Fact Sheet on Portland State University’s Edition 5.0 of Designing the Smart Grid for Sustainable Communities Course Series

Course Origins

The two-term course – Designing the Smart Grid for Sustainable Communities – was created in 2008 and launched in 2009 at Portland State University (PSU) at the request of and with critical staff and financial support from, Portland General Electric (PGE). PSU and PGE created an exploratory team led by Jeff Hammarlund, Pamela Morgan, and Gerald Sheblé. The team was intrigued by the potential for a rather fuzzy and just emerging set of concepts, technologies, applications, business models, and policy challenges to transform the nation’s century-old, centralized electric power system into a climate, renewable-energy, and consumer friendly “Smart Grid.”

The team was convinced that Portland’s and the Northwest’s commitment to innovation and sustainability made it an ideal location to determine if and how the smart grid could encourage and enhance sustainable development with the help of a grid that was cleaner and more distributed, efficient, and intelligent. When we started out, the concept of the smart grid and its relationship to closely related technologies and approaches including demand response, distributed generation, energy storage, and the integration of variable resources, was just emerging. We did not know it yet, but we were informed later that this was the first such course in the country so there was no blueprint to follow.

As we delved into this topic and began to assemble and offer this course series, we learned and experienced many new things. They include:

- The issues at this intersection of electricity, information technology, and sustainability would prove both fascinating and complex;

- An appreciation that while the technologies associated with the smart grid, microgrids, demand response, distributed generation, and energy storage are very important, it is equally important to explore the complex business, regulatory and policy issues and learn about various new players associated this transition.

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1 Jeff Hammarlund is a member of PSU’s Center for Public Service faculty and President and Principal Consultant with a small consulting firm, Northwest Energy and Environmental Strategies.

2 Pamela Morgan was, at the time, PGE’s Vice President for Regulatory Affairs and Strategic Planning, and is now President and Principal Consultant at Graceful Systems.

3 Gerald Sheblé was, at the time, PSU’s Maseeh Professor of Electrical and Computer Engineering, the Maseeh College of Engineering and Computer Science, and is now President of Energy Power Management Technology and Honorary Professor at the University of Porto Faculty of Engineering in Portugal.
With the help of a team of colleagues from academia and the private sector, Jeff Hammarlund and the other members of his faculty team have offered four very different versions of this two-term course series, each exploring different aspects of this fascinating topic. The changes were necessary because the issues within the topic are not static. The technological, economic, natural, and societal environments within which electricity’s creation, delivery and use occur are very dynamic.

We are now in the process of developing Edition 5.0, a two-term course series that will take place during Winter and Spring terms of 2015. In recognition of some of the environmental changes underway, we will adopt a broad definition of the Smart Grid to refer to a growing set of new energy technologies and approaches that can empower end-users and support sustainable communities. The boundaries of the “Grid” no longer hold all of the possible technologies or choices that could help lead us toward more sustainable communities. While the “smart” in “Smart Grid” will remain a key piece of the puzzle, recent events, new approaches, and additional challenges and opportunities are adding other important pieces to the puzzle. These include the distributed intelligence of other new technologies, and the commitment of people, organizations, and communities to pursue new and empowering ways to influence their energy future. We will continue to use the adopted title for this course series – Designing the Smart Grid for Sustainable Communities – but we could just as easily suggested a new name, such as Applying Energy Technology and Empowering Energy End Users for Sustainable Communities. The official title for the Winter Term class is The Smart Grid and Sustainable Communities: Making the Connections and the spring term course will still be called Making the Smart Grid Work in the Real World.

Our Interdisciplinary Approach

As the faculty team began to plan and develop this course in 2008, we realized that a topic as new, multi-dimensional, and complex as designing the smart grid for sustainable communities would require a multidisciplinary and interdisciplinary faculty team that could offer the knowledge, skills and perspectives of several academic disciplines, plus on-the-ground experience, and integrate them into a genuine “cutting-edge” interdisciplinary curriculum. We agreed that to be done right, this course would require several faculty members with knowledge and skills in a variety of academic fields and a willingness to collaborate in a cross-disciplinary context.

For example, depending on the topics we planned to cover in a particular course term, one person might take the lead on the policy and planning aspects of developing and integrating the smart grid infrastructure with the many other infrastructures it would need to integrate with in ways that would ensure “plug and play” interoperability (the electric transmission grid, the transportation system, the building and land use design and planning system, etc.) Another might take the lead on the power engineering aspects of the smart grid (integrating the smart grid with the existing power grid). Another might take the lead on the IT
communications and controls aspects of the smart grid. This is essential because the Smart Grid involves a “shot-gun marriage” of the utility industry and the IT industry, two industries that have very different institutional cultures.

