

RESEARCH ARTICLES

Peer to Peer: Margarita Takou, Ph.D., P.E.

WHAT GENERAL ADVICE DO YOU HAVE FOR NEW STANDARDIZATION PROFESSIONALS?

Get involved and volunteer within your committee. Participating in the standardization process is not only about working with standards, it's also a great way to learn and apply your leadership skills.

CAN YOU SHARE A FEW TIPS YOU MIGHT GIVE TO A NEW STANDARDIZATION PROFESSIONAL?

It can be hard for new standardization professionals to understand the amount of work a committee puts forth to get a small change approved in a standard. Being part of the process and later leading a project yourself is very fulfilling. Participating at meetings and listening to the discussions between committee members is a great start. There are a lot of opinions expressed during meetings, so take notes and do your own research before offering your own opinion or making a recommendation on a subject.

A good way to become engaged with a committee and its members is to volunteer and work with task groups, as that is where all

of the work is done. Task groups are small groups of committee members who discuss a very specific subject and recommend changes for the committee or subcommittee to consider and vote on. Usually, task group members are highly experienced individuals, but if you are not an expert on the subject discussed, the experience will serve as a great training opportunity.

Last but not least, reviewing ballots and voting is important to staying in good standing with the committee and tracking the upcoming changes to the standard.

WHAT ARE SOME RESOURCES YOU MIGHT RECOMMEND TO NEW STANDARDIZATION PROFESSIONALS (EITHER OFFERED BY ASTM OR SOMETHING YOUR COMPANY DOES)?

I find the member training offered by ASTM very helpful. You can find those offerings under your ASTM account. Also, the staff person for your committee will be a great resource for answering questions or directing you to the correct person if they do not know the answer. Your colleagues and mentors who are familiar with the ASTM process are also great resources.



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RESEARCH ARTICLES

Breaking the Bias Through Standardization: *#BreakTheBias*

By Chantal Guay

As a young female engineer, it was not uncommon for me to be asked at job sites whether I was the administrative assistant. You see, I was just “too pretty” to be an engineer. Even disguised as a backhanded compliment, the message was clear: I was not their idea of an engineer, and I did not belong.

I am not the only one who heard this message; unfortunately, too often we listen to it. In the United States, it has been estimated that almost 40% of female engineering graduates leave the profession.¹ Nevertheless, I persisted and rose in the ranks. I wish I could say that no one today is surprised by my role as a CEO, but there are still those who do a double take.

Research has shown that women are not considered prototypical leaders. There is a bias that certain roles, particularly leadership roles, are still better suited for men. While one might think it is more common for men to have a bias against women, it turns out this is not the case. A recent study from the United Nations found that 51% of women in Canada hold some form of gender bias, compared to 53% of men. Globally, gender bias is higher, with 86% of women and 90% of men showing at least one clear bias against gender equality.²

We have a lot of work to do to break the bias. And the longer we wait, the more it costs society. According to the latest gender gap report from the World Economic Forum, it will take nearly 268 years to achieve economic gender parity worldwide. That’s 10 generations of women who are to be paid less than men!³ Gender inequality affects physical and mental health, safety, employment—all spheres of life.

And it has staggering economic impacts. It is well established that closing the gender gap—such that women’s participation in the economy equals that of men—would add trillions to global gross domestic product (GDP). In 2015, McKinsey estimated that closing the gender gap would add \$28 trillion USD to global GDP in 2020.⁴ We have so much to gain, yet progress is slow.

In 2020, the Standards Council of Canada (SCC) published a report, *When One Size Does Not Protect All: Understanding Why Gender Matters for Standardization*, which found that the relationship between standardization and unintentional fatalities is indeed gender specific. We conducted a cross-country analysis, using data from 106 countries. Our research shows that at a national level, participation in standardization is associated with a decrease

in unintentional fatalities—for men. In other words, the more a country is involved in standardization, the fewer men die because of unintentional injuries.⁵ However, there was no such link for women, which means that being involved in standardization had no effect on unintentional injuries for women. This is further evidence that standardization is failing women.

Another example is that the risk of being injured or killed in a car accident is 73% higher for women.⁶ This is because crash test dummies are based on male anthropometry. Women are not small men. The assumption that they share men's anthropometry has led to many preventable accidents. Given that accidents are largely preventable, the evidence that women are not protected as well as men is unacceptable.

The COVID-19 pandemic has further shone a spotlight on the intersection between standards and gender equality. Throughout the pandemic, we've seen the impact when standards are not designed with women in mind. One example is personal protective equipment (PPE). Historically, PPE has been designed for the male shape—think about masks, face shields, goggles, and so on.⁷

ADVANCING EQUALITY THROUGH STANDARDS DEVELOPMENT

While understanding how standards impact men and women differently is important, it is also essential to understand why standards are not protecting women as well as men. Standards are set by those who participate in their development, and women are still underrepresented in the standards development process. SCC tracks the number of women in Canada who participate on technical committees at the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). Our latest data show that only 24% of mirror committee members are women, even though women make up almost half of Canada's labor force (48%).

