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Date: August 1, 2012

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GE's ecomagination Challenge: An Experiment in Open Innovation

In 2010, Beth Comstock, chief marketing officer and senior vice president at General Electric, sat in her office at GE's corporate offices in Fairfield, CT and pondered her next move. She had just reviewed the results of GE's ecomagination Challenge, and was making a mental tally of the problems and the accomplishments of that initiative. GE's ecomagination Challenge was "a \$200 million innovation experiment where businesses, entrepreneurs, innovators, and students shared their best ideas on how to improve our energy future."¹ Entrants could submit ideas to a panel of GE executives, leading academics, and technologists to evaluate the viability of ideas. In 2010, GE and venture capitalists provided \$71 million to various start-ups. During the upcoming second phase of investments in 2011, GE and venture capitalists planned to invest a similar amount in start-ups, but also wanted to select five \$100,000 Innovation Award winners to companies in the earlier phase of development. In addition, the entry receiving the most user-submitted votes would receive \$50,000.

The ecomagination Challenge was launched in partnership with venture capital firms Kleiner Perkins, RockPort Capital, KPCB, Foundation Capital, Emerald Technology Ventures, and Carbon Trust and was a key part of GE's business strategy to accelerate the development and deployment of clean energy technology and drive a global energy transformation. As part of its overall ecomagination commitment, GE planned to invest \$10 billion in R&D over a five-year period and "continue to increase operational efficiency, reduce the energy and water intensity of its operations, and grow ecomagination revenues."²

As GE's ecomagination Challenge engaged in an open innovation process within the company's traditionally closed R&D model, many new ideas had been identified in the green energy market space. But most of these ideas were uniformly early, extremely small in comparison to GE's own massive energy business, and were 18 months or more away from being ready to engage in any effective way with GE's energy business.

¹ <http://challenge.ecomagination.com/ct/a.bix?c=home>.

² <http://greenorder.com/2011/01/18/20.html?section=BLOG>.

Professor Henry Chesbrough prepared this case study with research assistance from Tania Dutta as the basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation. While GE executives generously gave their time, GE did not provide any funding support for the development of this case and bears no responsibility for the material in this case.

The following Monday, Comstock's boss, Jeffrey Immelt, the CEO of GE, expected a full report from her on the ecomagination Challenge. While he would want to know the results achieved to date and the lessons learned, Comstock knew that his real questions were going to be more practical. How were the newly created ventures going to create value for GE? Was this experiment something GE should do again in its energy business? Should it be done elsewhere in GE, or was this a noble failure that should not be repeated?

General Electric

GE was founded in 1892 out of a merger between Thomas Edison's business interests and Charles Coffin's Thomson-Houston Electric Company. It was one of the original 12 companies in the Dow Jones Industrial Average (formed in 1896), and is the only one of the original 12 still in the index. Today the company is an advanced technology, services, and finance provider, which tackles some of the world's toughest challenges. Built upon a culture of innovation that harkens back to Edison, the company is a leader in energy, health, transportation, and infrastructure. The company employs more than 300,000 people in more than 100 countries around the world.³

GE is also known for its leadership in management and the quality of its senior leaders. The company has made extensive investments in its own management education facilities in Crotonville, NY. Former CEO Jack Welch formulated a management process that focused GE on its best businesses, forcing the company to divest businesses that were unable to grow or held a poor market share position. Management reviews occupy much of the top managers' time at GE, and these reviews are closely connected to GE's strategic objectives in its main businesses. GE's skills in attracting and retaining high quality staff mean that its top managers are actively sought by executive recruiters around the world. When Immelt succeeded Welch as GE's CEO, some of GE's other top managers were rapidly recruited away to lead other world-class companies.

GE's revenues in 2010 amounted to just over \$150 billion, with its Energy Infrastructure business supplying \$37 billion of those revenues, and more than \$7 billion of GE's \$19.6 billion operating profit (see **Exhibit 1** for a Summary of GE's Operating Segments).

GE's Energy Business and ecomagination

GE's Energy business serves a variety of customers in power generation, industrial, government and other customers worldwide. The energy business offers both products and services related to energy production, distribution and management. It includes wind turbines as part of GE's renewable energy portfolio, which also includes solar technology. The business also offers aircraft engine derivatives for use as industrial power sources, along with gas turbines and generators that are used principally in power plants for generation of electricity and for industrial co-generation. GE's nuclear reactors, fuel and support services for both new and installed boiling water reactors are offered through joint ventures with Hitachi and Toshiba. The business also designs and manufactures motors and control systems used in industrial applications primarily for oil and gas extraction and mining.