Since PSU can afford to pay just one faculty member, PGE offered to provide significant underwriting support during the course’s first year. PGE also offered to continue to provide funding support at a lower level in future years so long as:

1. PSU continued to deliver a first-rate course that continued to meet PGE’s long term needs; and
2. PSU demonstrated a serious effort to secure underwriting support in future years from other businesses and organizations that might want to send some of their “best and brightest” mid-career professionals to this course. In particular, PGE encouraged PSU to attempt to secure underwriting support from BPA, Intel, and local IT and Smart Grid companies that might want to encourage some of their future leaders to take this course.

PGE senior management said they understood that the smart grid’s success requires an unprecedented amount of collaboration among and between companies in very different industries, including the utility industry that has traditionally been conservative and risk-adverse and the IT industry that has traditionally been entrepreneurial and innovative. It will also require significant collaboration between both of these industries and the public sector, with planners, design professionals, and others interested in creating vibrant and sustainable communities, and perhaps most important of all, with its customers.

As promised, PGE continued to provide funding at the lower level they had agreed to in 2010, 2011 and 2013 (the course was not taught in 2012 or 2014 due to other faculty commitments.) To our delight, in 2013, Intel and Veris Industries also stepped up to fill the funding gap as additional underwriters. Meanwhile, Climate Solutions and Smart Grid Oregon (now Smart Grid Northwest) continued to help with course marketing to their members and supporters, and Smart Grid Oregon continued its unusual but valuable role began in 2011 of hosting a course blog on its website. Smart Grid Northwest and Climate Solutions have agreed to continue in these important roles this year.

We plan to solicit support from those companies and organizations that have helped sponsor this course in the past. We are also seeking to recruit additional course underwriters. Without their help, we will not be able to offer this course series. Their support helps us in three crucial areas:

1. Providing modest compensation for three of the four core faculty members discussed below (Pamela Morgan, Mark Osborn, and Ken Dragoon). The three support faculty members are contributing their services gratis.
2. Supporting a significant portion of the travel and accommodation cost of our first-rate guest presenters who come from out of town. (Our guest presenters are committed to the objectives of this seminar series so it is very rare for any presenter to require a speaking fee. We work with them to keep travel and accommodation expenses as low as possible. However, we will not be able to recruit such extraordinary speakers without paying for their basic expenses.)
3. Contributing a small portion of the additional Distance Learning expenses involved in making this course series available on computers and in distance learning centers around the world.
The Innovative Features of the Course

From the beginning, the class has been quite innovative. Our course:

- Serves two critical audiences: (1) graduate students in engineering, information technology, public administration/policy, urban planning, business, economics, law, and related fields; and (2) mid-career professionals from the utility, information technology, public administration, architecture, urban and transportation planning, business, legal, and related communities who are interested in the topic as a part of their professional development. Both audiences benefit from the other’s presence in the class.

- Uses the different academic and experience backgrounds of its faculty to combine academic theory and research with real world challenges (“Making Oregon and the Northwest our Classroom”) for the benefit of the students.

- Includes nationally and regionally known experts in the curriculum to bring students additional perspectives. In past classes, these speakers have included the chairman of the Federal Energy Regulatory Administration, the chairman of the Colorado Public Utilities Commission, and Smart Grid thought leaders from California, Illinois, Texas, Ohio, New York and elsewhere. Other speakers have included the Executive Director, National Regulatory Research Institute, the Managing Director of Global Smart Energy, and Executive Editor of Smart Grid News; the Director of Pacific Northwest Smart Grid Demonstration Project; the Chairman Emeritus, The Brattle Group, the authors of some of our texts; and many more. A full list of previous course speakers is provided later in this fact sheet. The experience and insights of these speakers complement the multi-disciplinary faculty to provide a rich experience for students and enable them to produce outstanding work on the policy topics they tackle.

- Combines students into interdisciplinary small group “learning communities” that require communication, learning, and the completion of group assignments across traditional disciplines. We believe that an ability to communicate across traditional disciplines is critical to designing electricity systems and services for empowered energy end-users and sustainable communities. It is also a skill that is highly valued by employers interested in positioning their companies for a successful future. We complement the inter-disciplinary teams with small “affinity groups” that allow students to work on projects from within the perspective of their traditional disciplines.

- Covers two consecutive terms to deepen the learning experience. The first term focuses on providing students the basics to engage with the issues of technology, empowered energy end-users and sustainable communities and exposing them to work in multidisciplinary student teams. The second term deepens students’ knowledge base, with a primary emphasis on application of knowledge to “real world” projects that identify and test how to progress toward empowered energy end-users and sustainable communities. Examples of actual projects our multidisciplinary small group learning communities have addressed so far include:

  - Three different projects associated with PGE’s Salem Smart Power Project;
  - Strategies for the Smart Grid to Support Emerging Eco-Districts and District Energy Systems in Portland;
  - Exploring the Connections between Smart Grid and Vehicle-to-Grid: Opportunities and Challenges in Oregon;
The Smart Grid’s Role as an Enabler of Renewable Energy Integration in Oregon and the Pacific Northwest;
Strategies to Include Low-Income and Other Vulnerable Consumers as Smart Grid Beneficiaries;
A Lighting Energy Efficiency and Demand Response Strategy for the Portland State University Campus;
A Smart Meter Consumer Data Study.