The underrepresentation of women in technical committees is reflected in the standards that are developed. While technical committees should strive for gender parity, research indicates that at least 30% representation is necessary to ensure that women's contributions are not marginalized.⁸

There's no question we need to increase the participation of women on technical committees. But this is only one part of the solution. We also need to ensure that the female voice is reflected in the *content* of the standards—that standards are designed with women in mind, regardless of the number of women participating on technical committees.

We know standards are not meeting the needs of woman as much as they should. SCC conducted a preliminary mapping of the National Standards of Canada to the United Nations' 17 Sustainable Development Goals (SDGs) and found that only 2% of our national standards contribute to SDG 5, the UN's gender equality goal. Canada is a nation that considers itself a leader in gender equality and diversity, yet only 2% of the National Standards of Canada factor in gender equality.

I am proud of the work that SCC has done so far. In 2019, SCC became one of the first national standards bodies to publish a five-year strategy to improve gender equality in standards. Since then, we have been striving to foster a standardization system that is inclusive and equal, regardless of gender.

We are also leading the development of the United Nations Economic Commission for Europe's (UNECE) Guidelines on Developing Gender-Responsive Standards, which are currently open for comments. The guidelines address how to improve the representation of women on technical committees, how to ensure that meetings are inclusive and foster the participation of women, and how to ensure that standards are gender responsive, regardless of the number of women participating on the technical committee. The following three steps are concrete actions that committees can take to incorporate gender considerations:

- Start with the assumption that there are gender differences. To ensure standards are gender-responsive, we should start with the assumption that there are gender differences.
- Gather evidence. To determine if there are impacts and if the standard needs any potential modification, you need to gather data—specifically, sex-disaggregated data.
- Take targeted action. Based on the results of the research and assessment, take action to ensure the gender responsiveness of the standard.

In recognition of the need for gender responsive standards, the IEC and ISO have created the Joint Strategic Advisory Group on Gender Responsive Standards, with SCC co-leading the work. The group's charge is to create tools for technical committees that ensure standards are gender responsive.

Not only is SCC very involved in advancing gender equality in the standardization system, we have also been supporting work to advance diversity and inclusion in organizations across Canada. We recently published, in collaboration with the Ted Rogers School of Management's Diversity Institute, a Publicly Available Specification for the Canadian Government's 50-30 Challenge,⁹ which seeks to improve parity for women and underrepresented groups on boards and in senior management. We have collaborated with government, post-secondary institutions, and key stakeholders to give organizations a framework and tools to improve gender parity. This work establishes key terms and definitions for measuring diversity and inclusion in the workplace and builds on national and international knowledge and best practices to provide common language for organizations.

BREAKING THE BIAS: TAKING STEPS

To move forward, we need to break both known bias and unconscious bias. Gender inequality is a systems issue that requires structural changes within the standardization system. A recent ISO and IEC survey found

that 75% of responding technical committees have not considered gender.¹⁰ Among those that had not considered gender, almost 80% said that gender was not relevant to their sector. A recurring refrain amongst the comments was that technical standards “are not a gender issue.”

Although the actions may not be intentional, the consequences are real. It's important to mention that the failure to consider the needs of women is not necessarily indicative of dislike or believing that men are superior to women; rather, there is an inherent tendency to see men as prototypical, and this is also true in standards development. Acknowledging this tendency can help us take concrete actions to mitigate this bias and ensure standards work for all.

Standards are a force for good in societies, ensuring that products, services, and processes work as intended. They support economic growth, facilitate trade, and play a role in protecting health and safety. And yet, standards are achieving these outcomes while not fully addressing the needs of half the world's population. By taking action to ensure that standards are responsive to all, those of us responsible for standards development can magnify the positive impact they can have on society as a whole. I invite you to join SCC's community of experts who shape standards that affect us all.

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RESEARCH ARTICLES

Reflections on Standards and Conformity Assessment in Homeland Security

By Bert M. Coursey, Ph.D.

The United States has made significant progress since the terrorist attacks in September 2001 in developing an infrastructure for standards and conformity assessment for a range of homeland security products. The 9/11 Commission, in their final report in 2004, recommended several steps to make the nation safer and better prepared to respond to national-level disasters. In particular, they recommended that private-sector organizations follow standards such as NFPA 1600-2002: Standard on Emergency Management and Business Continuity. Then-Department of Homeland Security (DHS) Secretary Tom Ridge agreed with these recommendations, and thus NFPA 1600 became “the first” DHS-adopted standard. However, it took eight years to implement a DHS program such that individual corporations could demonstrate compliance with emergency management/business continuity standards.

Why did it take eight years to establish a program that everyone agreed from the start was a great idea? Multiple factors contributed to the timeline. There were two different communities involved: public sector preparedness and corporate business continuity. These two communities were represented by two different, very large agencies within DHS. The public sector was a responsibility of the Emergency Preparedness Directorate in the Federal Emergency Man-

agement Agency (FEMA); corporate interests were represented by the Office of Infrastructure Protection in the National Protection and Programs Directorate (NPPD).