GE's energy business also includes a wealth of service offerings that support its products. The business offers customers total solutions to meet their needs through a complete portfolio of aftermarket services, including equipment upgrades, long-term maintenance service agreements, repairs, equipment installation, monitoring and diagnostics, asset management, and performance optimization tools. The business is making new investments in areas of technology that complies with

³ Source: <http://www.ge.com/>.

more stringent environmental regulation, and water treatment solutions for industrial and municipal water systems including wastewater, mobile treatment systems, and desalination processes.

The scale and complexity of GE's energy business was a proud accomplishment that created new opportunities and challenges. The ecomagination initiative grew out of a desire to connect GE energy's disparate activities together under a powerful brand. Mark Little, SVP of Global Research at GE, spent many years in the Energy business. In his previous job, he helped to grow the power generation business within GE Energy from \$2 billion to \$10 billion. He remarked:

We kicked off the ecomagination theme in 2005. Initially we got a bit of backlash, since our customers were utilities and power generation companies. They thought we were somehow criticizing them. But once we got to explain the program to them they got excited. ecomagination gathered together many different things we were already doing in GE. We were growing our sales in renewable energy; we doubled our research spending in this area. We started getting even more traction once we created a label to connect our disparate activities together.

Tore Land, Director of ecomagination at GE, added:

ecomagination is GE's corporate strategy, built upon the idea of addressing unmet customer needs in the sustainable and renewable energy sector. We offer products and services that reduce our customers' environmental footprint and increase our customers' competitiveness. As a provider, we can help our customers and make ourselves more successful in the process.

The Need to Open Up: The Birth of the ecomagination Challenge

While GE's ecomagination initiative was well received, it forced GE to encounter some new and different entities that it did not have to deal with in its traditional energy business. The interest in renewable, "green energy" or "clean energy" was very high, and much of that interest came from organizations and individuals that GE currently did not do business with. Comstock said:

We started the ecomagination initiative in 2005 as an innovation platform to provide a focus for our capabilities in the clean tech space. Since that time, we have doubled our investments and greatly increased our sales. But there is only so much a single company can do. We ran into a very big problem: in order to really develop the clean tech space, we needed to develop an ecosystem of companies. That meant we needed ways to forge partnerships with a great many companies we didn't ordinarily come into contact with in our Energy business. To develop the technology for the smartgrid⁴, for example, is a very wide focus.

Because of the high level of interest in the green energy space, a significant amount of venture capital investment was flowing into the area. Estimates were that over \$1 billion of venture capital was invested in cleantech in 2007, with more than \$2 billion invested in 2008.⁵ Kevin Skillern, managing director of GE's Venture Capital group, commented: "Ten years ago, only 1 or 2 percent of VC funding was going into the energy sector. Today, 15 or 20 percent of global VC funds are going into energy. GE's got great processes, but we can't ignore all this external activity in one of our core

⁴ "A smartgrid is an electricity network that can intelligently integrate the actions of all users connected to it—generators, consumers, and those that do both—in order to efficiently deliver sustainable, economic, and secure electricity supplies."
<http://www.globalsmartgridfederation.org/smartgriddef.html>.

⁵ Venture Capital Investment in Clean Technology Grows Despite Decline in Overall Activity. Climate Change and Sustainable Business Solutions Update. Advisory Bulletin, 2008.

business areas.” A lot of other energy innovation activity was also underway in universities, research institutes, NGOs, and individuals.

This rapid increase in activity was challenging for GE to cope with. Land commented: “GE felt that its own development cycles were getting shorter and shorter, especially in areas like smartgrid software technologies, making it hard to keep up with the market relying only on our own internal resources.” Little also saw real challenges for GE’s business, noting: “This space is in its early stages, so you need a portfolio approach in starting projects. You don’t know which will prove to be the winning approach, so having multiple bets helps you cover the space better. And we don’t have all the good ideas inside GE; we cannot cover all the opportunities ourselves.” Land’s and Little’s perspectives were strongly consistent with those of a recent book on innovation called *Open Innovation*, written by the author of this case study.⁶

As these concerns were being considered, the idea of creating a challenge in the green and renewable energy space for outsiders to offer their own ideas to GE began to take shape. In this challenge, GE would ask the world to offer solutions that fit with the ecomagination theme, and commit \$100 million of its own money to launch companies for those responses that seemed the most promising.

Engaging the VCs

But the ecomagination Challenge was not limited to GE’s own support. GE executives also felt that there was an opportunity to do more by working with VCs already active in the energy space. Land said:

An ecomagination Challenge would harness the energy of entrepreneurs and VCs in service of the ecomagination strategy, and connect the individual solutions into a larger value proposition for our large customers. We felt that our Challenge would be more effective if we brought in outside partners, like VCs, to invest alongside us in these initiatives. The VCs look at the market with a different perspective than we do here at GE. Our GE commercial people have a deep understanding of the market, but it is from a GE perspective, conditioned by our own business model and previous experience. External VCs bring a different viewpoint, and might spot opportunities that our internal commercial people might miss.

