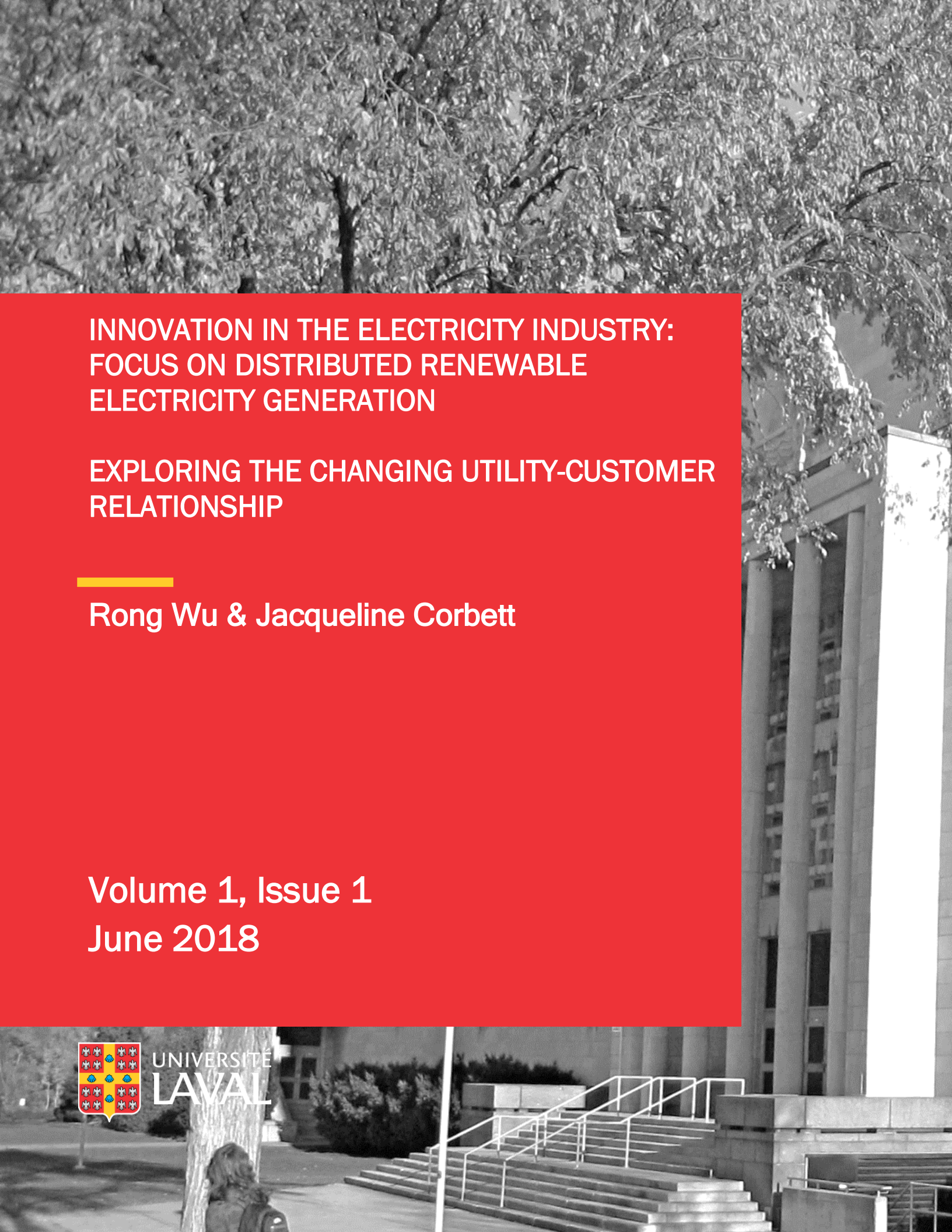

# INNOVATION IN THE ELECTRICITY INDUSTRY: FOCUS ON DISTRIBUTED RENEWABLE ELECTRICITY GENERATION

## EXPLORING THE CHANGING UTILITY-CUSTOMER RELATIONSHIP

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Driven by the growing environmental awareness of customers, technological innovations associated with the smart grid and renewable energies, and government regulations, most electricity service providers (utilities) in North America now offer some sort of distributed generation (DG) program. DG is considered a promising area of the smart grid and the transition to a more environmentally-friendly electricity supply chain. DG is often performed by non-utilities, including residential customers and other organizations such as universities, cities, and businesses. In this study, we include net metering, microFIT programs, FIT programs, and distributed electricity generation programs as part of the broad umbrella of DG even though utilities may manage these activities under different programs and regulatory frameworks.

