GridWise® Architecture Council
The Impact of Local Policy on Smart Grids
Workshop Proceedings

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Prepared by

The GridWise Architecture Council

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About this Document

The GridWise Architecture Council was formed by the U.S. Department of Energy to promote and enable *interoperability* among the many entities that interact with the electric power system. This balanced team of industry representatives proposes principles for the development of interoperability concepts and standards. The Council provides industry guidance and tools that make it an available resource for smart grid implementations. In the spirit of advancing interoperability of an ecosystem of smart grid devices and systems, this document presents a model for evaluating the maturity of the artifacts and processes that specify the agreement of parties to collaborate across an information exchange interface. You are expected to have a solid understanding of large, complex system integration concepts and experience in dealing with software component interoperation. Those without this technical background should read the *Executive Summary* for a description of the purpose and contents of the document. Other documents, such as checklists, guides, and whitepapers, exist for targeted purposes and audiences. Please see the www.gridwiseac.org website for more products of the Council that may be of interest to you.

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INTRODUCTION

To promote discussion among the broad stakeholders of the electric power system, the GridWise® Architecture Council (GWAC) is planning a series of workshops to examine practical applications of tools and solutions that transform conventional grids into smart grids. We expect a lively dialogue among our invited speakers, guests, and GWAC members.

The theme is the influence of local policy makers and technical champions on smart grids. This is a new view of what can be done at the local community level to complement national and regional level activities.

The speakers are active at the community level who are advancing smart grids with citizen participation and creating new business opportunities. The objectives of this workshop was to identify local community best practices for smart grid development, interoperability challenges faced by community smart grid projects, policy gaps, and key process steps.

Our speakers addressed:

•   Solar power installations with net metering

•   Combining solar and conventional power sources into a smart grid

•   The role of central generation as a battery for local power

•   Integrating customer equipment into a smart grid

•   Facilitating electric vehicle use by businesses and residents

•   Creating local employment with community smart grids

•   Local impact on reducing greenhouse gas emissions

From left to right, Erich Gunther, Judith Cullington, Andrew Moore and Ludo Bertsch

PARTICIPANTS

Andrew Moore
Solar Project Manager
T'Sou-ke First Nations

Judith Cullington
City Councillor
Colwood, British Columbia

Ludo Bertsch
President
Horizon Technologies

Ken Regelson
Consultant
City of Boulder Colorado

Gary Nystedt
Title
City of Ellensburg

Rob Peña
Associate Professor, Integrated Design Lab
University of Washington

Erich Gunther
Chief Technology Officer
EnerNex Corporation

Ron Ambrosio
Global Research Leader
IBM
GridWise Architecture Council Member

Ward Camp
Vice President, Regulatory & Environment Policy
Landis + Gyr
GridWise Architecture Council Member

Paul De Martini
Managing Director
Newport Consulting Group, LLC
GridWise Architecture Council Member

Rik Drummond
CEO and Chief Scientist
Drummond Group Inc.
GridWise Architecture Council Member

Mark Knight
Director of Grid Applications
KEMA
GridWise Architecture Council Member

Alex Levinson
Information Systems Architect
Lockheed Martin
GridWise Architecture Council Member

Tracy Markie
President
Engenuity Systems
GridWise Architecture Council Member

Bob Saint
Principle Distribution Engineer
National Rural Electric
GridWise Architecture Council Member

Thomas Sloan
State Representative
State of Kansas
GridWise Architecture Council Member

Kenneth Wacks
Consultant
Sensus Metering Systems, Inc.
GridWise Architecture Council Member

Ron Melton
GridWise Architecture Council Administrator
Pacific Northwest National Laboratory

Todd Halter
Scientist
Pacific Northwest National Laboratory

James Mater
Director
QualityLogic

Gordon Matthews
Office of Technology Innovations
Bonneville Power Administration

Terry Oliver
Chief Technology Innovation Officer
Bonneville Power Administration

Tim Schoechle
Expert Witness/Consultant
International Center for Standards Research

Daniel Kirschen
Close Professor of Electrical Engineering
University of Washington

Tom Asprey
Independent Renewables & Environment Professional

Michael Stelts
Director
Panasonic

Richard Duong
Product Engineer
Moxa Americas, Inc.