There were concerns inside GE about this approach. Some managers in GE Research felt that the \$100 million to be spent on a Challenge by GE could be better used to support additional internal research. Some inside GE’s energy business felt that working closely with VCs would risk GE losing control over not only the external ideas being supported, but also potentially internal GE ideas that leaked out during the evaluation and due diligence process. Another suggestion was to listen to the startups looking for support, but not to disclose GE’s activities or business needs to them.

Still another potential issue was whether external VCs would even agree to participate in such a process with GE, which actually turned out to be a non-issue. “We found great interest when we approached VC firms,” said Land. “After we had four VCs agree (after some considerable discussion with them), I stopped asking for more VC participation to keep the process manageable.” Kleiner Perkins, Foundation Capital, Rockport Capital and Emerald Capital all agreed to join the ecomagination Challenge.

⁶ Henry Chesbrough, *Open Innovation: The New Imperative for Creating and Profiting from Technology*, HBS Press, 2003

However, the VCs themselves had some concerns and ground rules that had to be established upfront in order to attract them into the initiative. Chuck McDermott, a general partner at Rockport Capital recalled:

I told GE that we would be very interested in this idea. We could be your pilot fish, swimming ahead of you in the energy market, able to do stuff with startups that GE is too big to do. But there were some things we needed in place for this to work well. First, we had to have absolute discretion at our investment committee over whether or not we invest in any deal. And second, GE can't lock in companies that receive its investment in ways that hardwire their exit options to GE. Things like right of first refusal for GE couldn't be built into the investments.

Despite their concerns, VCs also viewed the opportunity to work with GE as an overall positive. McDermott noted: "We have come to realize the growing importance of "strategics" in the energy market. These are the large companies that really drive the development of the energy markets, and have the clout to take new technologies to market at scale.... This could accelerate our time to revenue recognition for our portfolio companies." Trae Vassello of Kleiner Perkins echoed this sentiment: "GE is a large, well-known brand, and is involved in complex energy sales to utilities. Building a better relationship with them was a prime reason for our involvement. We already have good relations with GE at the top, but less so in the business units." **Exhibit 2** depicts the partnership between GE and the VCs involved in the ecomagination Challenge.

The Launch of the ecomagination Challenge

On July 14, 2010, GE publicly announced its ecomagination Challenge (see **Exhibit 3** for the announcement). Jeff Immelt, CEO of GE, came in person and made the announcement. Since nothing like this had been done before, the GE executives did not know how many submissions to expect. Steve Liguori who worked for Comstock in GE Marketing, recalled their thinking: "We knew going in that we were not in the same league as Pepsi Refresh, or finding the next flavor for Mountain Dew. Or Doritos' deciding which commercial to run at the Super Bowl. We were a B2B situation. So we expected perhaps a few hundred entries." GE had assigned 12 people to review the initial submissions, including people from GE, from its VC collaborators, and independent experts such as Chris Anderson of *Wired* magazine and Olaf Groth of Monitor consulting.

However, GE began receiving ideas from people even before the announcement event itself had concluded. At the event, nearly 4,000 entries were received, with 1,600 companies and institutions participating, from 160 countries around the world. Many of these were not the "usual suspects". Liguori said: "The submissions came from a wide range of innovation sources—startup entrepreneurs, research institutes, universities, governments—an incredible source of diversity in ideas for us." (See **Exhibit 6** for some examples of ideas that were awarded). Skillern concurred: "Ecomagination gave us a wider aperture to invite and consider a much wider variety of possibilities, and committed us to a larger, more ambitious scale of investment activity. We were already investing in startups, but not at this aperture, with this level of ambition."

GE and its VC partners were unprepared for this level of response. Each reviewer had to deal with 10 times more submissions than initially expected. And some of the ideas received were unconventional, to say the least. Liguori said: "The judges were overwhelmed by the quantity of projects. This made it hard to get the right ideas to the right judges to evaluate them. We had one crazy idea, where someone suggested stocking ponds with electric eels, and putting a cord into the lake to get the electricity out. Yet this got just as much attention as some very serious, interesting ideas."

In addition, no single set of criteria was used to evaluate each submission. Each judge made his or her own judgment. In part, this was a consequence of the ground rules set up with the VCs in advance.

Daniel Hullah of Rockport explained: “I asked Tore, what is the scoring rubric that you want me to use? How can you be sure that my evaluation will be consistent with that of another judge? He said to me, ‘just judge them as you would any potential venture investment for your fund’”. Also, GE and the VCs looked at each potential venture from a different perspective. “GE’s metrics for success were different than ours. Every year, we develop a few theses for where we want to invest, and unless it is highly unusual, we say ‘no’ to everything else. Some parts of GE just were interested in seeing the ideas, even if there was no entrepreneur behind the idea,” Vassello remembered.