As the first standards executive for DHS and the director of the new DHS Office of Standards in the Science & Technology Directorate, I was responsible for assisting the department in meeting the requirements of Public Law 104-1995, the National Technology Transfer and Advancement Act. My office focused from the beginning on developing voluntary consensus standards for equipment for first responders. Although we felt we were pushing the U.S. system of standards as fast as it could go, it was not fast enough to meet the immediate needs. We constantly heard from DHS leadership that we needed Consumer Reports (CR) or Underwriters Laboratories (UL) “certifications” for homeland security products.

But the leaders at DHS did not appreciate that these private-sector organizations have developed time-honored processes to ensure that products that are accepted for comparison (by CR) or receive a label (from UL) have undergone rigorous tests to demonstrate how they perform. Neither CR nor UL, for example, had the facilities or test methods to assess whether detectors for chemical, biological, radiological/nuclear and explosives agents met basic requirements. And neither wanted

to support a manufacturer's claims that these detectors could detect dangerous agents or prevent terrorists' attacks.

They were not unique in wanting to limit their corporate liabilities in these uncharted waters. The best protection for manufacturers was the "government contractor defense" (*Boyle v. United Technologies Corp.*, 487 U.S. 500 (1988)). Suppliers of military weapons and aircraft have limited liability because the contract between the government and the supplier defines potential liabilities, with a risk-based determination of who would be responsible when they procure the defense systems.

In the absence of voluntary consensus standards of performance, many public and private organizations and some federal agencies began to develop "lists" of equipment and push these lists out to potential buyers. Lists that received a lot of our attention were authorized equipment for purchase with FEMA grants monies, equipment for state and local emergency responders, and products for use in aviation protection.

We worked from the outset to provide FEMA, the Transportation Security Administration (TSA), and other DHS agencies with lists of voluntary consensus standards (from ASTM International, IEEE International, the National Fire Protection Association, and others) so they could provide users with an appropriate standard alongside the homeland security product (or category of products) on their suggested buyer guides. The first standards DHS adopted were personal protective equipment (PPE) standards from NFPA and NIOSH and the American National Standards Institute's N42 IEEE standards for radiation detectors.

Our approach was intended to add some rigor to the term *certification* by requiring third-party testing with agreed-upon test and evaluation protocols. Further, we pushed for product testing to be performed by International Organization for Standards (ISO) 17025-accredited test facilities. There were two major U.S. accrediting bodies (ABs) that already had a foothold in product testing:

the NIST National Voluntary Laboratory Accreditation Program (NVLAP) and the private sector's American Association for Laboratory Accreditation (A2LA).

THREE ACCREDITING BODIES: NVLAP, A2LA AND ANAB

NVLAP

NVLAP is not supposed to compete with the other programs unless they have a direct request from a federal agency. As director of the Office of Standards at DHS, I could request NVLAP to establish such programs, and I did that twice. We requested that they work with the DHS Domestic Nuclear Detection Office to set up the Graduated Radiation Detector Evaluation (GRaDER) program for radiation detectors. The framework for this program was the ANSI N42 IEEE standards for four classes of radiation detectors used in homeland security applications.

The GRaDER program represented a great success. First responder organizations had confidence that instruments were being tested in accredited laboratories against published consensus IEEE standards. The GRaDER program was our template for how to use the U.S. system of standards to improve performance of commercial off-the-shelf equipment for homeland security applications.

My second request to NVLAP was to establish a program for accredited laboratories for testing biometrics equipment. NVLAP assisted TSA in identifying appropriate standards and conformity assessment procedures for a qualified products list (QPL) for airport access control biometrics equipment. The accredited laboratories test a range of biometrics readers for personnel identification (e.g., face, fingerprint and iris).

A2LA

The A2LA organization already had a good foothold in the DHS legacy agencies. A signature program was their accreditation of the field office laboratories of the DHS Customs and Border Protection.

A2LA was to play a much more important role with the Transportation Security Laboratory (TSL) in Atlantic City, New Jersey. The TSL had the lead for DHS testing for trace explosives detectors and x-ray scanners for aviation. TSA spends up to \$2 billion per year on aviation security equipment and has an elaborate system of selecting, testing and deploying equipment to hundreds of airports. We were looking for ways to insert the U.S. system of standards into their qualified products list.

ANAB

The third accrediting body we worked with, the American National Accreditation Board (ANAB), was for an entirely different aspect of homeland security: private-sector preparedness.

Here is where it gets interesting: the DHS Office of Policy in the Obama administration decided that the nation needed something beyond “preparedness.” They asserted that the nation’s public and private sectors needed to be “resilient.” (The experts can better explain the fine distinctions among *preparedness*, *resilience*, and *sustainability*.) The Office of Policy began fashioning a program they called Resilience Star. This program took on a life of its own for a several years. I did my bit to assist in these efforts on resilience, including organizing conferences sponsored by the ANSI Homeland Security Standards Panel on resilience.