We do not require seminar participants to enroll for both terms but we encourage them to do so.

- Concludes with a conference or public forum at which the student teams present their findings and recommendations to government and business leaders. For example, in 2011, each of the student teams offered a presentation and a briefing book for the members of simulated “Governor’s Blue Ribbon Advisory Panel on Oregon’s Smart Grid Policy.” While the panel had no official standing, it consisted of people who could easily serve on such a panel and was chaired by the governor’s actual senior advisor on jobs and the economy. Many of these recommendations were incorporated in the governor’s actual Ten-Year Energy Plan. In most cases, the student teams are guided and supported by advisory teams comprised of many of the region’s top technical and policy experts.

- Reaches across the globe. Beginning in 2013, PSU expanded the availability of this course to interested parties throughout the Northwest region and beyond with the capabilities of PSU’s Distance Learning Center. Ultimately, our “distance learning participants” included people from other parts of the United States and from universities in other nations, including China, Mexico, and Iraq. We hope to expand the level of regional, national, and international participation in 2015. PSU’s Center for Public Service is happy to work with participating universities and utilities to provide graduate course level credit for students of participating universities (4 credits per quarter) and Certificate of Completion for mid-career professionals who are interested in advancing their careers but do not need university credit.

Three Distance Learning options are available for interested graduate students and mid-career professionals:

- **Video Conference.** Participants who can access participating Distance Learning Centers can see the class presentations and view and interact with the faculty, guest speakers, and other students in real time on large screens.

- **Live Streaming.** Participants can steam the class live on their computers. They can ask questions and participate in discussions with the help of Gmail Chat or similar options.

- **Media Archive.** Each class and presentation will be captured and stored for later viewing on your computer. A link will be provided for access to the archived media, which should be available the next day

**Course Value and Results**

By any measure, the four previous editions of this course have been a success. The quality and enthusiasm of the graduate and professional development students has been exceptional, the course evaluations have been consistently stellar, and a number of course alumni have received excellent job offers and advancements. The class has earned the
praise of many leaders, including the Secretary of Energy, all four Northwest governors, and both Oregon Senators.

The course has attracted PSU graduate students from the various engineering programs, business, economics, public policy, urban planning, and more. Employers funded most of the students who have taken this course through our professional development option. Companies who have sponsored their employees as students include high tech companies, government agencies, small firms, and non-profits. While taking this class, students have worked for such organizations as the Bonneville Power Administration, the Northwest Power and Conservation Council, investor-owned and consumer-owned utilities throughout the Pacific Northwest, the Department of Energy’s Pacific Northwest National Laboratory, the Oregon Public Utilities Commission, several other state agencies, Metro, the City of Portland’s Bureau of Planning and Sustainability, the Energy Trust of Oregon, Northwest Energy Efficiency Alliance, Navigant, PECI, McCullough Research, Lockheed Martin, Oregon Institute of Technology, Christiansen Electric, CH2M Hill, several Northwest law firms with significant energy law practices, consumer and environmental advocacy organizations, Intel, IBM, and several other high tech, IT, and smart grid companies, energy efficiency and renewable resource consulting firms, and more. So far, at least 14 participants with PhD’s have taken the class. Several course alumni have started their own consulting companies.

Course faculty continue to received inquires from potential employers asking for suggestions and recommendations of recent course alumni; we are most often asked to recommend students who are both strong technically and able to thrive in the interdisciplinary teams.

All three of the major national Smart Grid related on-line and print magazines and newsletters - Smart Grid News, Smart Grid Today, and Intelligent Utility – have run positive articles on this class. Secretary of Energy Steven Chu said the course represents the “invention of the wheel” for the kind of introductory interdisciplinary graduate level smart grid and clean energy course he hoped other universities would adopt around the country. The class was also featured and praised in one of the most respected books on this subject, The Advanced Smart Grid: Edge Power Driving Sustainability (Carvallo and Cooper, 2011). In early 2013, Nancy Sutley, the chair of the White House Council on Environmental Quality, met with the course’s lead faculty member to brainstorm on how the White House might encourage other universities to develop similar courses. This was after the White House contacted the course faculty to see if the President might be able to sit in a course session during his visit to Portland; we were honored and delighted to find a way for this to happen but security and timing issues ultimately precluded it.

Plans for the 2015 Course

While each edition of this two-term course series built on the previous versions, they also addressed new questions and challenges that fell within the broad intersection of electricity, information technology, and sustainability. Each edition of this course series also reflects the collective knowledge and views of that year’s particular faculty team. The electricity industry and broader community of stakeholders that surround it continue to change at a breathtaking pace. As these changes become clearer, the continuing members of the faculty team develop a better understanding of the implications of these changes, and new members of the team bring new insights, the course series gets updated as well. We plan to continue this “tradition of change” in 2015. In fact, the 2015 edition offers the most extensive transformation of this course since it was launched in 2009. This is necessary because the amount of change and uncertainty the electricity industry has witnessed over the past two years seems unpredicted in our lifetimes. There seems to be a growing consensus that the traditional “utility 1.0” model with its centralized command and control architecture and undifferentiated service for all ratepayers within a different class grid will
be replaced. Phrases like “utility of the future” and “utility 2.0” have entered the lexicon of even the most mainstream utility leaders. What is less clear is what will replace it. In various public and private forums, energy experts from both within and beyond the electric utility community are trying to understand what comes next.