Results of the First ecomagination Challenge

As shown in **Exhibit 4**, nearly 4,000 responses were received to the ecomagination Challenge in July. A second round (or Phase) of responses was invited in January of 2011, though this second round was focused on ways to connect the smart grid to the home. Immelt also attended the second round, where this follow-on challenge was announced. That received roughly another 1,000 responses. About 75,000 people participated in the process, either through submitting an idea themselves, or commenting on the submissions of others.

Forty of the responses received became “finalists”, in the sense that the proposals were judged to be thoughtful, addressed an important need, and often (but not always) were backed by a promising team of entrepreneurs. As GE and its VC teammates sifted through these ideas, GE decided to make some additions to the ecomagination Challenge after the initial launch. Hullah of Rockport Capital remarked that:

GE also identified early on a second category of awards, where the ideas were good but too early to be investible ventures. These became the ecomagination Challenge award winners. I think they set aside five \$100,000 prizes for these ideas. Most of the submissions at the beginning were just ideas, not even close to a venture.... Even when GE didn’t invest, or give an award, those who submitted still got some value out of the process. In this way, GE really built a community around the ecomagination Challenge. They improvised well, and made many adjustments during the process.

Comstock had a similar perspective from inside of GE:

We also paid some challenge awards to winners where we didn’t invest. I came to view these as the equivalent of early stage investments. We also had some challenges ourselves. Our equity guys were used to participating in Series B and later investments. How do you model some of these very early stage ideas? A good example of this was an idea for a solar refrigerator in Africa. It didn’t get the temperature very cold, but it really helped reduce food spoilage. We didn’t invest in it, but the idea had real promise.

Boff of GE added that GE also improvised a third category of awards. She said that “it was a ‘people’s choice’ award, though we called it something different. That idea received \$50,000 from us as well. This last category of awards involved the least amount of time and money from us, but got a huge amount of coverage.”

Immelt attended the event during which the initial round of VC investment and the \$100,000 Challenge Awards were announced. Comstock also was enthusiastic about the process that led to these results. “I loved how the VCs challenged our research people, and vice versa. This productive friction created great new perspectives for us. Initially an idea might be dismissed by one or the other, but then they would discuss it. And slowly, sometimes a possibility would emerge out of the discussions, and the idea might be viewed much more positively than before.”

Out of the finalists, 23 ventures have been funded so far, with roughly \$140 million committed of the \$200 million pledged. Exhibits 5 and 6 list those ventures where this funding has been publicly announced, as well as the other award winners.

The Road Ahead

The ecomagination Challenge has led to a number of new startups being funded, but from GE's perspective, the hard work was just starting. "It's not easy for entrepreneurs to work with a very large company like GE," stated Land. ecomagination has become an interface between GE and the startups. When we receive a new proposal from a start-up, we try to translate that into something that will be relevant to one or more of GE's commercial managers. When GE makes an announcement, we try to figure out how to translate that into something that might be relevant for some of our startups."

Mark Little of GE Research found many of the proposals technically interesting. "Many of the submissions we received were in smaller wind turbines, with generating capacities in the kilowatt range. These have different customers and different distribution channels, in comparison with our own business. Much of the smaller stuff is installed 'behind the meter', generating power locally, so you don't need to pay for the distribution of power from a central generation source. These are not natural markets for us."

Vachon put the results to date into perspective. "There's a mismatch with our own established businesses. GE needs to generate a Fortune 500 company every year in order to grow at an acceptable rate. So these small firms' ideas are years away from the market, and many more years from enough revenue to matter to a GE business." Boff noted: "It is still the early days. We're one year in, with 23 investments. We estimated that it would take 12 to 18 months to get traction, and to get to know the companies. We have already made one acquisition that we would not have made as a result of the ecomagination program. That was definitely not on our radar prior to doing this. But this is something for the long haul, and we know we will need lots of bets."

In order for the ecomagination Challenge to pay off for GE, some of the nascent ventures would need to gain scale or accelerate the growth of an existing GE business. A team with an idea, an unproven business model and only a potential target market will not garner much attention from a nearly \$40 billion energy business inside GE. And people inside GE knew that many of these ventures would likely not succeed, though they had no way of knowing which ventures would make it and which would not. There was also the risk of competition with GE's own businesses. "We did have a situation where a VC team wanted to invest in a project that was viewed as a competitor by one of the GE businesses," Little recalled. "The business was worried that a GE investment would signal that GE didn't believe in its own technology, or that the competitor technology was as good or better as GE's own technology."

Little echoed the importance of scale to GE. "In the energy business, scale matters a lot. The ability to take a technology and scale it to a multi-billion dollar business, we're very good at that. We can add a lot of value on both the technology and the business side. We can infuse a lot of our technology to make the product more manufacturable in volume, and we have a supply chain that can handle much higher volumes than the supply chain of any nascent startup."