Fortunately, the U.S. private sector, as well as state, local and tribal entities, realized soon after 9/11 that they had to take steps to protect their organizations from adverse events, whether those were terrorists’ attacks or natural disasters. Corporations had responded

quickly after Hurricane Katrina in 2005 to look at their distribution systems and how they could assist communities in need. The corporate world also recognized the need for attention to business continuity standards without too much concern about umbrella labels like *preparedness*, *resilience*, *sustainability*, and *supply chain security*. The checklists provided in the business continuity standards would address all these concerns.

CONCLUSIONS

After the terrorists’ attacks of 2001, the U.S. standards community came together with local, state and federal agencies to begin fast-track development of a number of standards to protect the nation from what were seen as imminent threats. Not all the tools for standards and conformity assessment put in place during that first decade are still in use today. The threats today have evolved to include infectious diseases, cyber security, wildfires, and other natural disasters.

A national response to these threats requires new standards and conformity assessment measures. Standards development organizations and accreditation bodies are again answering the calls in these new areas, in addition to continuing their efforts to revise and update the critical standards developed to mitigate terrorists’ attacks. The priorities for new standards will always be driven by the perceived risks. The leaders at DHS S&T and NIST are continuing to work with all the DHS components and other federal agencies and partners in the private sector to strengthen the standards and conformity assessment infrastructure for homeland security and protect the nation.



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RESEARCH ARTICLES

Broadband Standards to Manage and Monitor the Grid

By Robert Cruickshank, PhD; Alison Silverstein, MBA, MSE; Alexandra von Meier, PhD

As demands for electricity and clean energy grow and extreme weather threats increase, the legacy power grid requires interoperable and easily adoptable technology to prevent catastrophic outages and provide safe, reliable, and affordable service. In 2021, the Society of Cable Telecommunications Engineers (SCTE) completed two synergistic American National Standards to reduce grid failures, contain electricity costs, and monetize demand response. The standards enable better grid sensors and orchestration of electric loads using a simple information model designed to (1) improve electricity generation, transmission, distribution, storage, and end use while (2) accelerating the adoption of electric vehicles (EVs) and resilient local power using batteries and other distributed energy resources.

The ANSI/SCTE 267 2021 grid *management* standard orchestrates electricity demand from responsive loads relative to supply to manage costs and carbon emissions and improve the efficiency, carrying capacity, and life span of power generation and delivery infrastructures. The ANSI/SCTE 271 2021 grid *monitoring* standard provides a quantum leap in detecting and predicting conditions relevant to distribution grid faults, safety, reliability, congestion, and hosting capacity.

Globally, electric grids are complex, growing, and ever-changing networks of thousands of utilities, tens of thousands of power

generators, tens of millions of miles of transmission and distribution circuits, diverse storage systems, and billions of load points. Over the last 20 years, electricity costs in the U.S. have doubled and outages have increased by a factor of eight.¹ Increased granularity of observation and control in the last miles of the distribution network through modern instrumentation and responsive loads can play a vital role in addressing these challenges while supporting the beneficial electrification of transportation, buildings, and industry.² Strategic electric load shaping can ensure that large and small energy generation, storage, and delivery mechanisms are used efficiently to provide decarbonized electricity where and when needed.³

POWER GRID AND TELECOMS STANDARDS

Communications and power networks have supported each other for over a century. While electric customer-to-grid interfaces remain mostly unchanged, standards-based customer-to-network communication technologies and interfaces have evolved rapidly through telegraphy, operator-assisted telephony, rotary and touch-tone dialing, radio messaging, mobile phones, ethernet, and gigabit per second (Gbps) broadband connections.

All cyber-secure communications networks, operations and business support systems have symbiotic roles to play in modernizing the grid. In 1997, the Data Over Cable Service Interface Specifications (DOCSIS) for always-on high-speed Internet service were created to standardize interoperability among manufacturers' equipment. Soon, two billion cable modems were deployed along with satellite data, FM radio data, LTE, 3G, 4G, 5G, DSL, Wi-Fi, Z-Wave, Zigbee, and LoRa. Multiple networks can connect and authenticate standards-based responsive loads.

Demand response tools manage customer energy use strategically to meet prices, grid supply, or other customer goals. Over the last 40 years, millions of proprietary demand response devices have been deployed, but billions of standards-based demand response devices are now needed to rapidly decarbonize the grid. To that end, SCTE 267 enables a new generation of interoperable, modular, widely deployed demand response adapters and devices to supplement proprietary systems in time-shifting load on the electric power system.

ANSI/SCTE 267: OPTIMUM LOAD SHAPING FOR ELECTRIC VEHICLE AND BATTERY CHARGING

The SCTE 267 standard provides for end-to-end control of the electric power grid from generation to load, using one-way broadcast and two-way interactive signals. The standard defines, in easy-to-understand terms, how to create, transmit, and act upon a forecast optimum load shape (OLS) to manage the charging of EVs and facility batteries as well as the demand from flexible and discretionary smart electric loads.⁴

An OLS signal delivers a set of numbers, such as the target load for hours 1-24, that forecast the most efficient, cleanest, and/or least-cost electrical supply in grids, microgrids, and nanogrids. All stakeholders—generation entities, utilities, distributors, retailers, and consumers—can use OLS signals

to decide how to balance between grid and distributed supply or use reduction to meet their cost and carbon goals.