Lynn Segal
Guest

Leonard Tillman (Remote)
Partner
Balch & Bingham, LLP

Naeem Ahsan (Remote)
System Architect
KEMA

David Wollman (Remote)
Deputy Director, Smart Grid and Cyber-Physical Systems Program, and Manager, Smart Grid Standards and Research
National Institute of Standards and Technology

Robert Burke (Remote)
Principal Analyst
ISO New England
GridWise Architecture Council Member

Tony Giorti (Remote)
GridWise Architecture Council Member

Leighton Stewart
Account Executive
Seattle City Light

OVERVIEW AND OPENING REMARKS

WORKSHOP LEADER: RON MELTON, PACIFIC NORTHWEST NATIONAL LABORATORY

The GridWise® Architecture Council (GWAC) has a long tradition of bringing together interested parties to discuss topics related to electric power system modernization, particularly as they relate to system architectures and interoperability. For example, GWAC hosted its second workshop on Transactive Energy at IBM's T.J. Watson Research Center on March 28 – 29, 2012. This workshop expanded on the activities and results of the previous workshop held at OATI in May 2011. The objective of the first workshop was to bring together a small number of people engaged in research and development of transactive energy techniques to share their approaches, discuss the nature of these approaches, identify opportunities for collaboration, and identify research and development needs. Each participant described their work through a presentation to the group. Proceedings of the workshop have been published by the GWAC through Pacific Northwest National Laboratory (PNNL) on www.gridwiseac.org.

The 2012 Transactive Energy Workshop (TEW) engaged a broader group including researchers and others in the electric power industry with an interest in the topic. The first day of the workshop consisted of presentations from last year's participants providing an update on their ongoing work and presentations from new participants describing their work related to this topic. The second day consisted of working sessions to finalize the transactive energy white paper, discuss tutorial material on transactive energy, which will be presented at upcoming meetings, and to coordinate transactive energy panel sessions and tracks at meetings including Grid-Interop 2012 and the 2013 IEEE Innovative Smart Grid Technologies conference.

The GWAC recently decided to include focused workshop elements into each of the Council's meetings. This workshop on "The Impact of Local Policy on Smart Grids" is the first of these to be incorporated into a regular GWAC face-to-face meeting. Though the topic may seem to be a bit removed from discussions of architecture and interoperability – in fact it is not. Recalling that the upper-most layer of the GWAC stack is "Economic/Regulator Policy" the council chose to explore approaches and impacts of local action driven by community interests in these discussions. A variety of examples was presented ranging from small communities identifying a common interest and motivation in changing their use of electric power to larger communities mandating a change in their relationship to electric service providers. Along the way we also considered urban settings through innovative building technology.

Background

GridWise® Architecture Council Background

The GridWise® Architecture Council (GWAC) was formed by the U.S. Department of Energy to promote and enable interoperability among the many entities that interact with the nation's electric power system. The 13 GWAC members are a balanced and respected team representing the many constituencies of the electricity supply chain and users. The GWAC maintains a broad perspective of the industry and provides guidance and tools as practical resources for implementing smart grids.

One of the tools created by the Council is the Interoperability Context Setting Framework, which is the source of the widely-used GWAC Stack shown below. The top layer of this stack addresses the imperative

to consider non-technical regulatory and policy dimensions to interoperability as prerequisites for implementing smart grid technology. In other words, achieving smart grids requires not just technological solutions, but also involves informational and organizational challenges.