There was also the question of how to fit these ventures into GE. As Vachon said: "Sometimes a project sits between two GE businesses, or might span multiple businesses, such as a software solution for grid management that might also be used effectively in hospital management. We don't have a process to do these things. Our typical budget process eliminates funds for tests of such projects, since they are seldom core to any specific GE business." Skillern agreed, adding: "It's inherently hard for very large companies to work closely with startups. Often the startup's technology falls between

the cracks of two of our businesses, while the startup's business case has to be demonstrated. I don't think this is due to GE. It's true of any large company working with a startup."

As Comstock prepared her notes for the upcoming meeting with Immelt, she was proud of the results that the ecomagination Challenge had delivered so far. But she realized that these results came from the hard work of many GE executives who also had many other priorities to manage. She also knew that it would be difficult to measure the impact on GE's business performance for years to come. However, some of the relationships formed through the challenge seem to have the potential of accelerating the growth of some GE businesses, potentially adding several hundred million dollars in revenue to the GE growth.

The biggest challenge for GE would be to create processes and structures to make sure that at least some of these investments would pay off for GE in an even bigger way. She wondered if the ecomagination Challenge process is something that GE should do again, either in its energy business or elsewhere? Not all experiments succeed, and she knew that she would need to decide whether or not to replicate the ecomagination Challenge before the individual ventures had time to reach their long-term potential.

Exhibit 1 GE Revenue and Profit by Business Segment (from 10Ks)

General Electric Company and Consolidated Affiliates

Revenues (In millions)	Year				
Category	2010	2009	2008	2007	2006
Energy Infrastructure	\$37,518	\$40,648	\$43,046	\$34,880	\$28,816
Technology Infrastructure	37,860	38,517	41,605	38,338	33,735
NBC Universal	16,901	15,436	16,969	15,416	16,188
GE Capital	47,040	49,746	67,645	67,217	57,943
Home & Business Solutions	8,648	8,443	10,117	11,026	11,654
Total segment revenues	147,963	152,790	179,382	166,877	148,336
Corporate items and eliminations	2,248	2,488	2,199	4,679	2,509
Consolidated revenues	\$150,211	\$155,278	\$181,581	\$171,556	\$150,845
Segment Profit (In Millions)	Year				
Category	2010	2009	2008	2007	2006
Energy Infrastructure	\$7,271	\$7,105	\$6,497	\$5,238	\$3,806
Technology Infrastructure	6,314	6,785	7,460	7,186	6,687
NBC Universal	2,261	2,264	3,131	3,107	2,919
GE Capital	3,265	1,462	8,063	12,306	10,324
Home & Business Solutions	457	370	365	983	928
Total segment profit	19,568	17,986	25,516	28,820	24,664
Corporate items and eliminations	-3,321	-2,826	-1,909	-1,639	-1,188
GE interest and other financial charges	-1,600	-1,478	-2,153	-1,993	-1,668
GE provision for income taxes	-2,024	-2,739	-3,427	-2,794	-2,553
Earnings from continuing operations	12,623	10,943	18,027	22,394	19,255
Earnings (loss) from discontinued operations, net of taxes	-979	82	-617	-186	1,487
Consolidated net earnings attributable to the Company	\$11,644	\$11,025	\$17,410	\$22,208	\$20,742

Source: Public 10-Ks.

Exhibit 2 ecomagination Partners and Timeline

Innovation Challenge – Evaluation Process



* Short List - Submissions considered for (1) VC investment or commercial relationship, (2) R&D collaboration or (3) monitoring

** Awards include \$50k for most popular submission and \$ 500 k (\$100 k each) for 5 innovators

** Awards may include "GE Scientific Merit Award" to fund working relationship between challenge participant and GE GRC



ecomagination
2 / April 2010

Source: GE.

Exhibit 3 ecomagination Press Release

GE & Partners Announce \$200 Million Global Commitment to Accelerate Power Grid Technology Through Open Collaboration

San Francisco, CA – July 13, 2010 –GE (NYSE: GE) announced today a \$200 million open innovation challenge that seeks breakthrough ideas to create a smarter, cleaner, more efficient electric grid, and accelerate the adoption of more efficient grid technologies. GE Chairman and CEO Jeff Immelt unveiled the challenge, the “GE ecomagination Challenge: Powering the Grid,” here today. The global challenge invites technologists, entrepreneurs and start-ups to share their best ideas and come together to take on one of the world's toughest challenges - building the next-generation power grid to meet the needs of the 21st century. The challenge is one of the largest ever and is open immediately at www.ecomagination.com/challenge.