The OLS standard was needed because existing standards were siloed and did not provide for generation-to-load control of the electric power grid.⁵ Short-term benefits include the ability to quickly and easily create and distribute a far-reaching OLS signal so that OLS-enabled devices can participate in grid management. Benefits from lower costs, lower carbon, and greater resilience should accrue over the long term as more devices participate.

An OLS signal is created, transmitted, and acted upon as shown in Figure 1. An OLS producer (typically an entity associated with an electricity supply or control system) ingests forecasts of load, renewable generation, and costs. The producer then distributes OLS signals to OLS consumers (devices that manage the consumption of electricity).

EV charging is a prime OLS consumer example. As shown at the top right of Figure 1, unshaped EV charging appears as two spikes, one at 6:00 p.m. and another at 7:00 p.m. At the bottom right, shaped EV charging follows the OLS signal for the portions of time that the EV is plugged in. It is expected that existing interval-based electric meters are suitable for recording consumption and that load shaping can reduce customers' bills and grid stress.

Figure 2 depicts autonomous battery charging and discharging wherein the charger autonomously uses the OLS signal (in blue) to inform charging and discharging profiles (in orange).

ANSI/SCTE 271: REQUIREMENTS FOR POWER SENSING IN CABLE AND UTILITY NETWORKS

The SCTE 271 standard provides precision, sampling rate, and configuration requirements to measure and report voltage and/or current in hardware and software, enabling advanced power sensing in cable and utility networks.⁶ It includes requirements for

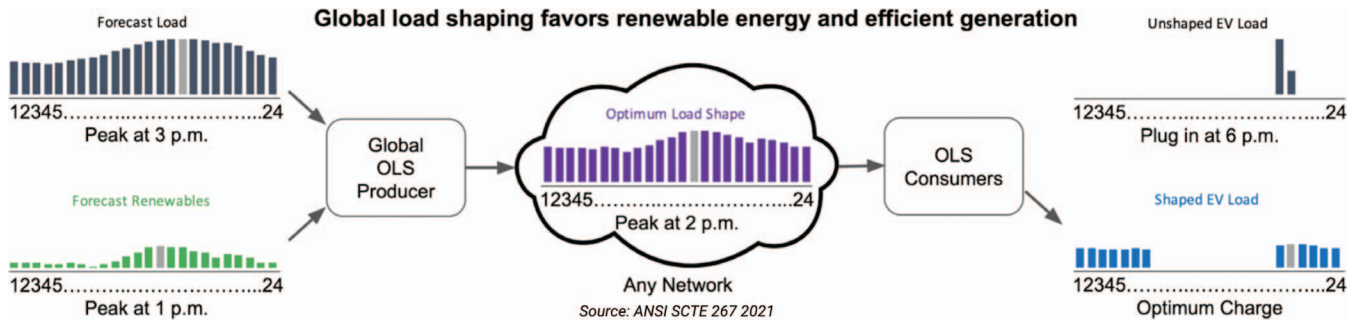


Figure 1. Example of creating, transmitting, and acting upon a wide-area “global” load shape.

sensing and communicating power quality observations from both the 60/75/90 VAC quasi-square wave hybrid fiber-coax (HFC) network and the 120/240 VAC supply from the electric grid. SCTE 271 sensors provide on/off status and useful power quality information to communications providers, utilities, and others.

For network elements, grid and HFC voltage are measured with a precision of 0.002 per unit (0.2% of the nominal value), and the sampling rate is a minimum of 10k samples/sec. The rate of change of frequency and sine-wave goodness-of-fit may be calculated remotely from the measuring network element. This approach is robust in situations with high electrical noise and distortion, where tra-

ditional assumptions about sinusoidal waveforms are not met.

Observation timestamps are reported in Coordinated Universal Time (UTC) with a resolution less than or equal to 1 microsecond. Clock accuracy is less than or equal to 500 nanoseconds relative to UTC. System timing can be derived from satellite or loop timing (DOCSIS, xPON, etc.) or another timing system with comparable stability and accuracy. Increased time granularity and more precise observations reveal more about local and wide-area conditions without the filtering and processing that occurs within traditional phasor measurement units.