Many agree that the future includes a more decentralize grid architecture that will devote more attention and resources to localized customer needs. Some experts, including the some of our guest speakers and authors, describe their vision of the future as a “clean disruption” that will be triggered by the “exponential cost and performance improvement of technologies that convert, manage, store and share clean energy”. For example, Stanford University’s Tony Seba, one of our primary authors and invited speakers, argues that just as the Internet and cell phone turned the architecture of information upside-down, the combination of digital (bit) and clean energy (electron) technologies will create a “new energy architecture” that is “distribute, mobile, intelligent, and participatory.” Greener technologies, such as solar, wind, electric vehicles, and a few years later, autonomous (self-diving) vehicles, will be combined with new business models, the democratization of energy generation, finance and access, and exponential market growth. Together they will “disrupt and sweep away the energy industry as we know it.” The existing energy architecture, which Seba describes as “centralized, command-and-control oriented, secretive and extractive” will be replaced with one that is “distribute, mobile, intelligent and participatory.”

A less sanguine variation of Seba’s “clean disruption” vision is the “utility death-spiral”, in which the costs of renewable and distributed energy resources continue to plummet just as traditional central utility services become more expensive. As customers become their own generators, they drop their previous share of the utility’s fixed costs onto the backs of other ratepayers, driving more to seek decentralized alternatives to utility power. At some point, the electric utility industry ceases to be a viable business and no responsible party is left to maintain and manage the grid.

Other experts, including Peter Fox-Penner, principal and chairman emeritus of The Brattle Group, and another of our authors and invited speakers, agree that more power will be produced locally, most likely within smaller scale versions of our current grid known as microgrids. The new edition of Fox-Penner’s book, *Smart Power*, still focuses primarily on changes he envisions to the ownership, operation, and governance of the central grid. But he does not deny that the ownership and operation of what is frequently called the “grid edge” is “of equal importance and could ultimately replace the core notion of utilities entirely.” But while Seba heralds the disruptive transition, Fox-Penner cautions that while he too wants to create a modern, carbon-free energy system, he also wants to make sure that adequate supplies of electricity – the oxygen of modern life – continues to reach us reliability and whenever we want it.

Fox-Penner agrees with Seba that the addition of digital sensing and control that comes with the Smart Grid “gives customers and non-utility ‘third parties’ the unparalleled ability to understand and control electricity use, relegating the old utility to the backfield.” However, he warns that the Smart Grid also “increases the importance of the traditional utility’s role of operating the local grid, and likewise the importance of state regulators, who continue to oversee this portion of the industry.” He notes the paradox that the Smart Grid, combined with the other developments Seba discusses, creates two contradictory pressures. It forces electric utilities away from their traditional retail role, while at the same time intensifying the need for them (or some new party) to invest in the local grid even as more customers find ways to buy less of the utility’s primary product. The likely result, says Fox-Penner, is likely to be a “slow moving train wreck.”
Given these and many other related developments, we plan to adopt a broader definition of the Smart Grid to include a growing set of new energy technologies and approaches that can empower end-users and support sustainable communities. The boundaries of the “Grid” no longer hold all of the possible technologies or choices that could help lead us toward more sustainable communities. While the “smart” aspects of the “Smart Grid” will continue to be a major focus, we will also explore the implications of recent events, new approaches, and additional challenges and opportunities that have made this an exciting field of study. These include the “Grid Edge”, the distributed intelligence of other new technologies, and the commitment of people, organizations, and communities to pursue new and empowering ways to influence their energy future. We will continue to use the adopted title for this course series – Designing the Smart Grid for Sustainable Communities – but we could just as easily suggested a new name, such as Applying Energy Technology and Empowering Energy End Users for Sustainable Communities.

Since the title of the overall course series – Designing the Smart Grid for Sustainable Communities – will remain the same, the winter term course will still be called The Smart Grid and Sustainable Communities: Making the Connections and the spring term course will still be called Making the Smart Grid Work in the Real World. While both courses will be significantly different than previous editions, they will follow the same basic pattern. The first term will still focus on providing students the basics to engage with the issues of technology, empowered energy end-users and sustainable communities and exposing them to work in multidisciplinary student teams. The second term will still deepen students’ knowledge base, but place primary emphasis on applying this knowledge to “real world” projects that identify and test how to progress toward empowered energy end-users and sustainable communities.

