristics of contemporary organizations.

In project management literature, there are a lot of technical handbooks, which concentrate on project management processes and on how to run successful projects in different fields. There is also literature, which covers the 'theory' of project management, its fundamentals, processes, methods, tools and practical cases, and ideas of success. Suikki, Tromstedt and Haapasalo (2006) in their research work on competence development define project management as an application of knowledge, skills, tools, and techniques to project activities to meet project requirements. They mention that project management competence consists of understanding the project management knowledge areas, leadership skills, and business environment.

Artto et al (1998) and Lock (2000) mention that project management is a universal concept containing planning and managing the project-oriented activities. It has evolved in order to plan, coordinate, and control the complex and diverse activities of modern industrial and commercial projects. Lock (2000) stated that the purpose of project management is to foresee or predict dangers and problems as far as possible to plan, organize and control activities so that the project can be completed as successfully as possible in spite of the risks. It starts before any resources are committed and must continue until all work is finished.

The Project Management Institute (PMI) organizes project management competences into nine basic project management knowledge areas viz Project Integration Management, Project Scope Management, Project Time Management, Project Cost Management, Project Quality Management, Project Human Resource Management, Project Communication Management, Project Risk Management, Project Procurement Management.

Jalava and Virtanen (2000) stress the project manager's role in project leadership. They explain the different roles the project manager may have: visionary, integrator, organizer, and agent, and their meaning to project management. They present 10 core elements in project management viz developing a clear vision, seeing the whole project, co-operating continuously together with the project participants, intervening in deviations, preventing personal interests interrupting the project, being careful with recruiting, and developing competence, taking care of project atmosphere, taking care of information needed, evaluating, and taking a leader's role. Project management competence consists of understanding the project management knowledge areas, leadership skills, and business environment.

In a separate study, Engwall (2003) argues for the necessity to understand projects in their organizational and historical contexts in order to provide a broader perspective on project management. They illustrate how current findings suggest that project management success is to a large extent due to context-specific circumstances. Thus, a project management approach that is successful in one project, under certain circumstances, might be a failure in a different project, or under different circumstances. Consequently, their study supports a line of research arguing for a non-universal, contingency approach to project management. Gaddis (1959) and Middleton (1967)

wrote about the imbalance between too much responsibility and too little authority as a classical issue in project management literature.

^x Following research work done by Sanchez and Heene (1997), Prahalad and Hamel in the 1990s and Abell (1993), I calibrated this scale as “competition” and “cooperation”. By competition, I refer to a strategy where the firms prefer to behave autonomously and look at other firms in the industry purely as competition. By “cooperation” I refer to a strategy where the firms believe that by linking firm addressable resources, capabilities and competences in networks of cooperating firms, all firms in the network may increase their strategic flexibilities to quickly configure new resource chains to serve rapidly changing market opportunities.

Rumelt (2008) mentioned about how the most important element of a strategy is a coherent viewpoint about the forces at work, not a plan and the importance of a cohesive response to a challenge. Ron Sanchez and Aime Heene (1997) in their work on competence-based competition mentioned that it is important to note that many industries are now evolving new kinds of competitive environments that are not adequately explained by traditional strategy theory. As a remedy, the movement to build a theory of competence-based strategic management is developing new concepts of competition and cooperation that are adding new dynamic, systemic, cognitive, and holistic dimensions to the theory of strategic management. It is likely that the ‘core’ of a firm’s competence is likely to consist of an extended set of interdependent resources and processes that must be managed as a system. The notion of ‘core competences’ introduced by Prahalad and Hamel in the 1990s (Hamel, 1989; Prahalad and Hamel, 1990; 1993; 1995) suggested a new conceptual vehicle for bridging the economic and organizational divide in strategy theory and for integrating the fragmented middle ground.

Abell (1993) stated that a firm may pursue its goals through ‘dual activities’ of competence leveraging and competence building. The firms evolving choices of competence building and leveraging actions may lead to stable, converging, or diverging competence grouping of firms in an industry. Sanchez, Heene, and Thomas (1996) mentioned that a fundamental aspect of competence theory is that competition is fundamentally a contest between managerial cognitions in which managers compete to imagine, develop, and leverage the organizational competences that both determine near-term competitive outcomes and shape the competitive environments of the ‘industries of the future’ (Prahalad and Hamel, 1996). Sanchez (1993) had mentioned that in competence-based competition, a fundamental aspect of the work of strategic managers is perceiving possibilities for building new competences and for new ways to leverage a firm’s existing competences. By linking firm addressable resources, capabilities and competences in networks of cooperating firms, all firms in the network may increase their strategic flexibilities to quickly configure new resource chains to serve rapidly changing market opportunities.

Gomes-Casseres (1997) mentioned that while models of competition generally assume that firms behave autonomously, models of co-operation involve linkages among firms. These linkages take various forms, including joint ventures, strategic alliances, and formal and informal networks. Also important to note is Brandenburger and Nalebuff’s (1996) concept of “Co-opetition” which states that the successful modern business has to think as much about cooperation as competition. Accordingly, successful entrepreneurial ventures may benefit by focusing their strategy not just on competitors but to a broader economic and social environment in which the company exists and redefine success from beating the competitor to adding value to the overall ecosystem.

^{xi} Following work done by Galbraith (1956) and Audretsch and Thurik (2001), I calibrated this scale as “high-impact” and “low-impact”. By “high-impact”, I refer to a situation where regulations and policy have a profound affect on the company progress. By “low-impact”, I refer to a situation where regulations and policy can be juxtaposed by other factors and these companies are relatively immune to regulation and policies.

It can be observed that although politicians and policymakers have made a plea for guidance in the era of entrepreneurship, scholars have been slower to respond. Richard Rumelt (2008) mentioned about how many aspects of structural change for an industry will depend upon the government’s policy response. It is interesting to note that like many others, the

Gates Foundation rarely funds activist groups directly. But there is no doubt that its support for scientific, policy, and aid organizations shape the terrain on which social movements operate.

Galbraith (1956) is the seminal statement on the role of government in the managed economy, where state intervention typically involved the social partnership of big business, big government and big labor. However as Audretsch and Thurik (2001) stated, there has been a shift in focus in the entrepreneurial economy where the competitive source of economic activity is knowledge, which tends to be localized in regional clusters. As a result, public policy requires an understanding of regional-specific characteristics and idiosyncrasies. As an example, Jorde and Teece (1989) argued for the abolishment of the antitrust laws in order to enable American firms to co-operate and compete more effectively against their international competitors.