Interoperability Framework
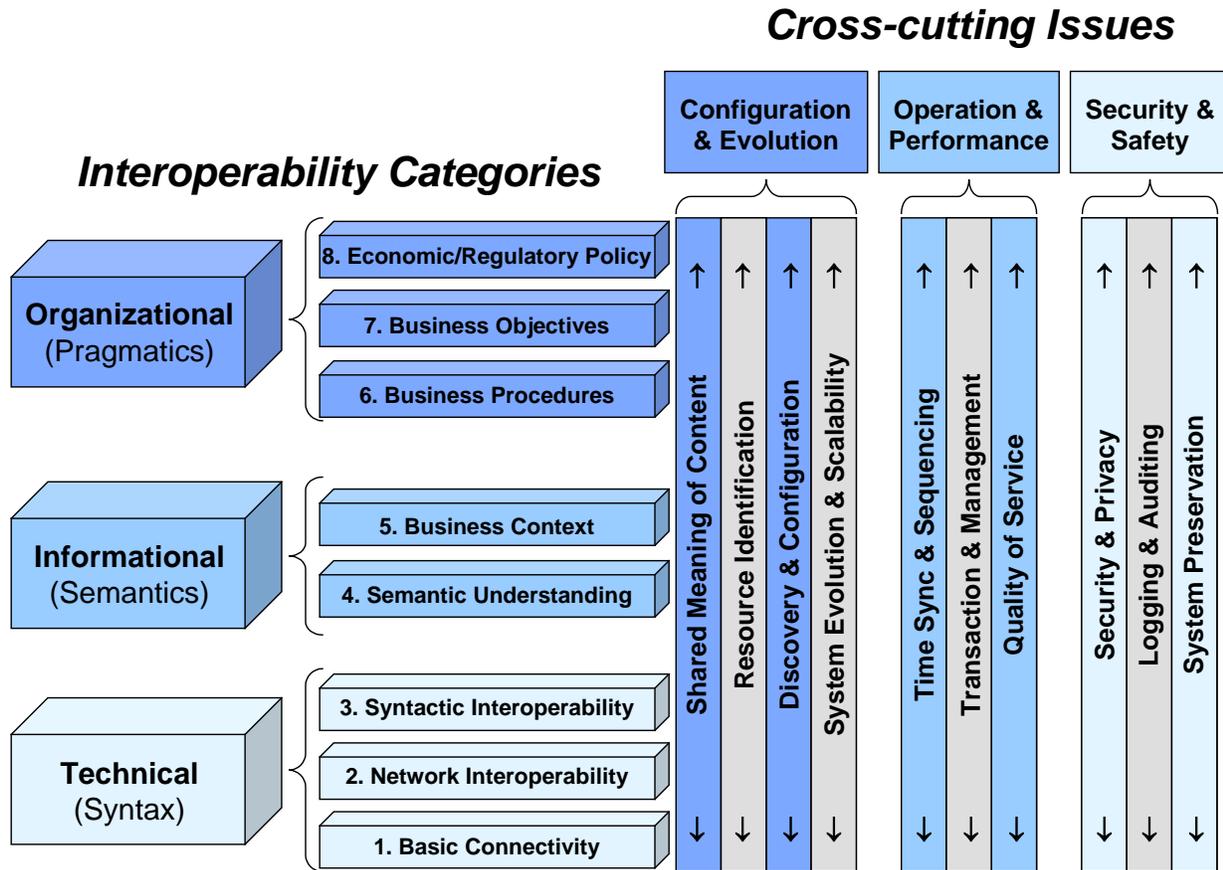
GWAC Interoperability Context-Setting Framework, aka the *GWAC Stack*

Find GWAC news and information at:
www.gridwiseac.org
https://twitter.com/#!/GridWiseAC

The current situation is that dynamic pricing is widely used in the wholesale power markets. Balancing authorities and others operations such as hydro desks routinely trade on the spot market to buy or sell power for very near term needs. In addition, dynamic pricing tariffs are being tried in a number of retail markets, for example, the PowerCentsDC dynamic pricing pilot[1].

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[1] http://www.powercentsdc.org

In addition to these practical applications research is taking place on more sophisticated techniques such as the previously cited work on transactive control. The community of people performing this research has not had a focused opportunity to discuss their work – thus this workshop.

PRESENTATIONS

Workshop introduction: Kenneth Wacks, GWAC member

This workshop addresses the practical benefits of smart grids for consumers focusing on local policy initiatives for sustainable energy such as solar power and electric vehicles. Speakers were from British Columbia, Canada, the State of Washington, and Colorado.

