

# Poised for Profit

IN SMART ENERGY

*How the Pacific Northwest can be a leader in the emerging Smart Energy Industry*



E X E C U T I V E S U M M A R Y

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POISED FOR PROFIT II:  
PROSPECTS FOR THE SMART ENERGY SECTOR  
IN THE PACIFIC NORTHWEST

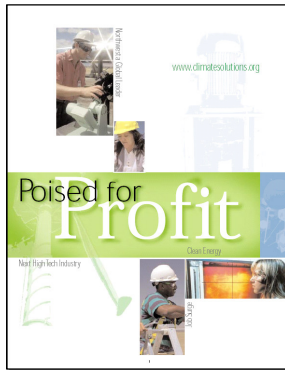
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### **POISED FOR PROFIT: PROMOTING A NORTHWEST CLEAN ENERGY INDUSTRY**



In 2001, eight economic development and energy agencies from Oregon, Washington, and British Columbia commissioned a study: *Poised for Profit: How Clean Energy Can Power the Next High-Tech Job Surge in the Northwest*. The resulting report revealed that the clean energy sector could be twice the size of the aircraft industry within 20 years. What's more, it could generate as many as 30,000 new jobs. That first report is available at [www.climatesolutions.org](http://www.climatesolutions.org).

A new partnership has come together to fund *Poised for Profit II*, follow-on research to support a world-class clean energy industry in the Northwest. Through the work of The Athena Institute, the project has produced a series of reports containing critical information for investors, entrepreneurs, and policymakers. These tools include:

- Research and analysis to pinpoint the largest and best opportunities
- Surveys of investor and utility plans
- Directories to research reports, related companies and helpful resources

This document is part of a research module called the Preliminary Analysis of Near-Term Opportunities. It reports on the market opportunities for Smart Energy technologies. Other documents in the module cover near-term prospects in wind, solar and fuel cells.

### **ABOUT THE PARTNERS**

*Poised for Profit II* was jointly funded and guided by the following organizations and members of the Poised for Profit Steering Committee:

- **Bonneville Power Administration:** Mike Hoffman and Kevin O'Sullivan
- **City of Portland:** Jeff Cogen and Curt Nichols
- **NW Energy Technology Collaborative:** Lee Cheatham and Jeff Morris
- **Oregon Institute of Technology:** Howard Thurston
- **Oregon Office of Energy:** Mark Kendall
- **Leading Edge British Columbia:** Anton Kuipers
- **Pacific Northwest National Laboratory:** Mike Lawrence
- **Portland Business Alliance:** Molly Moore
- **Portland Development Commission:** Ann Griffin
- **Portland General Electric:** Joe Barra

- **Seattle Office of Economic Development:** Ben Wolters
- **Washington Office of Trade and Economic Development:** Tony Usibelli and Tim Stearns

## **ABOUT CLIMATE SOLUTIONS**

The *Poised for Profit* initiative is managed by Climate Solutions, a public interest group that works to make the Pacific Northwest a global warming solutions leader. Since 1998, the group has targeted development of a Northwest clean energy technology industry cluster as a globally significant contribution the Pacific Northwest can make to reduce greenhouse emissions. Climate Solutions generates leading-edge information and knowledge on clean energy technology and the economic opportunities it presents. The organization issues reports, organizes conferences and builds cross-cutting alliances to further the goal of rapid energy transition.

## **ABOUT THE ATHENA INSTITUTE AND THE CENTER FOR SMART ENERGY**

**The Athena Institute** is a research organization that helps executives and organizations find success in emerging markets. Its methodologies and insights have been implemented by many organizations, ranging from Fortune 1000 corporations to public policy agencies.

**The Athena Center for Smart Energy** ([www.centerforsmartenergy.com](http://www.centerforsmartenergy.com)), the industry's guide to the value chain, is operated by The Athena Institute. The Center is dedicated to making North America the leader in Smart Energy innovation. The Center's research and acceleration programs help businesses and investors pursue their strongest opportunities in the Smart Energy sector.

## **ACKNOWLEDGEMENTS**

The Athena Institute would like to recognize the following companies and individuals for their contributions to the *Poised for Profit* initiative in general and this report in particular.

For catalyzing the project and providing oversight, we acknowledge Climate Solutions, with special recognition to Rhys Roth.

For expert comments and research materials, we wish to thank:

- Peter Arias, Reed Global
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- Liz Thomas, Preston/Gates/Ellis
- Wal Van Lierop, Chrysalix Energy

We also acknowledge and thank the more than 135 individuals who gave of their time for discussions with Athena analysts during the course of this study.

We are especially appreciative of the co-funders and members of the Steering Committee, who provided ongoing advice and assistance.

## **ABOUT THE RESEARCH INITIATIVE**

The Athena Institute was tasked to investigate near-term market opportunities in Oregon, Washington, and British Columbia for selected clean energy technologies. At the direction of the Steering Committee, we focused on opportunities that could see commercial success within five years, with emphasis on “cluster opportunities.” The Milken Institute defines clusters as “agglomerations of interrelated industries that foster wealth creation in a region.” (For example, Washington’s King County is known for its aerospace and software clusters.) This report relates to the prospects for regional cluster success. It does not address the prospects for individual companies or the economic benefits related to constructing and operating clean energy facilities such as job creation from wind farms or the economic benefits of spending less on imported energy.

Viewed through this filter, Smart Energy emerged as an area with significant near-term opportunities for the Northwest. Smart Energy is the application of digital technologies to the generation, delivery, and use of power. The use of the term “Smart” captures the fusing of intelligence into the existing system.

This document is an extract of a larger report that covers the Smart Energy sector. (That report can be downloaded at [www.centerforsmartenergy.com](http://www.centerforsmartenergy.com).) The challenge of the Smart Energy report was to create a coherent picture of an emerging sector not yet clearly defined. We first developed a way to organize and describe the sector. Then we uncovered those niches that represent the best opportunities for the Northwest. Because a taxonomy for this previously ill-defined industry has not yet been created, this Smart Energy sector report focuses at a broader level of analysis than the reports for fuel cells, solar, and wind.

## INTRODUCTION

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The world's electric power industry is in the early stages of an unstoppable change. A new wave of digital technology has arrived, promising to dramatically improve the generation, transport and use of electricity. Along the way will come enormous new opportunities, enormous new companies, and enormous new revenues.