The control plane for remote reporting of observations enables sensor configuration

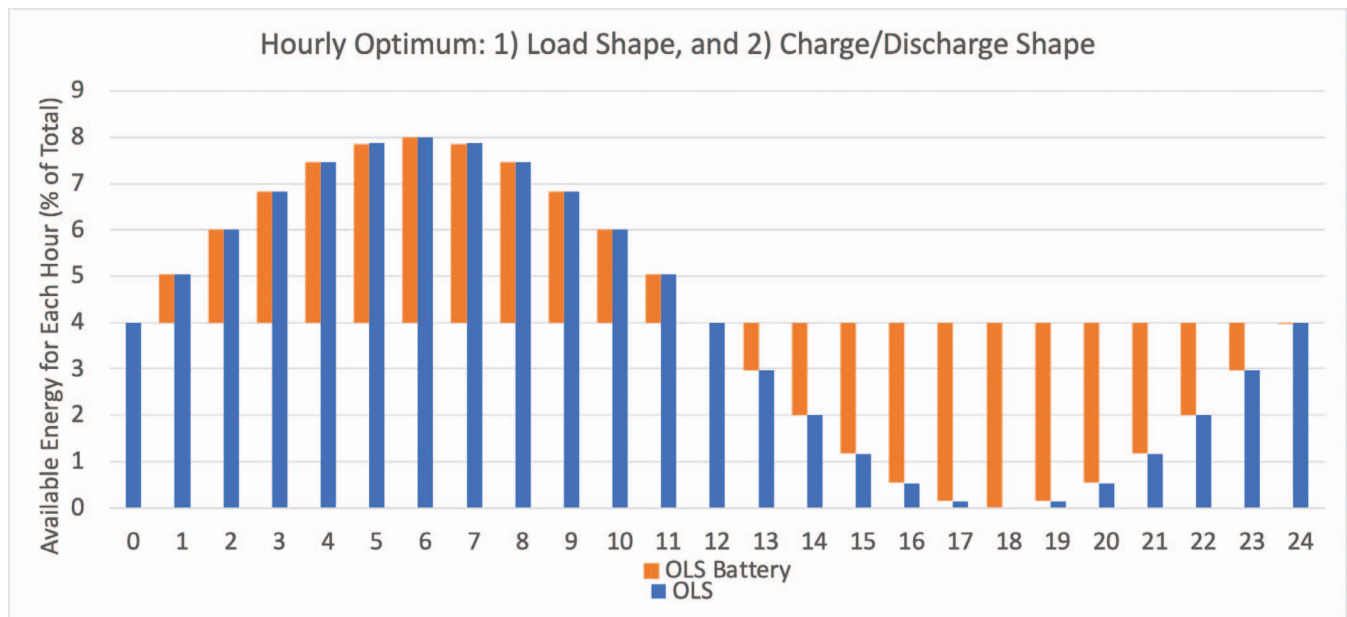


Figure 2. Use of a load shape signal in autonomous battery charging and discharging.

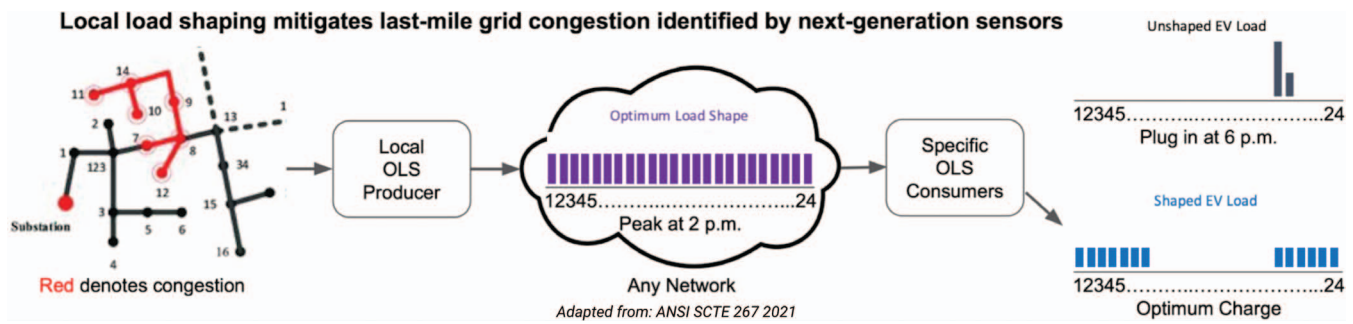


Figure 3. Example of a “Local” load shape that mitigates congestion in the last mile of the grid.

for a one-time poll reply, continuous replies, and/or fixed interval replies. The communication plane uses the IETF/APSIS YANG model as defined in the SCTE 216 Adaptive Power System Interface Specification.⁷ Streaming-oriented communications protocols such as gRPC are preferred. For authentication and encryption, the communication plane uses SSL as defined in RFC 6101 and TLS as defined in RFC 8446.

SYNERGIES AMONG ANSI/SCTE 267 AND ANSI/SCTE 271

SCTE 267 and 271 were designed to work separately and together. For example, voltage sags sensed by an SCTE 271 sensor indicate congested segments in the distribution network—which can be mitigated using SCTE 267 local load shaping. At left in Figure 3, mitigation of congestion (segments shown in red) is achieved by modulating loads to fully utilize, but not overload, a distribution circuit.