Under DG programs, customers can generate electricity for own consumption and, in some cases, sell back the excess electricity to the grid, thus, it is expected that future utility-customer relationships might be different than the traditional relationships of the past. Applying a predominantly management information systems (MIS) perspective to this research, we seek to understand the implications of these changing relationships on the information needs and processing capacities of utilities and their customers as well as the communications flows between all parties in the electricity value chain from generation to consumption.

**This report, the first of the series, focuses specifically on the question of how the utility-customer relationship is changing and the implications of these changes for utility-customer communications and information management.**

**Research Method**

Data for this research were collected through semi-structured interviews with nineteen participants from eleven different North American utilities between June and December 2017. Of the eleven utilities, five were Canadian and six were American. Four of the utilities were municipally-owned, four were cooperatives, and three were investor-owned.

The interviews were conducted in person where possible, otherwise by telephone and each lasted approximately 60 minutes in duration. Where permission was granted, the interviews were audio-recorded and transcribed verbatim. In other cases, notes were taken by the researcher and approved for accuracy by the participant.

Following the interview, the data were analyzed qualitatively by identifying key themes that emerged from the interviews. These are synthesized and reported in the Findings.

## SUMMARY OF FINDINGS

- The traditional bilateral utility-customer relationship is transitioning to a “triangle” relationship involving the utility, customer, and the vendor of DG systems.
- Utilities and vendors play different roles at different stages of the DG lifecycle and face emerging information communication challenges.
- Utilities could improve performance of DG programs by offering education to both customers and vendors, creating shared understanding with customers, and developing trilateral information processing functions to web portals.

# Findings

The majority of the utilities we spoke to deem DG programs to be an important part of their service offering. Although their strategy may not involve active promotion of the program, utilities want to accommodate the operation of the program. They see their role as supporting customers and making the process as seamless and painless as possible for them.

## 1. THE EMERGENCE OF 'TRIANGLE' RELATIONSHIP

In comparison with the traditional bi-directional customer-utility relationship as illustrated in Figure 1, we observe that the new relationship between the utility and their customers are becoming somewhat more complex as a result of the involvement of the vendors (e.g. solar system installers) in DG programs. This new 'triangle' relationship is most evident in the early stages of the DG lifecycle when customers are making the decision to participate in a DG program, installing the system, and connecting to the grid.

Figure 1: Traditional Customer-Utility Relationship

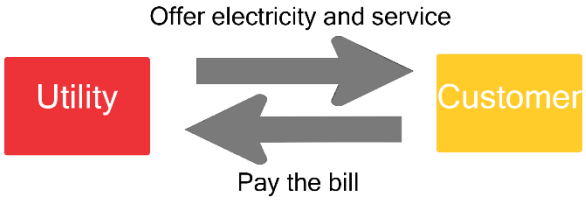
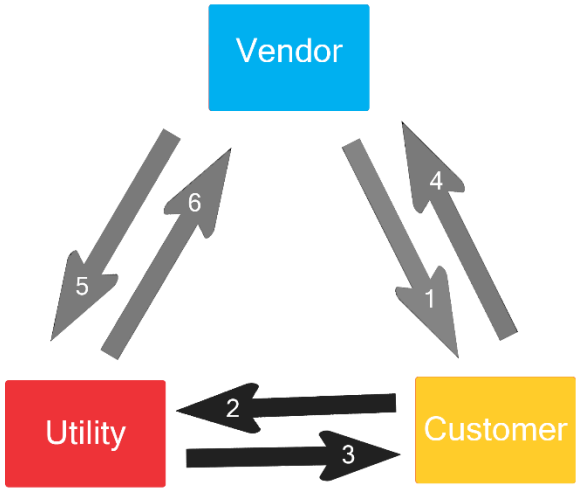



Figure 2: New Customer-Utility Relationship in Distributed Energy Programs




1. Vendor explains process, confirms system size, installs solar panels
2. Customer fact-checks information with utility; pays bills
3. Utility answers questions and provides information; offers electricity and bills the customers
4. Customer makes the decision regarding DG
5. Vendor applies on behalf of the customer
6. Utility accommodates operations with the vendor

Figure 2 illustrates the new 'triangle' relationship with the three parties main parties involved in operationalizing DG programs. In addition, the numbers indicate the steps in the communication process and activities among the three actors during the sign-up process of the program. After the system is installed and functioning, the vendor's role diminishes within the triangle depending on the extent of support and monitoring provided by the vendor during the life of the system. As a result, the main stable and long-term relation will likely remain the utility-customer relationship as indicated by the arrows in bold in Figure 2.