*"The Northwest has the capability to become the epicenter of a dramatic transformation of the energy system. We can move the grid as we know it into the information age."*

Mike Lawrence  
Associate Laboratory Director  
PNNL

The rewards will go to regions, companies and individuals that seize the chance. If the Pacific Northwest becomes one of those leaders, it can gain an industry of distinction to rival current mainstays such as aerospace, biotech, forest products and software. As this research reveals for the first time, the Northwest already has a head start. The region has quietly become one of the world's leading centers of Smart Energy research, products and commercial activity. Taken together, Oregon, Washington and British Columbia house more than 225 Smart Energy companies doing in excess of \$2B in annual revenues.

This executive summary is structured in a similar fashion to the full Smart Energy report. It outlines the sector, including issues and market potential. It inventories the region, its assets and its challenges. And it reveals the opportunities -- the specific market niches that could bring near-term growth and revenue. It mirrors the full report, which is divided into five areas:

- **Market Overview** -- an introduction to Smart Energy technologies and markets
- **Market Drivers** -- the factors promoting market growth
- **Market Barriers** -- the hurdles and obstacles
- **Market Potential** -- the 14 segments with near-term growth potential around the world
- **Regional Potential** -- the Northwest's assets, challenges and opportunities, plus an overview of ways to accelerate progress

The full report, available on [www.centerforsmartenergy.com](http://www.centerforsmartenergy.com), provides a more in-depth discussion, additional details, charts and illustrations, research support for the findings, mini-profiles of leading regional companies, plus an appendix that describes the project and its methodology.

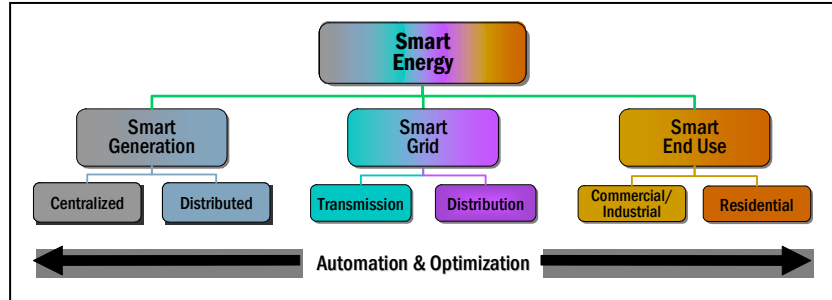
## MARKET OVERVIEW

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Smart Energy is the application of advanced technology to the electric power system, one of the few industries yet to feel the full impact of computerization. It spans the entire value chain, from creation (generation) to transport (grid) to consumption (end-use). Smart Energy has three subsections (see Figure 1):

Figure 1  
Electricity Value Chain

*“Smart Energy” (automation and optimization) extends throughout the electricity value chain.*



1. **Smart Generation** involves the production of electricity in ways that are more efficient and more controllable. Smart Generation includes alternative energy sources. *This document does not cover Smart Generation (or the subcategory Smart Storage).*
2. **Smart Grid** products help design, analyze, transform, control, condition, switch, monitor, protect and optimize electricity transmission (high-voltage) and distribution (medium voltage) with products such as intelligent switches, digital relays and advanced meters. *Many of the best near-term opportunities are in the Smart Grid area.*
3. **Smart End Use** includes products and services to increase efficiency and reduce peak loads. Energy management software and services, smart motors, intelligent load shedding and building automation systems are all examples of solutions that streamline operations while saving energy. *Some near-term opportunities are all or partially in the End Use area.*

## A SUBSET OF AN ENORMOUS MARKET

Smart Energy is part of one of the world’s largest industries. The U.S. market for retail electricity -- the nation’s “electric bill” -- is \$247B annually. The global retail market is an estimated \$800B. Managing this flow of electrons is a Herculean task that creates many market opportunities.

Some of the largest opportunities are related to the grid -- the infrastructure that transports electricity from the point of generation to the point of consumption. According to the Freedonia Group, the market for grid equipment amounts to \$17B in the U.S. and \$70B worldwide.

Many end-use opportunities are substantial as well. Electric motors represent as much as \$12.5B in annual sales, uninterruptible power supplies \$3B, and energy consulting and services \$2.5B, to name just three examples.

Although the bulk of these sales still go to analog and electromechanical devices, the transition to digital is well underway. Smart Energy products capture a higher percentage each year.

### SIX CUSTOMER SEGMENTS LEAD THE MARKET

Six customer segments represent the bulk of the spending in Smart Energy:

- Utilities
- Transmission organizations
- Independent power producers
- Energy service providers
- Large energy users (commercial, industrial, large multi-family)
- Moderate energy users (small business and residential)

Utilities represent the single largest market for Smart Energy products, as well as the single largest distribution channel to the other customers. As utilities recover from the financial crisis of the early 2000s, they will drive Smart Energy sales to new levels.

Large energy users are also a key segment for many Smart Energy products. Large corporations can often save hundreds of thousands -- even millions -- of dollars with Smart Energy products and services. Equally important, they can use Smart Energy products to improve power quality and reliability. High-quality, uninterrupted power has become essential to many businesses.

Some Smart Energy efforts focus on adoption by residential and other moderate energy users. We believe widespread residential adoption will occur far beyond the near-term horizon of this research.

## MARKET DRIVERS

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Six powerful forces are driving the Smart Energy sector worldwide.

### AGING INFRASTRUCTURE THAT MUST BE UPDATED

*"Our nation's transmission system over the next decade will fall short of the reliability our economy requires."*

Spencer Abraham  
U.S. Secretary of Energy

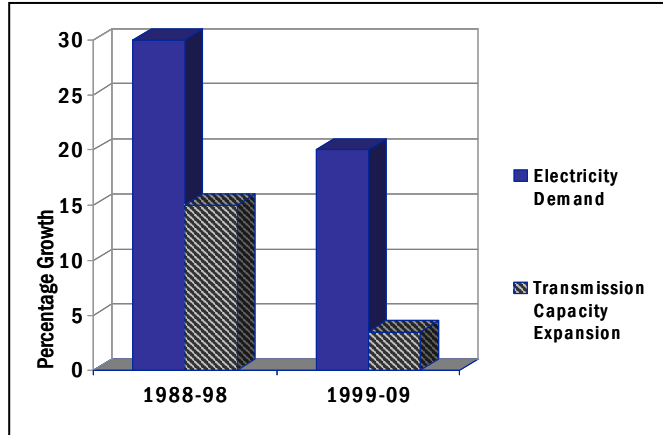
As the August 14, 2003 blackout made all too clear, the U.S. electricity infrastructure is inadequate for current needs and falling further and further behind. (See Figure 2.) It is in urgent need of billions in upkeep and upgrades. More and more of those improvements will be made with Smart Energy products in place of old-line electromechanical systems.