Creating a smart grid is much more than a technical challenge. Therefore, the GridWise Architecture Council created the "GWAC Stack" to extend a well-known communication reference model to informational and organizational domains. This bridges communications and business practices.

The intent of the "GWAC Stack" is to help smart grid designers align technical decisions with utility business practices. The data transmitted must be meaningful for the business activities. On a higher level, the data should help the business execute procedures, achieve objectives, and comply with regulatory requirements.

Our speakers will tell us how they handled these business and policy challenges. We will then discuss how these local initiatives affect the electric utility and regional smart grid planning.

Dr. Wacks introduced smart grids and explained the role of the U.S.federal government. The GridWise Architecture Council is helping the industry adapt traditional grids to smart grids by integrating systems through "interoperability."

Smart grids will be built on the existing electric network. The network is a collection of subsystems that were designed independently. A smart grid is based on a system of systems. For this to work the interfaces between the systems must be clearly and precisely specified. The GridWise Architecture Council has defined degrees of interoperability that translate into practical engineering challenges.

The government is mandating that utilities manage the grid for increased reliability. Information technology (IT) using a data communications network makes this possible.

The domain of the traditional electric utility has reached from the generator to the customer meter. The federal mandates to move away from increasing supply to managing demand requires extending the grid beyond the meter into customer premises and linking those houses to the energy IT network. Access to homes and buildings for energy management is facilitated by a gateway that connects to a communications network inside the house. From there, utility signals reach those devices that can benefit from energy management. The home owner may choose to install local power generators such as wind and solar.

Many of the workshop speakers will focus on the customer interface. They will address opportunities for companies to be created in the local community specifically to provide power generation services, electric vehicle charging stations, and energy management services. Some energy management may be incorporated into consumer electronics installed in the house.

As the GridWise Architecture Council has articulated, creating a smart grid is much more than a technical challenge. Therefore, in addition to discussing technologies, the speakers will explain how they handled business and policy issue.

Please see "Extending Smart Grids to Customers" for the introductory presentation by Dr. Wacks.

The GridWise Architecture Council appreciates the efforts of Drs.
Wacks and Melton in arranging for the workshop speakers.

 Extending Smart Grids to Customers Presentation

POWER FOR THE PEOPLE

SPEAKER: JUDITH CULLINGTON, CITY COUNCILLOR, COLWOOD, BRITISH COLUMBIA, ANDREW MOORE, SOLAR PROJECT MANAGER, T'SOU-KE FIRST NATION, LUDO BERTSCH, PRESIDENT, HORIZON TECHNOLOGIES

"Power for the people" provides radical approaches to community energy solutions. The T'Sou-ke First Nation and City of Colwood solar projects have implemented affordable community-wide approaches to reducing energy demand and providing sources of renewable clean energy.

Presenters Andrew Moore (T'Sou-ke Solar), Judith Cullington (Solar Colwood) and Ludo Bertsch (Horizon Technologies) will show how communities provide the answer to energy and smart grid implementation. They will speak to the benefits of a holistic and collaborative approach, and how it creates the roadmap for success."

Power for the People Presentation

SMART GRIDS, RENEWABLE, BASELOAD, AND LOCAL POLICY IN BOULDER

PRESENTER: KEN REGELSON, FIVE STAR CONSULTANTS

Even though outspent 10 to 1, Boulder's energy advocates won an election to municipalize (take over) the electricity system from our existing investor owned utility (IOU). Why? To answer this, this talk starts with the fundamentals of renewables, baseload power plants, smart grids, and IOU investments in fossil generation, and relates that back to the high-level local actions taken by Boulder voters and elected.

Smart Grids, Renewable, Baseload, and Local Policy in Boulder Presentation

RENEWABLE POWER AND SMART GRID A COMMUNITY PARTNERSHIP

PRESENTER: GARY NYSTEDT, CITY OF ELLENSBURG

Originator and Project Manager for Ellensburg's Community Renewable Park, Gary has been actively promoted distributed renewable power generation across the country over the past six years. In May 2009, Washington passed SB 6170, providing solar production incentives to encourage other communities to utilize and promote renewable energy sources. In his presentation, Gary will be sharing how the City's Community Renewable Project overcame many of the barriers holding back the advancement of renewables in their community. He will also be going over some of the challenges he faced in developing, marketing and funding the project.