We have already identified two potential projects for the Spring term. The first is helping the Northwest Power and Conservation Council staff develop the sections of the draft Seventh Power Plan that related to the smart grid, demand response, distributed generation, and energy storage. The second is helping Smart Grid Northwest, Oregon Best, and other partners develop what is currently being called the “policy pillar” of the proposed Pacific Northwest Transactive Energy Initiative. Depending on the class composition, expertise, and interest we may work on some of the other pillars as well. The scope of both of these projects is Northwest region-wide to be attractive to Northwest students and mid-career professionals who are not based in the Portland metro area and would be expected to participate through one of the distance learning options. We also expect to approach some of our local partners and friends, such as Portland General Electric, Intel, and the Portland Convention Center to see if they would like us to partner with them on a specific project.

We are happy to offer this course for graduate credit to students of other universities, assuming we can work credit arrangements. We are also happy to offer this course to mid-career professionals who do not need graduate credit through out professional development option.

The Center for Public Service is in the process of recruiting another stellar faculty team for winter and spring term 2015 course. The core faculty members include:

- **Jeff Hammarlund**, Adjunct Associate Professor and Senior Research Fellow at Portland State University’s College of Urban and Public Affairs and its Center for Public Service; President, Northwest Energy and Environmental Strategies; Founding Board Member and current Advisory Council Member, Smart Grid Northwest; previously, advisor to President Obama on the smart grid and clean energy; Senior Policy Analyst, Public Power Council; Senior Manager and Policy Advisor, Southern California Edison; Professional Staff US Senate Committee on Energy and Natural Resources.
Resources; and US Department of Energy; and a founding member of the course faculty;

- **Ken Dragoon**, Managing Consultant, Flink Energy Consulting; previously, Managing Consultant, Ecofys US, Inc.; Manager, Systems Analysis and Integration and Senior Resource Analyst, Northwest Power and Conservation Council; Research Director, Renewable Northwest; Power Systems Analyst, PacifiCorp and BPA;

- **Pamela Morgan**, Owner, and Principal Consultant, Graceful Systems LLC, former Vice President for Regulatory Affairs and Strategic Planning, Portland General Electric, and Senior Advisor on regulatory issues, Natural Resources Defense Council, and a founding member of the course faculty;

- **Mark Osborn**, Senior Vice President, Five Stars International, Ltd., Senior Utility Consultant, QualityLogic, and former Smart Grid Manager and Distributed Resources Manager, Portland General Electric; Manager, Market Development, EnergyWorks; and New Products Development and Senior Demand Management Analyst, PacifiCorp.

They will be assisted by **support faculty** members who will join us for selected sessions. At this point, support faculty member include:

- **Dr. Robert Bass**, Associate Professor, Power Engineering, Portland State University’s Maseech College of Engineering & Computer Science: Electric and Computer Engineering and Founder, PSU’s Power Engineering Laboratory (This is pending discussions with Bob Bass);

- **Michael Jung**, Policy Director, Silver Spring Networks, and former Chair of Oregon Governor Kitzhaber’s Ten Year Energy Plan Task Force;

- **James Mater**, Co-founder and General Manager, Smart Grid Business for Quality Logic and founding board member and current board Chairman, Smart Grid Northwest.

**Student Testimonials**

**Leah Y Parks, Associate Editor, ElectricityPolicy.com & Electricity Daily**

"The Smart Grid class is a class that should not be missed by anyone interested in staying abreast of the current developments in the smart grid and learning about where our 21st century electricity infrastructure is headed.

The lead professor, Jeff Hammarlund, puts together a team of expert professors as teachers who have actual experience working in the field. They all bring important and often eyeopening perspectives. The course material is relevant and informative.

Jeff creates an environment of mentoring, community, learning and an unsurpassed place for networking. In addition to motivated and exciting graduate students from PSU, there are also individuals from a great breadth of professional expertise in the industry. The team of teachers is very top notch, but Jeff’s sincere love of supporting and encouraging his students, young and old, is a breath of fresh air. After leaving the university, professionals often find it hard to encounter a truly mentoring environment. Jeff creates not only a space for learning, but a place where students and teachers engage in bi-directional mentoring and support.

It was a great pleasure meeting such a diverse group of people. I personally developed friendships with colleagues and met a person (currently an attorney) who had attended the
same graduate engineering program that I had at Stanford University. He 15 years back and I 10 years back. When working on the project, my group was composed of professionals from whom I learned a lot and motivated graduate students whom were a pleasure to work with and whom we all took great joy in seeing land amazing internships directly from work done during this course. One of the professionals in my group also shares my passion for energy storage and we continue, one year and a half years later, to meet at energy storage conferences around the country, inform each other of important storage initiatives happening in Portland, and share e-mails when we find a good story.

Now back to course content: This course looks at what smart grid gismos as well and infrastructure will be needed and are expected in the present and near future. The course gets course attendees involved in projects where students are pushed to think about and initiate a process of working out the nuts and bolts of how our grid architecture must evolve to meet the needs of a 21st century grid.