According to the Electric Power Research Institute (EPRI), the industry's capital expenditures during the 1990s were only 12% of revenues. That's less than half the historical average and the lowest ever except for the Great Depression. EPRI says

*Figure 2  
The Growing Transmission Gap*

*For the 10 years from 1988 to 1998, U.S. transmission capacity grew at half the rate of electricity demand. Predictions are that the performance will be even worse over the next 10 years, dropping to less than one-fourth.*

*Source: Pacific Northwest National Laboratory*



the U.S. has been experiencing an investment deficit of \$20B per year. That deferred investment is now coming due. The nation will either pay to update the infrastructure, or it will experience continued degradation in power quality, reliability and cost. Power outages already cost the nation more than \$100B per year, according to EPRI’s calculations.

## GROWING DEMAND FOR HIGH-QUALITY POWER

*“It is not the cost of electricity that drives our decision-making process; rather it is the cost of NOT having electricity.”*

Jeff Byron, Energy Director,  
Oracle Corporation

At the same time the infrastructure is deteriorating, the demand for electricity is rising. The Energy Information Agency predicts electricity demand will double in the next 20 years. The demand for “premium power” -- electricity free of fluctuations and interruptions -- will grow even faster. Today’s sophisticated medical, military, safety, and industrial electronics require uninterrupted and highly conditioned service. Once again, Smart Energy provides solutions. It increases supply by making more efficient use of electricity. It increases reliability by predicting, monitoring and preventing problems. It increases quality through sophisticated power conditioning.

## GROWING DEMAND FOR ALTERNATIVES TO CENTRALIZED GENERATION

*“Over the next 10-15 years, distributed generation will grow much bigger than people think right now.”*

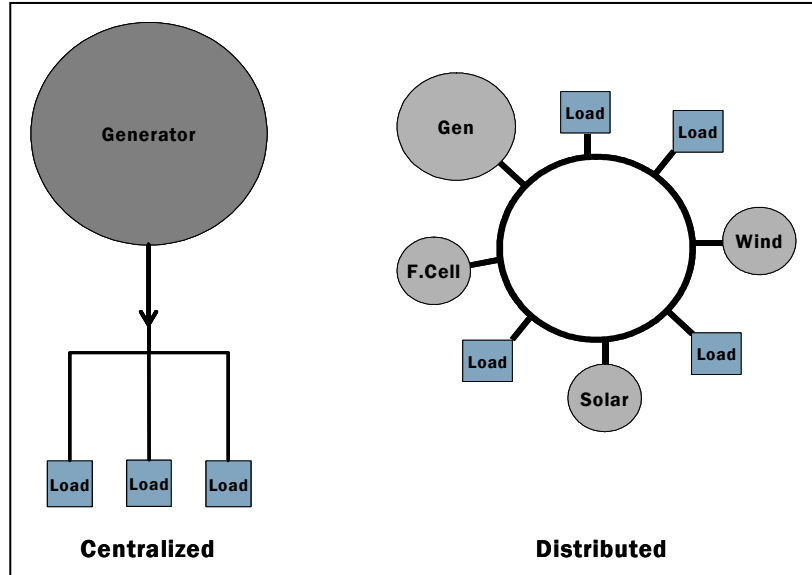
Bruce Sampson, VP  
Sustainability, BC Hydro

Recent decades have seen a move away from the traditional centralized approach. One part of this trend is “distributed generation” (DG), which supplements centralized power plants with smaller facilities near the customer. Scattered DG plants would shorten construction times, cut capital requirements, reduce transmission needs for high-voltage transmission and lessen the vulnerability to terrorism and system-wide blackouts. (See Figure 3.)

Increasingly, that distributed power comes from alternative sources, a trend known variously as “clean energy,” “green power,” “renewable energy,” or “alternative energy.” At the same time, interest is growing in “demand management,” a variety of ways to briefly reduce consumption during peak times.

Figure 3  
Distributed Generation

Centralized generation (left) features a large central plant that ships power to distant customers. Distributed generation (right) scatters power plants throughout the system, locating them much closer to customers.



Adapted from NewERA

For instance, a device at the customer premises may turn down a thermostat or briefly shut off a water heater in response to a signal.

The growing demand for these approaches simultaneously increases the demand for Smart Energy. Distributed generation requires monitoring, managing and connecting to the grid. Electricity from renewables must be inverted, conditioned, and controlled. Demand management requires smart meters and smart devices.

## RAPID TECHNOLOGY ADVANCES

*"The very thing that has transformed any number of industries is about to transform the electric power industry -- that is, computers and technology."*

Clark Gellings  
VP Power Delivery and  
Markets, EPRI

Today's power delivery system was designed in the 1950s and installed in the 60s and 70s, before the era of the microprocessor. Technical advances now make it possible to upgrade the system with digital reliability and responsiveness. Many of the core concepts were pioneered and proven in business computing, telecommunications and the Internet. With much of the learning curve out of the way, it becomes relatively simple to apply those same technologies to the electric power industry. These advances set the stage for the rapid growth of the Smart Energy sector.

## INCREASED GOVERNMENT SUPPORT

Governments around the world have greatly increased their attention to electric power issues. They are motivated by fear of blackouts, climate change, rising energy costs, dependence on foreign oil and vulnerability to terrorist attack. Governments increasingly see digital technology as a way to make electric power cleaner, more reliable and less at risk. As a result, they are spending billions each year on a variety of incentives for clean energy and for Smart Energy.

*“Annual investment into the grid could roughly double, depending on imminent energy legislation.”*

Randy Schrieber  
VP Strategic Operations, ABB

As this report goes to press, the U.S. Congress is debating an energy bill that contains significant provisions for grants, demonstrations, and incentives that would spur Smart Energy growth. The government of Canada has numerous agencies and programs in support of sustainability and renewable energy. Bonneville Power Administration (BPA), a federal agency, has a “non-construction alternatives” policy that considers ways to meet needs through efficiency and Smart Energy before it considers building new transmission lines.