Renewable Power & Smart Grid Community Partnership - Presentation

NET-ZERO BUILDINGS AND THE SMART GRID: SEATTLE'S BULLITT CENTER

PRESENTER: PROFESSOR PEÑA, UNIVERSITY OF WASHINGTON

In addition to being the "greenest urban office building in the world," the Bullitt Center, nearing completion in Seattle's Capitol Hill, will also be an urban power plant generating about 230,000 KWh per year with a 242 KW, 14,300 sf PV array. All of this energy will be fed into the municipal grid. At the same time, the building will purchase electricity from Seattle City Light – at a rate hopefully less than 230,000 KWh per year. Rob Peña from the UW's Integrated Design Lab will describe the Bullitt Foundation's plans and intentions for this project, how this building looks *back-to-the-future* in its approach to design, and how it could signal a turning point in the design of 21st century buildings. Rob asks this group: how might a city of net-zero energy buildings and widespread distributed power generation shape the Northwest's smart grid of the future?

Net-Zero Buildings and the Smart Grid Presentation

SUMMARY AND DISCUSSION OF PRESENTATIONS

Each of the presentations provided a different view and approach to community level activities changing the relationship between the community and the electric power system. Several common themes emerged from the presentations.

A Vision for a Sustainable Future

Each of the projects or activities presented during the workshop had a core a vision for better use of energy to achieve a more sustainable energy future. In the case of Solar Colwood and T'Sou-ke Solar the vision included both meeting community energy needs and creating new economic opportunity within the community. The Community Renewable Energy Park concept created by the City of Ellensburg was perhaps more pragmatic in nature in working to make it easier for a broad cross-section of the community to invest in and receive benefits from renewable energy while at the same time easing the impacts of new energy resources on the municipal utility. The Bullit Center in Seattle brought a vision of sustainable energy in an urban environment through integrated design of new buildings. The proposed change of energy service provider in Boulder, Colorado represented a broad vision of community involvement in determining the future of electric power in their community.

In each case there was an individual or a small group who had the vision for a new future and communicated that vision in a manner that could be understood and acted upon for others. Though it may seem obvious once stated – without this vision and leadership none of the projects or activities would exist today.

The Power of Holistic Approaches

Another common theme amongst the presentations and discussion was the importance of holistic approaches. These are approaches that consider the total system and system lifecycle. One particularly important aspect was imperative to several of the efforts – the need to consider and manage total energy requirements and in doing so balance new energy sources with effective use of conservation and energy efficiency approaches. A key point of the Solar Colwood and T'Sou-ke Solar activities was the overall effectiveness of the results was dependent on considering this balance. Though in their case they emphasized the solar technology first – due to its appeal to the communities – to provide a complete result they have had to look at the complete picture. One of their conclusions is that one should start with conservation and reduce energy requirements first. Then one can address sustainable means of meeting the lower energy supply requirements through solar or other means.

It turned out that the University of Washington had to take the same factors into considerations in designing the Bullit Center to be a net-zero building. The energy footprint of the building had to be reduced to the point that photovoltaic panels on the roof could supply enough energy to achieve the net-zero goal. The size of the roof was naturally limited by the size of the parcel of land – thus there are hard limits on the possible generation of power from the photovoltaic units.

Not Just a Technology Problem

All of the presentations and associated discussion had a combination of technology and social considerations. In some cases these had to do with making information available to people, in others it had to do with understanding people's expectations and providing a means for their expectations to be

articulated and taken into account in a project. The social dimensions that make these examples more than just "technology problems" are another manifestation of the power of holistic approaches.

RESULTS

The results of the workshop may be summed up through the following observations captured during the discussion of the presentations.

Open source solutions – new solutions may come from outside the existing industry. We heard an example of open source solutions, for example an energy management router, based on open source technology customized to serve a specific need. This combined with leveraging existing, ubiquitous technology can provide powerful and accessible solutions.