**Therefore, in addition to involving more actors, the new triangle relationship will involve both temporary and permanent relationships, making the environment ever more dynamic and challenging to manage.**

With utilities continuing to have the more enduring relationship with customers, it will be essential for them to continue to monitor and strengthen these relationships throughout the entire life cycle of DG programs. A key way of doing this will be to offer additional support and service to these customers (step 3 in Figure 2). We already observe that many utilities try to help their customers verify the information on DG obtained from vendors and other sources, so that the customers can make informed decisions based on correct information. For instance, some utilities offer fact-checking of vendor quotes. Other utilities emphasize the importance of building good relationships between themselves and the DG system vendors because these vendors need, first, to understand well how the programs works, and second, to act as effective intermediaries between the utility and its customers. In DG, no one wins when problems arise between the customer, utility, or the vendor.

**Significant benefits can be realized when the utility and vendor can work collaboratively to co-create value for themselves and their mutual customers.**

## 2. UTILITIES AND VENDORS PLAY DIFFERENT ROLES AT DIFFERENT STAGES OF THE PROCESS

From the customer perspective, DG programs can be broken down into three main stages: the deciding stage, the implementing stage, and the operating stage. Each stage has its own discrete activities, information requirements, and issues.

### EXPLORING STAGE

During the *Exploring Stage*, many different actors, including the utility, vendors, family, friends, neighbors and the local community, influence the customer's perceptions and interests in DG programs. Customers obtain information from these influencers in terms of the initial investment, payback, and experiences participating in the programs. Additionally, they may seek information related to renewable energy rebates and incentives related to DG programs. The major activities are thus information gathering on the part of the customer to determine if this is something they wish to pursue.

## IMPLEMENTING STAGE

Once the decision has been made to move forward, customers enter in the *Implementing Stage*, in which the customer-vendor relationship becomes established and takes on heightened importance. Currently, typical residential (but also commercial) customers lack sufficient knowledge of the electricity grid and DG, so most often they have to rely on vendors for the essential information, specifically, details such as the implementation process, specification of proper system size, and return on investment. To help reduce their risk, customers often seek to validate this information, whether with their utility (depending on the nature of their existing relationship) or other third parties. During this implementation phase, the vendor (in most cases) takes responsibility for managing the details of the project, including securing the necessary approvals and completing the necessary paperwork. Thus there is increased interaction between the vendor and the utility. It is at this stage that the utility-vendor relationship within the Triangle gets tested. Conflicts between the interests, priorities, and cultures of these two organizations can put strain not only on their relationship, but also the utility-customer relationship and the vendor-customer relationship.

### *Customers' Expectations and Right-Sizing the System*

Among the main motivations for customer participation in DG programs are financial benefits (e.g. saving money) and environmental concerns. The financial payback of a DG for the customer depends on the size of the system. Except for feed-in-tariff (FIT) programs, where customers are explicitly generating electricity for the grid, most DG programs are moving towards a net approach where the objective is for customers to offset up to 100% of their consumption load.

Utilities are mainly concerned that the system is properly designed and sized and that customers are well-informed about the details and constraints of the DG program. Given that the electricity generated by the customer offsets what they would otherwise buy from their utility, some have suggested utilities are motivated to encourage smaller systems.

On the other hand, vendors benefit from selling larger systems to their customers, leading to concerns about oversized systems that will ultimately reduce the return on investment to customers and lower their satisfaction with the DG program. Perversely, it could also lead to greater electricity consumption (e.g., rebound effects) as customers attempt to recapture value from their over-investment.

For customers, a key question is who to trust. So far the answer is mixed and, we believe, hinges in part on the strength of the utility-customer relationship. When this relationship is strong, customers seem interested having their utility do fact-checking of information received from vendors in a sort of 'trusted advisor' type of capacity. However, where the utility-customer relationship is weaker, customers will look to others to provide a sober second regard.

Tensions are always likely to exist to some degree between the objectives of utilities and renewable electricity system vendors. However, **effective communications and sharing of information between all three parties – the utility, vendor and customer – could go a long way to ensuring that customers have reasonable expectations of DG programs and make the best decision given their particular situation.**

### OPERATING STAGE

Once the system is implemented, customers move into the *Operating Stage*. As the current generation of solar photovoltaic (PV) systems (among the most popular for residential DG programs) are more reliable and require little maintenance, vendors of these types of systems slip more into the background. Unless there is a problem with the physical system, most vendors have limited contact with their customers once the system is operational. The utility-customer relationship regains prominence because it is normally through the monthly electricity bills that customers can see whether their investment is paying off in real monetary terms. Therefore, **it is essential for utilities to make the billing system and information regarding load and generation levels clear and easy for their customers to understand.**

Two potential issues may arise during this Stage. First, in some areas, the renewable energy sector (e.g, solar system vendors) is very new and characterized by many start-up companies and entrepreneurs. As the industry matures, some of these vendors merge or go out of business, leaving customers in a situation of having 'orphaned' systems. In such cases, they may turn to their utility for support or, in extreme situations, retire from DG programs.