There’s lots of activity at the state and provincial level as well, including in Alberta, California, Connecticut, Ontario, Michigan and Texas. Some regions are mandating stricter standards or adopting minimum green energy requirements for utilities. Others are using public funds to stimulate clean energy and Smart Energy companies. British Columbia has green power targets for utilities and plans to spend C\$600M over the next 10 years to reduce demand through efficiency and energy technology. BC, Oregon and Washington all provide incentives for the installation of renewable energy and programs to stimulate market demand for energy efficient products.

## **MARKET RESTRUCTURING**

The electric power industry is restructuring in some parts of the world. Areas of the industry that were previously closed off to competition are now open, leading to new market opportunities and fast-growing new companies, many of them related to Smart Energy. Competitive environments cause utilities and other energy companies to look for ways to reduce head count and the need for large capital investments. The automation and optimization of Smart Energy can often provide a solution to the need to do more with less.

## **MARKET BARRIERS**

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Despite the powerful forces on the side of growth, the Smart Energy sector faces hurdles. We expect that digital technology will ultimately transform the electric power industry, ensuring its ability to serve the growing need for reliable, affordable, high-quality electricity. However, the pace at which this transformation takes place is uncertain, due to numerous challenges and roadblocks, the most significant of which are described below.

## **REGULATORY CONFUSION SLOWS PROGRESS**

The North American regulatory situation is literally too complex to cover in this report -- and that complexity is a big part of the problem. The U.S. is a confusing patchwork of overlapping federal, regional, state and municipal agencies. The U.S.

*“Nothing can go forward until the financial health of the electricity industry is stabilized and clarity over the rules, roles, and responsibilities of electricity regulation is reestablished.”*  
EPRI “Electricity Sector Framework for the Future”

power industry is neither fully regulated nor completely deregulated. Canada also has multiple jurisdictions. Some provinces, such as Alberta, have deregulated. Others, such as British Columbia, have produced hybrid, partially deregulated systems. Still others retain a regulated structure.

Regulatory confusion is the single greatest challenge to the growth of Smart Energy. Debates are raging on whether to:

- Create Regional Transmission Organizations in charge of the transmission grid.
- Mandate reliability standards.
- Impose a Standard Market Design.
- Reveal true pricing to customers.
- Allow construction of new high-voltage transmission.
- Allow utilities to recover the costs of new technology in their rates the way they recover the cost of new power plants.
- Reward utilities for implementing energy efficiency.
- Require utilities to include green power as part of their energy mix.
- Create credits and incentives for alternative energy and smart meters.

The Federal Energy Regulatory Commission, the Department of Energy, the U.S. Congress, the Canadian Parliament and various provinces and states are grappling with these issues now. If they make serious progress, 2004 and 2005 could see a substantial improvement in Smart Energy fortunes. If stabilization is delayed, market expansion could be delayed as well.

## **LACK OF MARKET ACCESS HOLDS BACK NEW COMPANIES AND TECHNOLOGIES**

Many observers believe that deserving Smart Energy technologies don't get a fair hearing in the current climate. They describe the extreme difficulty of selling to utilities. More than one venture capitalist reported shying away from companies that sell only to utilities, because it takes years to get those utilities to consider a new idea.

Part of the problem lies with regulations that make it hard for utilities to get their money back, as mentioned above. Part of the problem lies with a lack of standards, forcing new companies to re-engineer and resubmit their designs to each utility (including well over 3,000 utilities in North America alone). And part of the problem lies with the dynamics of this market.

### **COMPETITIVE DYNAMICS**

It is difficult to capture the competitive dynamics of such a large and fragmented sector. Even so, a few generalities apply.

On the grid side, sales are dominated by a few global giants such as General Electric, Siemens and ABB, all with U.S. headquarters on the East Coast. They have long-standing relationships with utilities and distributors. All three groups -- suppliers, distributors and utilities -- have been conditioned by a half-century of business in a regulated industry. They have many reasons to be cautious and few incentives to be experimental. Sales cycles are extremely long. Both suppliers and customers tend to be large, bureaucratic and resistant to change. They tend to look to the East Coast and Europe for their partnerships. They seldom acknowledge the Pacific Northwest as a source of electric power innovation or expertise. At the same time, there is a high degree of uncertainty about who is responsible for upgrading the grid, making it unclear just who is the customer.

On the end-use side, most product sales go through large chains and large distributors. Again, it can be extremely difficult to gain access to those big players and their market clout. When it comes to energy services, few national players have emerged. Energy consultancies and energy service companies tend to be local or regional players, pointing to the difficulty of expanding a service model to national or international scale.

These competitive dynamics -- poor access to sales channels and long, difficult sales cycles -- stand as roadblocks to the expansion of Smart Energy. They are not insurmountable, but they do require startups to think proactively about channel relationships and strategic partnerships.

### **SHORTAGE OF CAPITAL INHIBITS GROWTH AND STARTUPS**

The regulatory and market access problems mentioned above have investors sitting on the sidelines. In some cases, they are waiting for tax credits or incentives, which have a history of coming and going. In most cases, though, they are waiting for clarification. This hiatus applies to venture capitalists, who don't know which markets will be allowed to grow; to project financiers, who don't know which technologies will get approvals and incentives; and to utilities, who don't know how or whether they can recover the costs of technology investments.

The capital shortfall has other causes as well. Most venture capitalist and angel investors do not know about Smart Energy or understand its parallels to the software and semiconductor industries. They also have concerns about regulatory barriers; about longer times until payoff; and about the lack of standards that would permit a large market to grow exponentially. As a result, they rarely look at

deals in the energy space. At the same time, venture funding from utilities, which hit unprecedented levels in the late 90s, have now virtually disappeared.

To be fair, finding startup capital is difficult in any industry. And there are signs that energy and energy technology are finding increasing favor. Although overall VC investments have plunged dramatically since the recession, the percentage devoted to energy-related businesses has increased.

## **OTHER PROBLEMS CONTRIBUTE TO THE CHALLENGE**

In addition to the three major barriers outlined above, the Smart Energy sector must grapple with several other issues:

- **The commercialization chasm.** It is extremely difficult to extract ideas from developmental labs and turn them into marketable products.
- **Lack of popular appeal.** Grid infrastructure is not a sexy topic.
- **Lack of self-awareness.** Most Smart Energy companies still don't see themselves as part of a sector. They fail to take advantage of the networking, policy advocacy and joint marketing that can give them great leverage. They even lack a common terminology to discuss their products with customers and each other.
- **Shortage of trained personnel.** Many companies must look overseas for power engineers and to the East Coast for experienced energy technology management.