Knowing what is coming is important. The utility industry is changing at breakneck speed. Barclays downgraded the entire electric sector of the U.S. high-grade corporate bond market to underweight. There is an expected consumer shift to solar + storage from dropping prices. This shift portends grid defection in the next few years in parts of the country. Customers continue to be inundated with new gismos like the "Nest" and the technology industry is putting pressure on the utility industry as well. Google, Microsoft, and Solar City are all interested in becoming players in this field and are not necessary working with the existing utilities.

Jeff is the type of person who truly wants his students to learn about the electricity industry, create bonds, engage in bi-directional mentoring, and to help their career flourish. He is not only successful, intelligent and a guru in the field, but he brings other gurus and experts together to learn and teach each other. Everyone in the class is both a student and a teacher, a mentor and being mentored at the same time.

This is a special and unique learning environment. A graduate student should come because of the amazing learning and connections to be made. A professional should come for the chance to not only learn from some of the top professionals in the field, but for the chance to meet colleagues, special students, and experts in an exciting and cutting edge class."

Abraham Mooney, P.E. Signals Engineer – TriMet "You can’t have a future of renewable energy without the smart grid; it as simple as that. In the current paradigm generation follows load, ramping up and down to accommodate. All the flexibility in the system is built into the generation side. The future will turn that on its head. Load must follow generation with consumers carrying the flexibility. The flexibility is handled via the ‘internet of things’ where consumers decide when and how to use electricity. Do I care most about price? Instead do I want the most green energy? Or perhaps I’m a dinosaur and I don’t care about either of these options and I just want the power on demand, the most expensive option. The way (and the when) we use power will be optional and subject to market demands. Odd as it may seem, this new paradigm is the only way to accommodate the variability of renewable energy sources. Jeff Hammarlund’s course will talk you through the ins and outs of this incredibly complex technical and political paradigm change. It’s the wave of the future."

Ben Walsh, Principal, Mitler Construction Management, Green Builder "The course structure directly engages participants with current industry leaders and issues. The timeliness of the subject matter and the instructors’ and presenters’ depth of expertise make for an exceptional educational opportunity and, in my experience, value for the professional development dollar."
Ken Kaufmann, Partner, Lovinger Kaufmann LLP. "DSGSC is a worthwhile course for every professional interested in expanding his or her breadth of understanding of technical and policy issues related to the smart grid. The lectures focus on hot topics in the smart grid field, are delivered by articulate experts, and generate lively conversation among the students, each of whom brings a unique perspective from his or her diverse academic and professional background. The course deepened my understanding of the subject matter and fostered many new professional friendships. I recommend it for professionals seeking to stay abreast of smart grid developments as well as for students planning to work in the electric energy industry."

Chris Chambers "As a former student of the class I have to award it the best course in my whole program. The reading is fascinating because the operation of the power grid is basically a big secret yet crucially important to how fast we can build solar, wind, and drive electric vehicles. But the most valuable feature is probably the chance to work in small groups with professionals. Those projects gave me a window to a suite of soft skills we don't talk about in our other courses (time keeping, large document management, overall workflow) and a tremendous chance to network. I was referred for my first career job by someone I met in the class, and a project I did gave me the experience to qualify. I have included that PSU advanced lighting projection project in nearly every cover letter I’ve sent out in the past year, and talked about it in every interview. I have not talked about my HR case study or Supreme Court decision ever. Even if it weren’t a path to employment, it’s one of the most interesting subjects in natural resource policy."

Kirsten Midura, Senior Consultant, Navigant "I took the course during the last round, and I found it to be an essential class for anyone interested in the Smart Grid or advanced metering infrastructure. Jeff Hammarlund is one of the most brilliant and entertaining lecturers I have had in my academic and professional careers. Furthermore, this class provides a great opportunity to expand your professional network and share knowledge with like-minded individuals. I would highly recommend this class to anyone who is even remotely interested in the future of energy and energy technology."

Ryan Edge "It was the most comprehensive and incisive study of the technologies, policies, issues and business models required of the next iteration of the electric grid. The faculty is leaders in their respective fields and a formidable ensemble. The course led directly to the job I have today working to integrate solar and develop enlightened utility business models."

Guest Presenters and Advisory Team Members

The faculty team is in the process of identifying and recruiting a stellar group of nationally and locally known guest presenters and team project advisors for our 2015 course series, assuming we are successful in securing receive the underwriting support we will need. It is premature to list the guest presenters we are targeting for 2015 at this time. However, we can provide a sense of the exceptional quality of the guest presenters, panel members, and advisors by providing a list of individuals who have participated in those roles during the four years we have offered this class so far. The quality of presenters we are recruiting for this year is no less stellar. The speaker and project advisor affiliations were correct at the time they joined us for specific sessions. Many speakers have since moved on to other positions.
Guest Presenters (during the 2009, 2010, 2011 and/or 2013 course series) include:

- **Lisa Adatto**, Oregon Director, Climate Solutions; and a class student
- **Dr. Jennifer Allen**, Director of PSU’s Institute for Sustainable Solutions and Associate Professor of Public Administration
- **Joe Barra**, Director of Customer Energy Resources, Portland General Electric
- **Rob Bennett**, Executive Director, Portland Sustainability Institute
- **Jess Berst**, Managing Director, Global Smart Energy, and Executive Editor *Smart Grid News*
- **Ron Binz**, Principal, Public Policy Consulting, and former Chairman, Colorado Public Utilities Commission
- **Diane Broad**, Director and Senior Consultant, Ecofys US
- **Clark Brockman**, Director of Sustainable Resources, SERA Architects
- **Rex Burkholder**, Metro Councilor
- **Andrew Campbell**, Energy Policy Advocate and Advisor; former Senior Advisor to two California Public Utilities Commission Commissioners
- **John Cooper**, President, Ecomergerence; formerly Technical Lead for Smart Grid, Austin Energy, then Vice President for Utility Solutions, GridNet; co-author, *The Advanced Smart Grid; Edge Power Driving Sustainability*
- **Ken Dragoon**, Research Director, Renewable Northwest; Manager, Systems Analysis and Integration and Senior Resource Analyst, Northwest Power and Conservation Council; and current course faculty member
- **Patty Durand**, Executive Director, Smart Grid Consumers Collaborative
- **Michael Early**, Executive Director, Industrial Customers of Northwest Utilities
- **Dr. Conrad Eustis**, Director, Retail Technology Development, Portland General Electric; later a course faculty member
- **Wayne Embry**, Founder and Managing Partner, Reference Capital Management
- **Dr. Peter Fox-Penner**, author of *Smart Power*, and Chairman Emeritus, The Brattle Group
- **Hannah Friedman**, Technical Research Director, Portland Energy Conservation, Inc.; and previous course student
- **Mike Gravely**, Manager, Energy Systems Research, California Energy Commission
- **Lee Hall**, Smart Grid Program Manager, Bonneville Power Administration
- **Don Hammerstrom**, Senior Engineer and Project Manager, Pacific Northwest National Laboratory, US Department of Energy
- **Steve Hawke**, Senior Vice President, Portland General Electric
- **Dr. Judith Heerwagen**, J.H Heerwagen & Associates; Program Expert, US General Services, Office of Federal High Performance Buildings
- **Roy Hemmingway**, Energy Consultant and former Chair, Oregon Public Utilities Commission
- **Scott Hempling**, Executive Director, National Regulatory Research Institute
- **Bill Henry**, Analyst, EQL Energy, class blogger, and long-term class participant
- **Carol Haertlein**, Smart Grid Grant Specialist, PNGC Power
- **Chris Hickman**, President, Innovari Energy
- **Bob Jenks**, Executive Director, Citizens’ Utility Board of Oregon
- **Steve Jennings**, Chief Marketing Officer, BPL Global
- **Michael Jung**, Policy Director, Silver Spring Networks, and later, a course faculty member
- **Bobby Kandaswamy**, Director, Intel Capital
- **Dr. David Kathan**, Senior Economist and Group Manager, Office of Energy Market Regulation, Federal Energy Regulatory Commission
Patrick Keegan, Vice President, Residential Utility Solutions, Ecos; and previous course student;
Dr. Dmitry Kosterev, Electrical Engineer, BPA Transmission Planning; Chair, Modeling and Validation Work Group, and Chair, Planning Implementation Task Team, North American SynchroPhasor Initiative;
Rick Kriss, Founder and Managing Director, KLATU Networks;
Pamela Lesh, President and Principal Consultant, Graceful Systems LLC; founding and current course faculty member;
Cheryl Linder, Global Offering Leader, Energy and Utilities Industry, IBM Global Business Services; and course student;
Bruce Lovelin, Chief Engineer/Systems Engineering Manager, Central Lincoln PUD;
Richard Lowenthal, CEO, Coulomb Technologies;
Dr. Dmitry Kosterev, Electrical Engineer, BPA Transmission Planning; Chair, Modeling and Validation Work Group, and Chair, Planning Implementation Task Team, North American SynchroPhasor Initiative;
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Cheryl Linder, Global Offering Leader, Energy and Utilities Industry, IBM Global Business Services; and course student;
Bruce Lovelin, Chief Engineer/Systems Engineering Manager, Central Lincoln PUD;
Richard Lowenthal, CEO, Coulomb Technologies;
Dr. Robert Procter, Senior Economist, Electric Rates & Planning, Oregon Public Utilities Commission;
Steve Pullins, President, Horizon Energy Group, and Team Leader, Laboratory Modern Grid Strategy, National Energy Technology;
Thomas Puttman, PE, AICP, LEED AP, Sustainable Infrastructure Lead, David Evans and Associates;
Linda Ratkin, IT professional, visionary for PSU Smart Grid Living Laboratory; previous course student and later a course faculty member;
Alexis Ringwald, Co-founder and CEO. LearnUp; former Director, Business Development, Serious Energy at Serious Materials; formerly Co-founder and Director of Business Development at Valence Energy, Co-Director, Climate Solutions Road Tour, Fulbright Scholar, The Energy and Resources Institute, New Delhi;
Anders Rydaker, President, District Energy St. Paul and President, Ever-Green Energy;
Scott Shull, Strategic Planner, EcoTechnology Innovations Program, and Director, Smarter Commercial Buildings, Intel Corp;
Lisa Schwartz, Senior Associate, Regulatory Assistance Project; later director, Oregon Department of Energy, currently Team Leader, Electricity Markets and Policy Group, Lawrence Berkeley National Laboratory;
Lauren Shapton, Manager, Mass Market Programs, Portland General Electric;
Mark Shanahan, former Executive Director, Ohio Air Quality Development Authority; formerly Energy Advisor to then Ohio Governor Ted Strickland;
Scott Shull, Strategic Planner, EcoTechnology Innovations Program, and Director, Smarter Commercial Buildings, Intel Corp;
Jason Slami-Klotz, Senior Policy Advisor, Northwest Energy Efficiency Alliance; and previous course student;
Dr. Aaron Snyder, Director, Smart Grid Labs, EnerNex;
Matt Spaur, Advanced Metering and Smart Grid Market Development, Itron, Inc.;
John Stafford, Vice President Conservation Solutions, Sensus;
Chris Thomas, Policy Director, Citizens Utility Board of Illinois;
John Thornton, Vice President, Manufacturing & Supply Chain, Porteon Electric Vehicles, Inc.; and previous course student;
Dr. Robert Topping, Interim Director and Director of Strategic Initiatives, Regional Education and Training Center (RETC); and previous course student;
Kevin Walker, Chief Operating Officer, Iberdrola USA; formerly Senior Vice President and Chief Information Officer, American Electric Power, and President and Chief Operating Officer, American Electric Power (AEP) Ohio;
Kevin Watkins, Vice President of Engineering, PNGE Power;
Jon Wellingham, Chairman of the Federal Regulatory Commission.