A QUANTUM LEAP

SCTE 267 and 271 are open standards designed to facilitate competitive marketplaces for products to *manage* and *monitor* the global power grid, microgrids, and nanogrids. SCTE 267 raises the efficiency and cost-effectiveness of generation-to-load infrastructure by using broadband and other networks to deliver smart energy management signals that shape load relative to electricity supply. New OLS-enabled CTA-2045 Ecoport adapters and in-

line EV charging dongles can be deployed far and wide using existing FM radio data, satellite data, and other types of unidirectional and bidirectional networks.

SCTE 271 offers a quantum leap in the detection and prediction of reliability and congestion-related electricity delivery issues across tens of millions of miles of sensor-starved secondary distribution grids. Together, the two new SCTE standards offer secure out-of-band alternatives to traditional utility system control and communications methods. SCTE 267 and 271 are now in field trials.

ADDITIONAL READING

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Robert Cruickshank is a technology strategist, inventor, and implementer of electric load shaping that enables buildings and transportation to maximize renewable energy and minimize fuel costs and carbon emissions. He began developing smart buildings at AT&T Bell Laboratories, led the development of the world standard cable modem at Cable Television Laboratories, and currently builds grid monitoring, cybersecurity, and control applications with the U.S. Department of Energy National Laboratories and CableLabs.



Alison Silverstein is an independent consultant, strategist and researcher on electric system reliability, resilience, market design, transmission, energy efficiency and technology adoption issues, including facilitating the industry-wide advancement of synchrophasor technology. She has advised the U.S. Department of Energy, states, utilities, ISOs, and non-governmental entities since 2004.



Alexandra von Meier directs electric grid research with the Berkeley Energy and Climate Institute and is an adjunct professor with the Department of Electrical Engineering and Computer Science, University of California, Berkeley. She was previously a professor of energy management and design with Sonoma State University. Her work has addressed electric grid operation, renewable energy, and nuclear materials management.

RESEARCH ARTICLES

Standards and Patents and (F)RAND Licensing

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Technology standards are increasingly critical in everyday life. Our laptops and cell-phones and cars must be able to “talk” with smart sensors, printers, and websites, so standards have been developed to help make that process seamless. Such information and communications technology (ICT) standards are developed collaboratively by industry players at standards-developing organizations (SDOs), although standards often originate with one or several companies contributing solutions approved by SDO members.

As leading, best-of-breed technology is generally desirable, instances sometimes arise in which parts of a standard are covered by a patent. If the patent is necessarily (unavoidably) infringed whenever the standard is implemented, it is called a standard essential patent (SEP). If a party wishes to comply with the standard or a part thereof that infringes the SEP, a license or other permission may be required.

In some SDOs, a standard may be declared royalty-free so that implementers can deploy the standard without paying a royalty. With many standards, however, the parties that contributed the technology want some return for their R&D investment. So that the SEP owner can receive a fair return and the implementer can avoid rates and rules that may be deemed excessive or unfairly leveraged, a regime has been widely adopted in which the SEP owner agrees to license others on (*Fair*)

Reasonable And NonDiscriminatory [(F)RAND] terms and conditions.

While the (F)RAND paradigm has worked for many years, with parties coming together on licensing, recent events have stressed this model. In recent years, SEP owners that make no products and companies that have a greater interest in revenues than reciprocal licensing have hiked the value of SEPs. (F)RAND is also being challenged by some implementers who have adopted “efficient litigation” strategies that resist licensing and view SEP litigation, with its reduced injunction risk and increased SEP owner expense, as preferable.

Some accuse a SEP owner that asserts its SEPs at inopportune times at un(F)RAND terms with practicing “patent holdup.” Others will tag unduly obstructionist implementers as “holding out.”

KEY QUESTIONS

These (F)RAND divergencies raise a number of issues.

Question #1

If a SEP owner has agreed to license on (F)RAND terms under an SDO policy, can the SEP owner seek to enjoin (or stop) the implementer from infringing (or trespassing) on the SEP property? If so, when can the SEP owner enforce such an “exclusive” right?

Patent laws in various countries define the patent as the “right to exclude others who, without authorization (or license), make, use, sell, or import” a [patented] invention. However, the question is how much of that right is relinquished when the SEP owner agrees to an SDO’s (F)RAND policy. SEP owners submit that, without meaningful injunctive remedies, reluctant licensees will not negotiate toward a (F)RAND result. Implementers argue that injunction adversely affects rates and is inconsistent with (F)RAND.

Question #2

Is there a basis for determining whether one or both parties are complying with the (F)RAND process? There is a flow set out by the Court of Justice for the European Union (CJEU) in which the SEP owner identifies its SEP(s) and how they are infringed. The implementer indicates its willingness to conclude a (F)RAND license. The SEP owner then presents a written offer specifying the royalty and how it was calculated. The implementer responds diligently to the offer (e.g., with a counteroffer) in accordance with commercial practices and in good faith.

This high-level CJEU rubric is useful, but it opens potholes and pitfalls. For example, what is meant by *good faith* and *bad faith*?