## **MARKET POTENTIAL**

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Within the areas of Smart Grid and Smart End-Use, our research has uncovered sub sectors with prospects for near-term growth worldwide. (Later in this document we discuss which ones are best suited for the Northwest.) The research also provides the basis for some general estimates of market size and growth rate.

### **NEAR-TERM MARKET OPPORTUNITIES WORLDWIDE**

The following areas exhibit the potential for substantial near-term growth around the world. (See Figure 4.)

#### **GRID MONITORING, COMMUNICATIONS AND CONTROL**

Utilities are increasingly replacing electromechanical systems with digital technology to monitor and remotely manage the grid. Northwest companies in this category include Consolidated Electronics, MCM Enterprise, NxtPhase, Power Measurement, Schweitzer Engineering Laboratories, and Serveron.

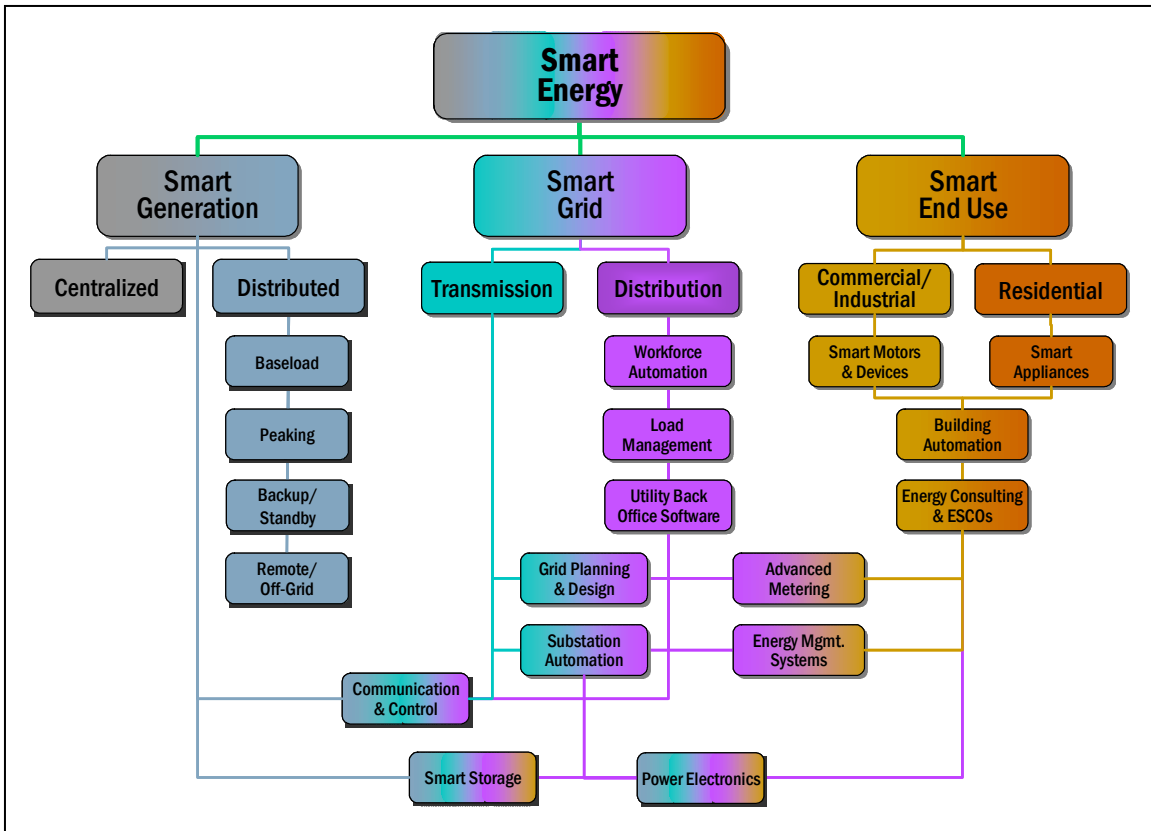


Figure 4: Smart Energy Opportunity Areas

**GRID PLANNING AND DESIGN**

The power grid is one of the most complex systems on earth. There is a tremendous need for computer tools to model, simulate, design, optimize and construct grid facilities. The Northwest is already a national leader in grid planning, with several important research efforts underway at Powertech Labs, Pacific Northwest National Laboratory (PNNL), University of Washington, Washington State University, and Oregon State University. Itron subsidiary Linesoft is a category leader.

**TRANSMISSION/DISTRIBUTION/SUBSTATION AUTOMATION**

Products in this category replace old-style electromechanical products with new digital technologies for switching, monitoring, protection and control. As with the related category of grid monitoring, communications and control, the potential market is huge since so much of the grid is in urgent need of upgrading. Northwest companies with a role in this area include Alstom Transformers, Cascade Controls, NxtPhase, PC Utilidata, Power Measurement and Schweitzer Engineering Laboratories.

#### **WORKFORCE AUTOMATION AND MANAGEMENT**

Products in this category help utilities automate and manage their key assets: their equipment, their workers and their customers. Included are both software (e.g., field force scheduling and dispatch) and hardware (e.g., wireless devices for trucks or handhelds for workers). Northwest companies with interests in this space include Fieldsoft Technologies, Itron, Itronix (not related to Itron) and MDSI Mobile Data Solutions.

#### **LOAD MANAGEMENT/DEMAND RESPONSE**

Products in this category allow a utility to remotely or automatically reduce the amount of power used by customers. They promise a less costly way to respond to peak loads than keeping another power plant running just in case. Most analysts predict big revenues in this category once regulatory hurdles are overcome. Northwest companies with offerings in this area include Celerity Energy, Legend Power Systems, MicroPlanet and PCS Utilidata.

#### **UTILITY BACK OFFICE SOFTWARE**

The electric power industry is one of the last in the world to fully embrace computing. Many utilities still run their operations on ancient minicomputers and home-grown software. With thousands of utilities serving billions of customers, the market opportunity is enormous for customer information systems, asset management systems, and enterprise resource planning (ERP). Northwest companies with products and services in this category include Alstom ESI, Cayenta Canada, Eden Systems, Energration, Equarius, Microsoft, and Utility Solutions.