During the Spring Term, multidisciplinary student teams work on “real world” projects. They are supported and mentored by members of the faculty team, but also by members of Project Advisory Teams who have been recruited as a result of their technical and/or policy expertise. Advisory Team members from 2009 onward have included:

Lisa Adatto, Oregon Director, Climate Solutions; and previous course student;
SA Anders, Director of Operations, Citizens Utility Board of Oregon; Board Treasurer, Smart Grid Consumer Collaborative; now Smart Grid Projects and Projects manager, Portland General Electric; and former course student;
Joe Barra, Director of Customer Energy Resources, Portland General Electric;
Kathleen Belkhayat, Business Sector Project Manager and Strategic Energy Management Project; and a previous course student;
George Beard, Strategic Alliance Manager, PSU;
Fletcher Beaudoin, Long-term Sustainability Planner, PSU; and previous course student;
Greg Bingham, Project Manager, Merchant Transmission & Resource Integration, Portland General Electric;
Jennifer Blake, New Construction-Major Renovation/Lighting Specialist, Evergreen Consulting;
Bill Campbell, Principal, Equilibrium Capital Group, and Board Chair, EnergyRM;
Tom Foley, Smart Grid Oregon Board Member; former board chair, Energy Trust of Oregon; and senior staff, Northwest Power and Conservation Council;
Jason Franklin, PSU’s Director of Campus Planning and Design;
Mark Fuji, Capital Construction Project Manager, PSU;
Mark Gregory, Associate Vice President for Finance & Administration, PSU;
Roy Hemmingway, Energy Consultant, Smart Grid Oregon Board Member, and former Chair, Oregon Public Utilities Commission;
Mike Hoffman, Co-Founder, Powerman and Senior Energy Analyst, Pacific Northwest National Laboratory;
Dr. David Kathan, Senior Economist and Group Manager, Office of Energy Market Regulation, Federal Energy Regulatory Commission;
Tom Konicke, Portland Manager, Energy & Facilities Services, McKinstry;
Dr. Wayne Lei, Director, R&D and Smart Grid Programming, Portland General Electric;
Noel Mingo, Utilities Manager, PSU;
Benjamin Lyon, Utility Program Manager, Enlighted, Inc.;
John McArthur, Sustainable Transportation Program Manager, Oregon Transportation Research and Education Consortium, (OTREC);
Our first Winter term class session is scheduled for Wednesday evening, January 14 from 6:40-9:40 pm. Classes will continue at the same time over the next ten Wednesday evenings through March 18. Our classroom will be the largest of the Distance Learning rooms, Urban Center Room 204. Our first Spring Term class is scheduled for Wednesday evening, April 1 and will continue over the next ten Wednesday evenings through June 10.

For more information, including the current course plan, previous course syllabi, faculty bios, and registration visit the course website.

If you have further questions, please contact:

- Jeff Hammarlund, Lead Faculty and Program Manager: 503-249-0240 or hammarj@pdx.edu
- Dan Trifone, Program Coordinator: 503-725-5114 or dtrifone@pdx.edu

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