If an implementer cannot pay a royalty (e.g., because of bankruptcy) or says it will not commit to a rate even if a court sets it, or refuses to grant a reciprocal license under the implementer’s SEPs, courts may find that the implementer is outside (F)RAND.

Question #3

There is a question of if or when a SEP owner’s (F)RAND conduct may be subject to anti-competition (or antitrust) charges. Some contend that (F)RAND disputes are purely commercial and subject only to contract law, not anti-competition law. Others contend that a SEP owner enjoys artificial leverage and that seeking an injunction or excessive terms can

be abusive, thereby giving rise to unfair (disruptive) competition charges. Whether parties comply with the (F)RAND assurance process (e.g., the CJEU process) might influence whether serious anti-competition allegations and remedies may apply.

Question #4

Are there methods of determining (F)RAND? Most courts find that prior license agreements for the same SEPs, negotiated under ordinary commercial circumstances, are useful in determining what “willing” parties consider reasonable. Some courts have used a simple formula—for example, determine a total cumulative royalty for all SEPs declared for a standard (e.g., x% of infringing product revenue) and then allocate a share of that royalty based on how many of the SEPs were contributed by the particular SEP owner (e.g., 5 out of 100 SEPs means 5/100 of x%). The court may adjust the rate based on non-SEPs improperly listed and may further look at the relative importance of the owner’s SEPs.

Some argue that the SEP value should be based on the smallest saleable infringing unit covered by the SEP. Others disagree. Whether the royalty should be a flat (per unit) rate or whether it can vary depending on environment is also in debate. There is consensus, however, that a royalty should be based on invention value and not the result of standardization. But *value* is not a straightforward concept.

Question #5

To which implementers does a SEP owner’s assurance apply? This is highly dependent on what the SDO policy states and its interpretation. A key dispute is whether the SEP owner must license all requestors (including component makers) that infringe all or part of the standard or whether a SEP owner complies with the policy if it licenses makers of a downstream product that includes components, providing component makers assured

access. The European Technical Standards Institute has a policy that states as follows:

6.1 Availability of License

When an ESSENTIAL IPR [SEP] relating to a particular STANDARD ... is brought to the attention of ETSI ... ETSI shall immediately request the owner to give ... an ... undertaking in writing that it is prepared to grant irrevocable licenses on ... [FRAND] terms and conditions under such IPR ...

A federal appeals court recently found that the holder of ETSI SEPs had a choice as to where in the product stream it would grant licenses. An implementer that was denied a license did not have standing to sue a SEP owner, because downstream manufacturers were being licensed. The importance of this interpretation relates to a doctrine called “patent exhaustion.” According to the U.S. Supreme Court, licensing the maker of an infringing \$10 component might, in certain circumstances, preclude (or exhaust) the exercise of patent rights against a larger \$1,000 infringing end-product maker downstream. If a SEP owner must license component makers, it may be seriously undercompensated if it is foreclosed from licensing the end-product maker. The appeals case strongly supports SEP owner rights.

On the other hand, there is cause for concern if a component maker cannot seek a license and is therefore unprotected from a lawsuit. While some contend that an end-product license protects upstream component makers, the legal basis for that argument is not clear. The appeals court decision may prompt SDOs to specify implementer rights more clearly in their policies.

Question #6

What about transferred SEPs? Does the (F)RAND assurance travel to the next SEP owner, and the owner after that? Many SDO policies seek to address this situation, but things get murky when a SEP purchaser down

the chain of ownership questions how it is bound by an earlier owner’s agreement with an SDO.

Question #7

In a similar vein, which companies in a corporate family are subject to the SDO policy? Most SDOs bind related companies, like subsidiaries, parents, and sister companies. Otherwise, an implementer might be surprised to find that the signatory who may be selling products and securing (F)RAND licenses is actually patent-poor. Needed SEPs may all be owned by a sister company with no (F)RAND assurance!

Question #8

Is it (F)RAND-compliant if a SEP owner requires an implementer to take a license under all of the owner’s SEPs that the implementer is infringing? Similarly, what if the SEP owner offers a global license only? Each country (or region) has specific laws relating to patents and may have different markets and stages of development. Is a SEP owner in (F)RAND compliance if it licenses its SEPs as a package and/or licenses globally? At least one court has found that such practices do not breach (F)RAND, and a U.K. court determined rates for various geographies, but the law is unsettled.

In any event, it is widely agreed that a SEP owner cannot condition a SEP license on the implementer giving or taking a license covering non-SEPs, although the parties may agree voluntarily.

Finally, a Key Question

Can an implementer comply with (F)RAND if it declines a license until the validity, infringement, and enforceability of SEPs are decided? At least one SDO has considered this licensee concern.

SEPs, (F)RAND, injunctions, competition, and global implications are a shifting landscape. Issues raised in this article may help standards professionals navigate the terrain.



Marc Sandy Block is retired from IBM Corporation after working in intellectual property and standards. This article is not legal advice, opinion, or counsel. There are no representations regarding applicability to your situation or accuracy or completeness. The author's views are his own.