#### **ADVANCED METERING**

The United States alone has approximately 130M electric meters and 140M gas and water meters. Utilities are now converting to advanced digital meters that can transmit data back to the home office. The category is expected to grow 15-20% annually for the next five years. Much of that growth may come from the software that piggybacks on the growing popularity of the meters themselves. The Northwest is home to Itron, the world's largest provider of advanced meters, and to several other firms with offerings in this category, including Dent Instruments, E-Power Technology, Teldata, H.J. Arnett Industries, Power Measurement, Utility Systems & Applications and others.

#### **ENERGY MANAGEMENT SYSTEMS**

Energy management systems gather information about energy usage to create a single picture and a single control point. Utilities use them to manage thousands of customers. Large end users employ them to manage high-rises, campuses and factories. Regional companies in this space include Avista Advantage, Christenson Power Services, and Alstom.

### **SMART MOTORS / ADJUSTABLE SPEED DRIVES**

Electric motors use a significant percentage of the nation's electricity. New designs increase efficiency through on-board intelligence and through the ability to adjust the speed to match the need. Related Northwest companies include Motors and Controls Corp. and MagnaDrive.

### **SMART DEVICES AND APPLIANCES**

Just as building controls are becoming intelligent, so too are devices, equipment and appliances. This intelligence may allow remote monitoring and control. It may replace electromechanical systems with digital versions. Or it may increase energy efficiency. The Northwest has some ongoing research, but little commercial activity in this space.

### **BUILDING AUTOMATION AND CONTROL**

More and more switches, sensors, thermostats and controls come with embedded intelligence and the ability to communicate. They can be pulled together and managed through building management systems and building diagnostics. Once under control, they can be managed to improve energy efficiency. The DOE has funded a significant amount of research in this area at PNNL. The Northwest also houses the branch offices of Johnson Controls and Siemens Building Automation. It also has several "home-grown" companies including Alerton, Control Contractors, Holaday-Parks Building Automation Systems, and Regal Controls.

### **ENERGY CONSULTING AND ESCOS**

This category is growing in line with the global trend toward outsourcing. Energy consultants work with utilities and large customers. Energy services companies (ESCOs) contract with large users to manage and improve energy use (often receiving a portion of the savings as part of their fee). Northwest examples include Acres International, Energy International, Clark's Energy Service Corp., Northwest Energy Services, and Quantum Engineering & Development.

### **POWER ELECTRONICS**

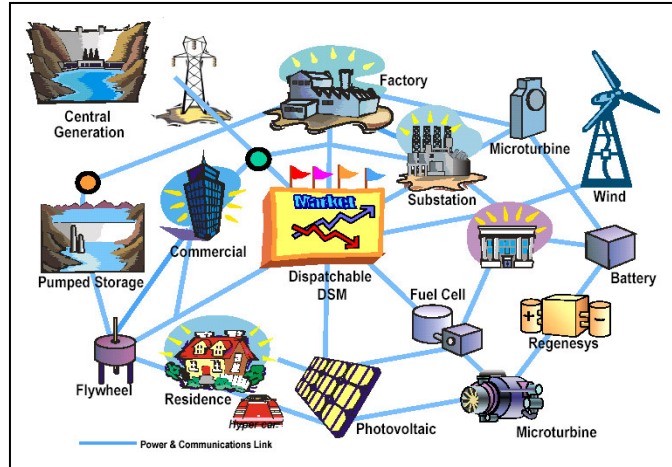
Power electronics come into play at the point of generation, the point of distribution and the point of consumption. At the point of generation, they are often called "balance of system." They invert, convert, and condition electricity from sources such as diesel generators, wind turbines, PV panels and fuel cells.

At the point of distribution, electronics are needed to control, condition and connect to the grid. (See Figure 5.) And at the point of consumption, power electronics find many uses. Power factor correction devices adjust for characteristics that cause motors to draw more power than they actually need. Advanced power supplies use semiconductors to add new levels of control and

Figure 5  
BPA's EnergyWeb

The Bonneville Power Administration is a world leader in understanding and advancing the concept of an intelligent, decentralized power system, as illustrated in this concept drawing. Such a system will require new products for connecting distributed power sources to the grid.

Source: BPA



efficiency to electrical devices. Uninterruptible power supplies protect against power dips, surges and outages.

The Northwest houses numerous companies that operate in this space, including Advanced Power Technology, Alpha Technologies and its BC subsidiary Argus Technologies, Denon Technologies, JATS Alternative Power, MTI Systems, New Path Renewables, Northern Technologies, Philtek Power, RBH Electronic Designs, Schott Applied Power, Sure Power Industries, Thomson Technology and Xantrex.

## REVENUES WORLDWIDE FROM SMART ENERGY

Establishing the worldwide market size is difficult. Only some of the Smart Energy categories are routinely tracked by analysts and market research firms. Our research has uncovered the following estimates of current annual sales worldwide in several categories that are all or partially composed of Smart Energy products:

- **Advanced meters:** \$1.2B, growing 15-20% per year.
- **Electric motors:** Estimates range up to \$12.5B (although most of this number is still standard motors, smart motors are capturing a growing percentage).
- **Energy Consulting and Energy Service Companies:** \$2.5B, growing 15-20% per year.
- **Power electronics:** Balance of system, \$3B, growing 20-25% per year; Uninterruptible power supplies, \$3B, growing 8% per year.
- **Transmission and distribution equipment:** \$70B, growing 4-6% per year. (Only a percentage of this number is Smart Energy, the balance being wires, poles and electromechanical devices. However, the Smart Energy portion is growing rapidly on a percentage basis as digital devices replace analog versions.)
- **Utility back office software:** Customer information systems \$1B growing 6% per year; energy trading \$2.6B growing 10% per year.

- **Workforce automation:** Workforce automation software, \$1.3B growing 15-20% per year; wireless systems for utilities, \$1B, growing 15% per years.

We estimate the Smart Energy segments discussed in this document represent at least \$15B in revenues worldwide. By way of comparison, experts typically put the worldwide wind market at \$7B, the solar market at \$1.5B and the fuel cell market at \$0.5B.

## REVENUES AND JOBS REGIONALLY FROM SMART ENERGY

The focus of this report was to develop a taxonomy and definition for Smart Energy to identify near-term market opportunities. Although it is beyond the scope of this report to provide market projections and economic development impacts, it is clear from initial analysis that this emerging industry has the potential for strong growth in both jobs and revenues.