A second issue relates to the ongoing provision of data regarding the performance and production of customers' systems. With smart inverters now becoming more standard, various system manufacturers (separate from the solar system installers) offer websites and applications for customers. How and to what extent these are used by various parties will be the subject of future research report.

**Energy Storage**

Increasingly, energy storage through batteries are been seen as an essential part of sustainable future distributed renewable electricity programs. The adoption of electric vehicles and new advances such as the Tesla Powerwall are creating new possibilities for capturing and storing electricity for later use. Integrating these new technologies and services into DG systems will likely further introduce new players into the electricity industry and change the relationship between utilities, vendors, and their mutual customers.

## Recommendations

In the face of these changing conditions, we offer three main recommendations to utilities and the electricity industry in general:

### 1. OFFER EDUCATION TO BOTH CUSTOMERS AND VENDORS

Utilities have to cope with the difficulties of information communication with both customers and vendors. Therefore, we recommend that utilities develop and provide specific and easy-to-understand training and documentation on DG programs via their websites. This would enable vendors and potential DG customers to fully understand and follow the rules of the programs. In turn, this would greatly improve the efficiency and correctness of information communication among the three parties.

For instance, regarding the issue of proper system sizing, utilities could provide tools to allow customers to figure out the reasonable size of a system by calculating their own electricity consumption over the previous last year. Although this information is generally contained on bills or accessible by logging in to an online account, it is not always easy for customers to understand or extract. An interactive decision-support tool that pulls information directly from the utilities' billing system could facilitate this process, saving the customer, utility, and vendor time and effort. In addition, such training could help customers and vendors understand why it is important not to oversize the DG system. With enhanced education, all parties will be able to more efficiently and effectively engage in DG programs. Meanwhile, it could have added benefits of reducing utilities' efforts managing the DG programs because of improved information processing performance.

## 2. CREATE SHARED UNDERSTANDING WITH CUSTOMERS

Our second recommendation is for utilities (as well as vendors) to change the dynamics of communication and create relationships based on shared understanding with customers. The objectives are to achieve communication effectiveness and enable customers to cooperate with utilities and vendors to achieve mutual goals, such as better environmental performance and energy efficiency. In other words, customers should be encouraged and enabled to engage in the co-creation of value.

To create shared understanding, utilities might increase the interactions with customers and strategically enhance their use of social media, including social networks, blogs, and wikis to reach DG customers. Utilities (in collaboration with vendors) could create a social media group for DG that discusses challenges and opportunities related to the program and allow more effective communications. For example, in some areas, regular washing of solar panels can contribute to maintaining high levels of electricity generation. This 'tip' could be shared on the platform in order to reach a larger number of customers. Moreover, the interaction among customers could also be encouraged. This is important as our research suggests that social influences play an important role in the *Exploring Stage*. Building a dynamic and interesting online DG community could thus have multiple effects: disseminating information about DG programs to potential customers, improving customers' satisfaction with the program, and enhancing the utility-customer relationship for better overall results.

## 3. DEVELOP TRILATERAL INFORMATION PROCESSING FUNCTIONS

The third recommendation takes a longer-term view and, admittedly, comes with significant political, legal, and social challenges. However, it is still worth noting. If we accept that relationships of the future will be increasingly multi-party as suggested by the triangle model, then the patterns of communication must also change from bilateral (e.g., vendors-customers; customers-utilities; utilities – vendors) to multilateral. In this scenario, the electricity industry should seek to develop and adopt tri- or multi-lateral information processing and communication strategies so as to enable more transparent, efficient, and effective communications between all relative stakeholders. This could initially be done, for instance, through a web platform that is shared by the utility, vendor and customer to manage and track progress on the DG system implementation. From there, other applications or a broader-based inter-organizational communication platform could be envisioned.

**Grid Management**

Besides questions of how to effectively manage changing relationships with their customers, DG programs can create various issues and challenges for utilities in grid management, such as:

- Grid imbalance that is caused by the different solar generation levels in summer and winter.
- Integration of individual solar (or other DG) systems onto the grid. For instance, sometimes, residential net metering projects are too small to be visible for grid manager, but as the numbers increase, so too could the impacts.
- Grid management planning for the utilities with relative high numbers of DG customers.
- Need for operational agility in grid monitoring, as the integration of DG may require utilities to adjust voltage levels and change the taps much faster.

## Conclusion

Distributed generation is changing the traditional utility-customer relationship, making it more complex and dynamic through the integration of new actors. Customers, utilities and DG system vendors all have information requirements in order to fulfill their various roles in DG programs. As a result, new information processing and communications capabilities are required. These capabilities can be created by leveraging new information technologies, within the smart grid as well as social media and other technologies, to provide a platform for education, create shared understanding and co-creation of value, and facilitate transparent and effective multi-party communications for the benefit of all.