Leveraging zero value government/public land – communities often have land that has no practical value but which can be put to good use relative to renewable energy. The City of Ellensburg was able to site their renewable energy park on such land.

Take advantage of existing government policies – in some cases policies and regulations already on the books can enable community projects to proceed. Many times these policies are not well known – it pays to ask.

Community level energy modeling – The community group in Boulder, Colorado, that came together to discuss the future of their electric power system was able to perform useful energy modeling for their community using low cost or free tools. By pooling their expertise and drawing on the large body of expertise available via the Internet they were able to achieve surprising results.

For most, if not all of the projects or activities presented some form of external funding was used to jump-start the effort.

There seem to be three common factors associated with community energy projects:
- Green energy – this is one of the elements that leads to social acceptance of the activity
- Rising energy costs – the activity of projects offered a long-term means of addressing this problem
- Ubiquitous nature of underlying technology – the ability to make information available to community members is greater than ever before.

Interoperability – though none of the projects explicitly considered interoperability as an element of their project, all faced interoperability challenges of some kind. In some cases the interoperability was technical in nature – that is not surprising. More interestingly, there were interoperability challenges, for example in the T'Sou-ke solar project that related to the business relationships between the community and energy service providers. New approaches as the community level may break the model and require new approaches and business relationships. This in turn may drive new information requirements – pushing interoperability challenges down the GWAC stack.

FUTURE WORKSHOPS

The second workshop focusing on the state of transactive energy will be held in Irving, Texas on October 31 – November 1, 2012.

THANK YOU

Ron Melton
GWAC Administrator, PNNL

On behalf of the GridWise Architecture Council, I would like to thank those who participated in this workshop. The presentations and discussion provided a glimpse of the future that was summed up by one of the Council members as follows, "The future is already here, it just isn't evenly distributed."

REFERENCE MATERIAL

Important Links

GridWise Architecture Council
http://www.gridwiseac.org/

National Institute of Standards and Technology
http://www.nist.gov/smartgrid/

Pacific Northwest National Laboratory/Energy and Environment Directorate
http://energyenvironment.pnl.gov/

T'Sou-ke Nation Website
http://www.tsoukenation.com

Solar Colwood
http://www.tsoukenation.com

City of Ellensburg Community renewable Park
http://www.ci.ellensburg.wa.us/index.aspx?NID=310

Appendix A - Agenda

Workshop – The Impact of Local Policy on Smart Grids – Day 1

12:00 – 1:00 pm	**Lunch Session – Workshop Introduction and Objectives –** Erich Gunther, Ron Ambrosio & Ken Wacks
1:00 – 2:30 pm	**Power for the people** **Judith Cullington**, *City Councillor, Colwood, British Columbia* **Andrew Moore**, *Solar Project Manager, T'Sou-ke First Nation* **Ludo Bertsch**, *President, Horizon Technologies*
2:30 – 3:00 pm	**Smart Grids, Renewables, Baseload, and Local Policy in Boulder** **Ken Regelson**, *Five Star Consultants*
3:00 – 3:15 pm	**Break**
3:15 – 3:45 pm	**Renewable Power and Smart Grid Community Partnership** **Gary Nystedt**, *City of Ellensburg*
3:45 – 4:15 pm	**Net-Zero Buildings and the Smart Grid: Seattle's Bullitt Center** **Rob Peña**, *Associate Professor, UW Integrated Design Lab*
4:15 – 5:00 pm	**Summary and Day 2 Objectives –** *Ron Melton*
5:00 pm	**Adjourn**