Smart Energy brings with it high-paying jobs for scientists, researchers, engineers, professors, lab technicians and other knowledge workers. It also holds the potential for family-wage jobs, including technicians, trainers, operators, and programmers along with field sales, installation, repair and support. Because of their complexity and their high value-to-weight ratio, many Smart Energy products can be manufactured in the Northwest for export outside the region. Although we can expect high-volume manufacturing to migrate eventually to low-cost centers such as China, even then we can reasonably expect to keep some design, prototyping and fabrication jobs in this region.

Based on company directories produced as part of the *Poised for Profit* initiative, we estimate the Smart Energy sector in BC, Oregon and Washington encompasses more than 225 companies with revenues in excess of \$1.9B, plus at least another \$150M in research and development funding, for a total in excess of \$2B.

At initial examination, the Smart Energy sector clearly represents not only existing revenue and jobs, but also the potential for impressive growth and benefits to our region. Understanding the complete economic impact will require further research into specific numbers across job categories and into an accurate indirect multiple to reflect “trickle down” jobs.

## REGIONAL POTENTIAL

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### REGIONAL ASSETS

The Northwest has the assets necessary to establish a powerful Smart Energy cluster. The five most important are:

- **Successful pioneers.** The Northwest is already a global leader in Smart Energy thanks to companies such as Itron, Schweitzer, Alstom and others. Our research has uncovered more than 225 Smart Energy-related businesses in the Northwest, doing over \$2B annually.
- **World-class research.** The Northwest is blessed with one of the country's largest concentrations of Smart Energy research. Important centers in British Columbia include University of British Columbia, University of Victoria, Simon Fraser University, Powertech Labs (a BC Hydro subsidiary) and several others. Oregon boasts Oregon State University, Oregon Institute of Technology (which is just launching a Smart Energy-focused program) and Bonneville Power Administration. Washington centers of world-class Smart Energy research include Pacific Northwest National Laboratory, Washington State University, and University of Washington. Some of the fields where Northwest labs have made notable contributions include high-voltage transmission, grid simulation and design, grid monitoring and control, demand response technologies, advanced motor design, building automation and more.
- **Transmission and distribution expertise.** The Northwest has deep expertise in grid issues -- transmission modeling, design, planning and installation -- and decades of experience shipping power between regions. Bonneville Power Administration, to name just one example, oversees one of the largest transmission systems in the world. Many of our agencies and utilities have both the necessary experience and the necessary "mind-set" -- an interest in and openness to advancing technology.
- **Transferable skills.** Smart Energy has strong synergies with existing regional strengths in software, semiconductors, wireless communications, electronics and fuel cells.
- **Environmental consciousness.** The Northwest has many government and industry programs in support of energy efficiency and energy technology. Organizations such as the Northwest Energy Efficiency Alliance and the Oregon Energy Trust spend tens of millions each year to deploy energy-saving technologies. The Northwest's environmental record and reputation make it easier to attract skilled workers, entrepreneurs, managers and executives.

These and other assets make the Northwest an ideal test-bed for the Grid of the Future. The region has an unparalleled mixture of climates, power sources,

transmission facilities, customer types and utility types. What's more, it is home to several "enlightened" organizations (to quote one Canadian official). Bonneville Power Administration is a government-owned transmission operator whose mission includes support of new technologies. BC Hydro has an exemplary record of support for sustainable technologies of all types. Utilities such as PGE, Avista, PSE, Tacoma Power and others have been leaders in testing and trying new technologies. Combined with our exceptional research facilities, these things make the Northwest a strong option for the many research and demonstration projects now on the drawing board.

## REGIONAL CHALLENGES

In simplest terms, companies need access to four essential ingredients to succeed: 1) ideas, 2) money, 3) talent and 4) markets. If they want to enjoy the benefits of an economic cluster, they need access to a fifth ingredient: 5) each other. The Northwest has challenges in all of these areas.

**Access to ideas.** The Northwest houses some of the world's premiere Smart Energy research efforts. Yet only a small fraction of that intellectual property is ever converted to business opportunities.

Part of the problem is the dreaded "commercialization chasm" -- the extraordinary difficulty of translating theoretical advances into practical products. This problem is not unique to the Northwest. Labs and universities everywhere struggle with commercialization. But even if we are not alone in this difficulty, it still could prevent us from harvesting the fruits of our top-notch research facilities.

Part of the problem lies with lack of proximity and parochial attitudes. Few Seattle entrepreneurs, for instance, have any idea of the rich resources embodied by institutions such as Powertech Labs (in Vancouver, BC), WSU (in Pullman, WA), PNNL (in Richland, WA) and BPA (in Portland, OR).

Finally, part of the problem comes from the capital and market issues described below, which make it even harder to transfer ideas out of the labs.

**Access to capital.** To be sure, the capital shortage is acute in every geography and every industry. But the Northwest's Smart Energy companies face other significant hurdles. Of the major metropolitan areas, only Seattle has a large community of both venture capitalists and angel investors. Portland, Vancouver, Tacoma, Victoria and Spokane have made progress, but still don't have great depth.

The situation is made worse because few regional investors have an understanding of or interest in energy. In many cases, Northwest Smart Energy startups are forced to look outside the region for capital -- a much harder prospect.

**Access to talent.** On one hand, the Northwest is an attractive place to live. What's more, both Seattle and Portland have broad bases of high-tech management expertise, much of it under-employed due to the slowdowns in the software, semiconductor and aerospace industries.

When it comes to energy technology expertise, however, the Northwest is far from existing talent pools. "There is a cluster of big energy technology companies in Pennsylvania and the East Coast," explains Andrea Johnston, CFO of Vancouver, BC-based NxtPhase, which builds grid monitors and controls. "There's a big pool of top management talent to draw from. It's much harder to recruit top people to move across the continent, away from their roots and their business networks."

**Access to markets.** The Northwest suffers from its lack of visibility. The world does not look to this region for leadership in energy, or recognize its strengths. And the Northwest's regional market isn't big enough to sustain startups and act as a steppingstone. Startup companies may get one or two local sales if they're lucky. Then they typically have to look 2,000 miles away for the next one -- a tremendous challenge for a young, cash-strapped company.