"Innovation is the engine of the global effort to transform the way we create, connect and use power," Immelt said. "At GE we have invested broadly and deeply in digital energy solutions and see this as a substantial market for us, but we can't do it alone. We want to work with our partners to make sure we have a comprehensive digital energy offering. This challenge is about collaboration and we are inviting others to help accelerate progress in creating a cleaner, more efficient and economically viable grid. We want to jump-start new ideas and deploy them on a scale that will modernize the electrical grid around the world."

The Challenge, launched in collaboration with leading venture capital firms Emerald Technology Ventures, Foundation Capital, Kleiner Perkins Caufield & Byer and RockPort Capital, and Chris Anderson, Editor-in-Chief, *Wired* magazine, is part of GE's ecomagination initiative, a global commitment to build innovative clean energy technologies and will help fund the most promising ideas. Proposals are sought in three, broad categories: Renewables, Grid and Eco Homes/Eco Buildings. Select Challenge entrants will be offered the opportunity to develop a commercial relationship with GE through:

- **Investment:** the \$200 million capital pledge of GE and its partners will be invested globally into promising start-ups and ideas
- **Validation:** evaluate entrant's business strategy through in-depth discussions with GE's technical and commercial teams
- **Distribution:** explore partnership opportunities with GE to scale a business and create global reach
- **Development::** leverage GE's technical infrastructure and GE Global Research Centers to accelerate technology and product development
- **Growth:** explore opportunities for utilizing existing GE customer to take Challenge products to market

The \$200 million commitment will help bring these new ideas to market by providing businesses and individuals with the opportunity to secure growth capital through GE investment and/or investment by participating venture capital firms. It is open to anyone aged 18 years or older and all legally formed entities.

GE CMO Beth Comstock said, "We took on a challenge when we launched ecomagination five years ago and we have learned about the power of partnerships to deliver clean energy solutions today. The challenge announced today is about collaboration and harnessing the promise of fledgling ideas and businesses to transform our energy future. We are confident in people's willingness to change the way the world uses energy and in the ideas that will make this possible."

"The Smart Grid is a new platform and a new market that is just beginning to be explored. Great ideas on how to do this can come from anywhere, so this competition is designed to tap the widest possible range of innovators, from big companies to entrepreneurs to students," said Anderson, who is serving as an advisor on the Challenge.

Over the course of 10 weeks, entrants will be able to submit their ideas via ecomagination.com. Entries will be evaluated as candidates for both a potential future commercial relationship as well as a \$100,000 innovation challenge award acknowledging their entry as an example of outstanding entrepreneurship and innovation.

The candidates for a future commercial relationship with GE will be evaluated by a committee of representatives of GE businesses and the challenge partner firms. A separate, independent judging panel including challenge advisor Chris Anderson, GE executives and leading academics and technologists will also provide input on the commercial relationship candidates, as well as select the five recipients of the \$100,000 innovation challenge award. Members of the general public will also be able to review and comment on entries and show support for the idea that they believe will have the most impact on the smart grid of the future. To view the full terms and conditions, visit ecomagination.com/challenge.

Modernizing the world's aging electrical infrastructure is critical to meet ever-increasing demands on the power grid, support more renewable energy and increase energy efficiency. Full smart grid implementation could reduce U.S. carbon emissions through efficiency and enable further reductions through new source management, make the most of current assets, and support thousands of new jobs. "Modernization of global electricity transmission and distribution systems have simply not kept pace with our society's growing demand for clean and highly reliable power," said Gina Domanig, Managing Partner of Emerald Technology Ventures. "Smart Grid innovation has been a significant area of investment focus for Emerald over the past decade and we are pleased to be a partner in the GE ecomagination Challenge."

Foundation Capital General Partner Paul Koontz said, "Global power grids make up the largest networks in the world. In most cases, the technology on which they are based is essentially 100 years old. The opportunity to reinvent how energy is produced, distributed and consumed is extraordinarily large and is critical in the battle against climate change. We're pleased to support GE's initiative to engage the entrepreneurial community, and the powerful innovation engine it represents, in this effort."

"Kleiner Perkins Caufield & Byers is committed to a sustainable energy environment and are working to reduce the world's dependency on fossil fuel-based energy through our growing portfolio of innovative Greentech companies," said Ray Lane, Managing Partner at Kleiner Perkins Caufield & Byers. We believe the Smart Grid is the information technology backbone that will enable faster scaling of energy innovations. Kleiner Perkins is proud to be a part of the GE ecomagination Challenge, and we are committed to working closely with GE and other investor partners to help commercialize the best Smart Grid innovations."