Workshop – The Impact of Local Policy on Smart Grids – Day 2

8:30 – 9:00 am	**Day 2 Welcome and Recap of Objectives –** *Ron Melton & Erich Gunther*
9:00 – 10:00 am	**Workshop Discussion –** *Ron Melton to facilitate*
10:00 – 12:00 am	**Workshop Draft –** *Ron Melton to facilitate*
12:00 – 1:00 pm	**Working Lunch –– Workshop Wrap-up** *- Ron Ambrosio & Ken Wacks*
1:00 – 2:30 pm	**GWAC FY13 Planning –** *Ron Melton*
2:30 – 3:00 pm	**Transactive Energy Update –** *Ron Melton*
3:00 – 3:15 pm	**Break**
3:15 – 3:45 pm	**SGIP Update/Discussion –** *Steve Widergren*
3:45 – 4:15 pm	**NIST Update –** *Ron Melton (if no one from NIST is available)*
4:15 – 4:45 pm	**BnP DEWG –** *Ward Camp*
4:45 – 5:00 pm	**Review of Action Items –** Ron *Melton*
5:00 pm	**Adjourn**

APPENDIX B – SPEAKERS' PROFILES

Ludo Bertsch
President, Horizon Technologies

Ludo Bertsch, P.Eng, runs Horizon Technologies, a BC company that designs and develops Smart Home technology solutions that integrate with Smart Grid while pursuing environmental responsibility. Over the last 30 years, he has designed products for major International manufacturers and collaborated with many partners. In addition, Ludo contributes to International standards and utility regulatory processes. He has designed his latest innovations adapting the revolutionary, yet inexpensive, open Android tablet system.

Judith Cullington
City Councillor, Colwood, British Columbia

Judith Cullington is a councillor with the City of Colwood and the lead for the Solar Colwood program. In her 'other' life she is also a consultant who helps communities and organizations to move towards their sustainability goals. She is also the proud owner of a solar hot water system, an electric car, and a "smart home."

Andrew Moore
Solar Project Manager, T'Sou-ke First Nations

Andrew Moore is an Architect who specializes in community development. He has worked extensively with all levels of government, the private sector and grass roots organizations in the UK, Canada and Africa.

He has worked for the T'Sou-ke Nation for the last five years developing a comprehensive community plan and implementing many of the priority activities. One of these projects is an innovation and demonstration project creating clean renewable energy from the sun. This solar project is twice as large as any other project in BC assisting T'Sou-ke to become one of the most solar intensive communities in Canada. All programs are aimed at providing training, jobs and economic development for the band whilst integrating cultural values that lead the way back to a sustainable community once more.

Gary Nystedt
Resource Manager, City of Ellensburg

Gary Nystedt is the Resource Manager for the City of Ellensburg's municipal utilities. Gary grew up in the Midwest – graduated in Architecture at the University of Nebraska where he became part of the solar energy movement back in the 70's during the Arab oil embargo days. In 1990, Gary and his family moved to Ellensburg, Washington where he took over the responsibilities of managing the City's Conservation & Renewable Programs. Ellensburg is

unique in that it has its own electric and natural gas utilities. To date, they have completed over $16 million in residential, commercial and industrial conservation projects

Robert B. Peña
Associate Professor, Integrated Design Lab, College of Built Environments, University of Washington

Rob Peña is an Associate Professor in the Department of Architecture at the University of Washington where he teaches architectural design and building science with an emphasis on ecological design and high-performance buildings. As a building performance consultant with the UW Integrated Design Lab, Rob works regionally with design teams on the development of high performance and net-zero energy buildings. He is working to establish Architecture 2030 energy standards on the campus of the University of Washington and in the City of Seattle.

Ken Regelson
Founder, EnergyShouldBe.org
Ken Regelson is the founder of EnergyShouldBe.org - a non-profit that uses short, clear, credible videos to move people from vision to action to create an abundant and secure energy future. He is an energy analyst, video content creator, and an energy future policy advocate. He was a key volunteer for Boulder's RenewablesYES.org - the successful political campaign to move Boulder's electricity system to a future worth having and far less reliant on fossils.

Ken has a Masters in Electrical Engineering from Stevens Institute.

He has been honored numerous times for his work on renewable energy at the Public Utilities Commission and state legislature in Colorado including:

- 2004 CoSEIA President's Award for net metering advocacy.
- 2005 Center for Resource Conservation ReWard for energy advocacy
- 2006 Wirth Chair Community Award for passage of and rulemaking for Colorado's renewable energy standard - Amendment 37.
- 2011 CoSEIA Sunny Award