**Access to each other.** Northwest Smart Energy firms are scattered hundreds of miles apart. What's more, the regional Smart Energy industry is not yet "self-aware." These factors deprive regional firms of networking and partnering opportunities that can accelerate industry growth. Without a serious and sustained effort to promote communication and cooperation, this lack of proximity could doom Northwest hopes of becoming a global leader. It is quite possible the next few years will see a repeat of the last few -- namely, isolated pockets of individual success, but few spin-off benefits.

## REGIONAL OPPORTUNITIES

After examination of the opportunities, assets and barriers described above, we conclude that the Northwest has significant potential in at least five niches. These segments were selected for two qualities: 1) a promise of rapid near-term growth and 2) a close match with our regional strengths.

- **Advanced metering**, where we already house the worldwide market leader
- **Utility back office software**, where we are home to an industry leader and which meshes with our existing software expertise

- **Grid monitors and controls**, where we also have a category leader and several important startups
- **Transmission/distribution/substation automation**, where we have related companies and stand to gain from the expected up tick in grid spending
- **Power electronics**, where we have the world leader and promising startups

In addition, at least five other niches offer moderate-to-strong potential:

- Energy management systems
- Building automation and controls
- Distributed generation interconnection and support
- Energy service companies (ESCOs)
- Workforce automation

## **REGIONAL BENEFITS FROM A SMART ENERGY CLUSTER**

What does the Northwest stand to gain if it succeeds in nurturing a new Smart Energy cluster? The economic benefits include hundreds of new products for export, thousand of new jobs and billions in new revenues. The Northwest will see numerous other rewards as well. For instance, it will gain a strengthened electrical infrastructure as Smart Energy products are applied regionally and as concepts such as demand management are applied:

- Fewer new high-voltage transmission lines
- Fewer new power plants
- More reliable power
- Cheaper power
- A significant reduction in emissions, greenhouse gases and health care costs

Finally, the Northwest will gain the intangible benefit of providing leadership towards a sustainable future.

## **ACCELERATING PROGRESS**

The Northwest is fortunate to have the beginnings of a meaningful Smart Energy cluster. It should act now to build on this early lead. The following ideas could significantly accelerate growth:

- **Regulatory changes.** The region should work with regulators to adopt rates, regulations, policies and incentives that favor the deployment of Smart Energy technologies. Aggressive regional policies could create fertile market opportunities for home-grown companies.

*"If the Northwest becomes the best place for market access, we will attract everything else we need."*  
Mossadiq Umedaly,  
Chairman, Xantrex

- **Standards and test beds.** According to EPRI, the utility industry currently uses 152 different communications protocols. Several CEOs emphasized the power of creating regional standards and testing facilities for certification. Any such effort would need to include regional utilities to have validity. This move alone could dramatically improve the region's value as a leading center for Smart Energy companies.
- **Market access and market transformation.** A concerted program to improve market access could make this region a magnet for Smart Energy companies. Standards and test beds (see above) are one step. Utility and regulatory cooperation is another, since utilities must have incentives to try new technologies (today, they often have disincentives instead). And market transformation would be the third step. The Northwest has had success changing consumer behavior in areas such as recycling and using compact fluorescents. Those skills should now be applied to Smart Energy products. Government and military buying programs could also create early markets.
- **Business assistance.** We can take several steps to help Smart Energy companies succeed. *Trade associations* would supply all-important networking, outreach, joint marketing, and policy recommendations. *Incubators and accelerators* could offer services, mentoring and facilities. *Workforce training programs* would increase the number of skilled workers and managers.
- **Outreach and education.** First, we can increase the flow of capital to deserving Smart Energy companies through research, publications and events devoted to helping investors understand the category. Second, we can attract entrepreneurs, service companies and relocations by letting let the world know of our region's advantages.
- **Pursuit of major research.** First, the region needs to coordinate its home-grown research to avoid duplicating efforts. Second, it needs to attract even more R&D. Governments, foundations and private companies are pouring hundreds of millions of dollars into Smart Energy research. We need a concerted effort to bring more of those dollars to the Northwest.

The ideal initiative, of course, would combine these separate programs into a coordinated plan. That plan would build a regional market as a steppingstone to success nationally and internationally.

The Northwest already has the beginnings of a Smart Energy cluster. Through actions such as those described above we can add fuel to that flame. By helping this category grow into a full-fledged industry of distinction, we can bring thousands of new jobs and billions in new revenues while simultaneously reducing pollutants and greenhouse gases.

## ABOUT THE ANALYSTS

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**PS Reilly** is a noted expert, researcher, and advisor on commercial success in emerging markets. Her insights and predictions are regularly featured in articles, columns, and keynotes. Most recently she was Vice President of Emerging Markets for Ziff Davis Media, where she provided strategic advice to leading technology companies, including IBM, Peoplesoft, and many others. She has designed and led numerous large-scale research projects, from analysis of a single market, to investigating the economic impact of regional policy and infrastructure changes.

**Jesse Berst** is an internationally known technology and business analyst. He has authored or co-authored more than a dozen books on technology topics, written hundreds of articles for leading publications and keynoted dozens of business events in the U.S. and abroad. He combines two decades of professional experience in emerging markets with a personal interest in environmental and energy issues. He has served on the Department of Energy National Grid Vision Planning Committee and is the Chairman of the Advisory Committee for Pacific Northwest National Laboratory's Energy Sciences and Technology Directorate.

**Jeff Canin** brings 20 years of experience in the financial services sector. As a stock analyst with Hambrecht & Quist, Montgomery Securities and Salomon Brothers in San Francisco, he provided in-depth high tech research coverage to institutional investors in North America and Europe. Since 1995, he has worked as a venture capitalist and consultant to emerging growth companies in the information technology and distributed energy fields.

**David Amdal** has a 25-year career heading international market research firms. He was formerly head of market research for BIS Strategic Decisions for the Asia-Pacific region, a \$30M operation with ten offices in seven countries. (BIS has since become Giga Information Group.) He has conducted 300+ market entry evaluations, identifying the sectors, customers and communication with the strongest potential for success. Clients have included Apple, IBM, Canon, S.C. Johnson, Foremost, R. J. Reynolds, Heineken, Guinness, Bayer, BIC, Coca-Cola and Gillette, as well as regional development authorities.

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*To download the full study from which this summary was extracted, visit [www.centerforsmartenergy.com](http://www.centerforsmartenergy.com).*

# *The Poised for Profit II Partnership*

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