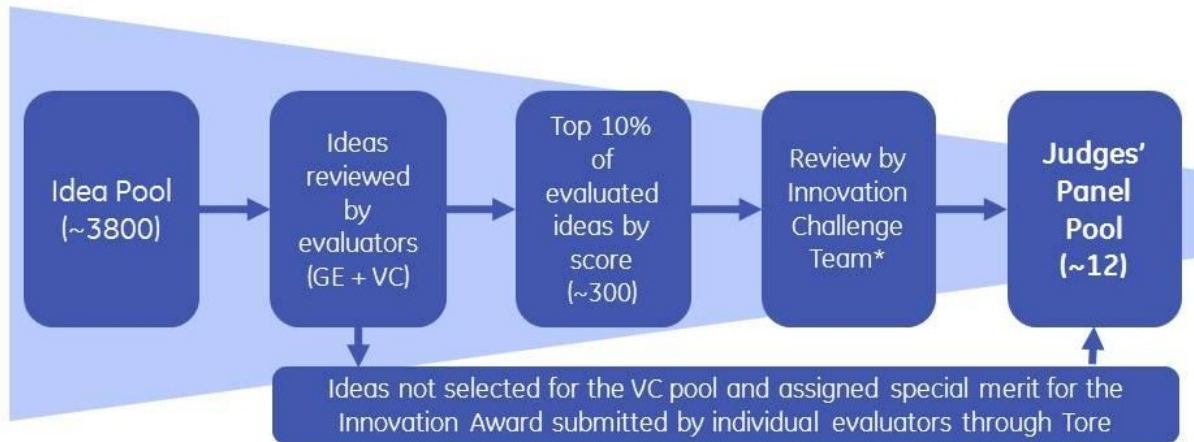
RockPort Capital General Partner Chuck McDermott said, "The electric power grid is the central nervous system of the global economy. Though today's grid is a 20th century engineering marvel, the smart grid of tomorrow promises to revolutionize how we manage our homes, offices and factories and to maximize the use of next generation clean energy resources. Through this challenge, we will match the best ideas and best entrepreneurs with GE's commitment to innovation, unparalleled technical knowledge and its deep penetration into the most vital areas of the world's energy infrastructure. Working together we can transform yesterday's grid into a 21st century marvel."

Source: GE.

Exhibit 4 ecomagination Review Process

Downselection Process

At each stage, ideas were evaluated based on the Innovation Award Criteria.



*Ideas selected by Innovation Challenge team screened additionally by Global Research



Exhibit 5 ecomagination Award Winners, November 16, 2010

“The GE competition winners include companies like Soladigm of Milpitas, Calif., a maker of “smart windows” that automatically switch from clear to tinted to control heat and glare. I wrote about Soladigm...in late July when it came out of stealth and announced it had raised \$30 million from billionaire Vinod Khosla’s Khosla Ventures.”

“Another winner: OPOWER of Arlington, Va., an energy efficiency and smart grid software company that already claims six of the ten largest U.S. utilities as customers. At VentureBeat’s GreenBeat conference two weeks ago, an OPOWER executive said more than once that the company was hiring.”

“GE’s Comstock noted that this was the first phase of awards related to the Ecomagination Challenge. GE expects to spend 12 to 18 months fielding more ideas and investigating them.”

Source: Excerpted from Kerry Dolan, “GE Picks First Dozen Smart-Grid Ecomagination Winners,” Forbes, November 16, 2010.

Exhibit 6 List of Publicly Announced Awards from ecomagination Challenge 2010

- **ClimateWell**, Stockholm, Sweden (Efficient Appliances). ClimateWell's energy-efficient cooling and heating systems run on solar-powered hot water rather than electricity, maximizing energy efficiency. This technology translates into a significant reduction of power consumption and carbon emissions. While initially targeting operations like hospitals or commercial buildings, GE is working with ClimateWell on deploying this technology in additional markets already served through GE's appliances business.
- **Consert**, Raleigh, NC (Energy Management Systems and Software). Concert's demand side energy management solution empowers utilities, municipalities and co-ops to manage load curtailment, increase operations efficiency and act as a virtual power plant. Concert's technology complements GE Digital Energy's existing solutions to meet the unique needs of these market segments.
- **FMC-Tech**, Ltd., Shannon, Ireland (Intelligent Sensor Technologies). The power line monitoring system for medium voltage networks serves as a nervous system for the smart grid and has applications for GE's Smart Grid Delivery Optimization. It integrates overhead line sensing, data storage, and wireless communication to a local controller to detect and locate faults in the smart grid and manage distribution communications, providing a platform for the present and future needs of the network.
- **Fu Foundation School for Engineering and Applied Science**, Columbia University, New York, NY (EV Charging Stations). A new collaboration with GE, Columbia Engineering, FedEx Express, and Con Edison to enable the conversion from hydrocarbon to electric delivery vehicles in New York City. Columbia Engineering's technology, developed by its Center for Computational Learning Systems, manages load and delivery and links electrical vehicle charging stations to the utility's electric distribution management system in real-time. FedEx is providing and operating the all-electric vehicles that the collaborative team will study. In addition to providing funding, GE will supply expertise from its Digital Energy division and GE's Global Research Center to support this program.
- **JouleX**, Atlanta, GA (Energy Management Systems and Software). JouleX provides a single, network-based, energy-management solution. The JouleX Energy Manager monitors, analyzes and automatically adjusts the energy usage of a network's connected devices and systems. It has the potential to reduce energy consumption by 30-60 percent. It will enhance GE's data center solutions to help customers reduce energy consumption in the data center. In addition, the technology will enhance Demand Response Management System capabilities in GE's Digital Energy business.
- **OPOWER**, Arlington, VA (Energy Management Systems and Software). OPOWER integrates consumer demographics, energy consumption data and behavioral analytics to encourage households to make intelligent choices around power consumption in their homes. The average user reduces consumption by about 2.5 percent per month, helping to deliver savings. With GE's global work in Smart Metering and Automatic Metering Infrastructures, OPOWER can help utilities secure buy-in from consumers and public utility commissions.
- **Scientific Conservation**, San Francisco, CA (Energy Management Systems and Software). This platform monitors and manages energy drift in commercial buildings through predictive maintenance of core energy systems: heating, ventilation, air conditioning, refrigeration, lighting, controls and renewable sources. Using its patent pending diagnostics, it typically improves efficiency covering the cost of installation in less than two years. The technology has applications for GE's Intelligent Platforms building management software business and provides conservation opportunities for GE's real estate portfolio and GE buildings.

- **SecureRF** Corporation, Westport, CT (Utility Security). SecureRF provides security solutions that address lower-powered embedded devices that will be used throughout the Smart Grid. Its Algebraic Eraser™ is a public-key cryptography method designed for resource-constrained devices like meters and sensors. GE's Digital Energy business can draw on this security technology for the smart grid to help utility customers alleviate consumer privacy and data security concerns.
- **Sentient Energy**, Burlingame, CA (Intelligent Sensor Technologies). Sentient develops advanced grid monitoring solutions that consist of modular intelligent monitoring devices and software applications, enabling cost-effective distribution automation. It improves fault location, cause analysis and remediation, grid capacity management, and utility workforce utilization, presenting integration and partnership opportunities for GE Energy's Digital Energy offerings.
- **Soladigm**, Milpitas, CA (Building Efficiency). This window technology electronically switches glass from clear to tinted, enabling control of heat and glare. It can reduce energy usage for heating, ventilation and air conditioning (HVAC) systems by 25 percent and reduce the HVAC peak load by 30 percent, an important tool to level demand for the future smart grid infrastructure. With GE's green homes and green hospitals ecomagination programs, its zero energy home program and other energy efficiency initiatives, there are multiple paths for commercial relationships with the technology
- **SustainX**, West Lebanon, NH (Energy Storage). This technology provides isothermal, compressed-air energy storage technology to enable cost effective, grid-scale energy storage. SustainX's approach has the potential to be less than half the cost of traditional compressed-air energy storage. The technology presents opportunities for collaboration with GE's Global Research Center and commercial partnership opportunities with GE Energy to commercialize energy storage applications and to enable a higher percentage of renewable power generation in markets like Europe.
- **SynapSense Corporation**, Folsom, CA (Data Center Services). Using a robust wireless sensor network, SynapSense's solutions measure and manage the environmental conditions and power usage throughout data centers, resulting in a 10 percent reduction in overall energy consumption for typical, enterprise-class data centers. The technology offers commercial relationship opportunities with GE's Digital Energy business and its Intelligent Platforms business with its visualization and energy management offerings.

There were also five innovation winners that will each received \$100,000 to develop their ideas, and another set of companies will be given \$10,000 for being "best in show." The innovation winners are:

- **Capstone Metering**: Intelligent Water Meters – Carrollton, Texas. A smart water meter that can generate its own power using water and help conserve water.
- **ElectricRoute**: Secure Communications Network for the Electric Grid, Salem and Hollis, New Hampshire: Secure network infrastructure to connect substation to transmission and distribution systems.
- **GridON**: Controlling Power Quality in Electric Grids, Givatayim, Israel. The technology involves a fault-current-limiter that increases grid reliability and enables more intermittent renewables by limiting short-circuiting and outages from overloads.
- **IceCode**: Wind Turbine Blade Anti-Icing and De-Icing, West Lebanon, NH. High-power pulses remove ice from turbines, limiting the downtime of the turbines. The technology can also be applied in refrigeration and other applications.

- **WinFlex**: Inflatable Wind Turbines, Kiryat Yam, Israel. Trading steel for inexpensive cloth, these wind turbines reduce the return on investment and cut installation costs.

Source: GE.