Reforming the Energy Vision (REV)
Working Group II: Platform Technology

Subcommittee on Microgrids and Community Grids

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Working Group 2 Platform Technology
Subcommittee on Microgrids and Community Grids

I. Executive Summary

a. About:

The Working Group 2 Platform Technology: Subcommittee on Microgrids and Community Grids (Microgrid Committee) was formed on May 12, 2014 at the Reforming the Energy Vision (REV) Collaborative Meeting. The Microgrid Committee included 134 individuals representing a broad cross section of interested parties and DPS Staff. The Microgrid Committee co-conveners were Matthew Wallace, DPS Staff; Andrea Cerbin, Pace Energy and Climate Center; Tom Mimnagh, Consolidated Edison; and Walter Levesque, DNV GL.

The Microgrid Committee identified seven specific areas of focus related to microgrid development. Volunteers from the full Microgrid Committee were sought to form the seven subgroups assigned to research and compile information on each of these specific areas of focus and present findings back to the full Microgrid Committee. The subgroups and their respective leads were:

i. Regulatory – Andrea Cerbin, Pace Energy and Climate Center
ii. Economic and Financial – John Kelly, Perfect Power Institute
iii. Interconnections – Mike Razanousky, NYSERDA
iv. DSPP Planning – Rob Sheridan, National Grid
v. Ownership and Control – Lewis Kwit, Energy Investment Systems
vi. Intrinsic and Extrinsic Values and Worth – Ruben Brown, E Cubed
vii. Social, Environmental, and Community Implications – Andrea Ruotolo, New York State Smart Grid Consortium

The Microgrid Committee held seven weekly meetings from May 15 through June 26, with regular subgroup meetings throughout this timeframe.

b. Objective:

The objective of the Microgrid Committee was to identify the technical and regulatory issues and barriers that need to be addressed to better enable the development of single- and multi-customer microgrids (including community microgrids) in New York State.

c. Key Findings:

The statements in these key findings and in the report are the issues identified by the Microgrid Committee and its subgroups. They do not represent a consensus of opinion.

i. Microgrids are not viewed holistically or uniformly under current regulations:
   1. Regarding the qualifying facility exemption for multi-customer microgrids, clarification of the terms “at or near” and “users” is needed. Clarity will result in more efficient evaluation of microgrid feasibility.
   2. Clarification of the obligation to serve as a provider of last resort is needed with regard to privately owned microgrids.
   3. Net metering policies need to be clarified for microgrid owners with mixed DER assets.

ii. Development of the economics and financing of microgrids are needed, including opportunities for market participation.
   1. Standby rates require re-evaluation, especially for microgrids that support critical infrastructure, have reliable DER, and/or can be depended upon for grid support.

2. Without distribution-level markets to monetize the value of grid support, microgrid development faces limited economic feasibility and a lack of incentive to develop infrastructure that can support the grid.
3. There is a lack of options to finance non-utility-owned microgrids.
4. Financing/economic issues become more complex as you move from single-use to multiuse microgrids.
5. Investigation into proper cost allocation for the various uses of microgrids is needed.

iii. Further development of interconnection standards in New York State for microgrids are needed
1. Interconnection approval procedures could be made better, more efficient, and more user friendly.
2. New standards around microgrid interconnections (coordinating with IEEE work) need to be developed along with consistent permitting practices.
3. Development of technology is needed to better enable and control the bi-directional flow of power to and from microgrids.
4. Testing of new systems and controls is needed to verify safety, reliability, resiliency, costs, etc., of microgrid systems.

iv. Incorporation of microgrids into DSPP planning:
1. In order to effectively perform integrated planning, the DSPP must include integrated microgrid (and DER) alternatives into system planning models, analysis, and system enhancement recommendations.
2. A clear set of policies, standards and guidelines need to be created, communicated, and maintained concerning the integration of microgrid (and DER) systems with the DSPP. An appropriate and ongoing forum is likely necessary to develop, maintain, and evolve these guiding documents to align with the capabilities and markets over time.
3. Defined Roles and Responsibilities must be developed and communicated for all participants engaged with integrating microgrids (and DER) within the DSPP.
4. To foster microgrid (and DER) penetration, proactive investment in modeling tools, sensors, software, and skilled personnel are necessary to leverage the potential benefits of these distributed resources.
5. The DSPP should collaboratively work with communities to identify potential microgrid opportunities.

v. Diverse ownership and operational control models will drive microgrid development. Learning opportunities should be encouraged.
1. An administrative pathway to exempt pilot projects from existing regulatory barriers could help to more immediately satisfy REV objectives.
2. Opportunities for microgrids to develop power capacity that exceeds internal loads for participation in wholesale and retail markets are needed to make private ownership of microgrids more economically feasible.
3. Regulations that virtually prohibit utilities from owning distributed generation and selling electricity should be re-evaluated within the context of microgrid development (regardless of overall DER policy).
4. Utilities will play a critical role in defining requirements for the point of common coupling, to assure safety while permitting power flow between the grid and the microgrid.
5. Government or rate-based funding may be required to facilitate the strengthening of the grid to enable robust capabilities for two-way power flow between microgrids and the grid.

6. Examining existing grid-independent microgrids could reveal information regarding the barriers and benefits of grid-interconnection.

vi. Microgrids provide intrinsic and extrinsic values and worth.
   1. Microgrids provide opportunities for fast start projects that can scale out from pilot stages relatively quickly and that can be coupled to any number of loads, technologies, institutional devices and lead investments -- enabling lead investments by end-users, competitive third party providers and/or utilities. Microgrids are not constrained to State leveraged funding.
   2. Existing DER investments are a prime starting point for value-added additions (e.g. demand response systems, retail access customer base, clean heat and power systems, district energy systems, other DG installations, load management systems, etc.).
   3. Microgrids provide a new energy usage/management and investment option for existing and new single- and multi-end-user facilities, contiguous and nearby campuses, and for communities.
   4. Microgrids can provide additional streams of positive value (revenue) to participants in the microgrid to help justify the investment.
   5. Intrinsic interests are a key factor in Microgrid start-up investment and in later rounds of investment. Extrinsic interests (values) need to be identified and optimized to justify investment by DSPP and/or third party intermediaries.

vii. Social, environmental, and community engagement implications are key to evaluating the sustainability of microgrid development in New York State.
   1. Social and environmental implications and obligations should be considered when evaluating microgrid projects.
   2. A methodology to evaluate social and environmental implications of microgrids should be developed. Community objectives, priorities, and sensitivities should drive microgrid planning and development processes.
   3. Opportunities for communities to participate in microgrid development should be created to better understand the needs of different customers, to ensure that planning and development of those projects do not exclude some sectors of the society, and that the projects do not have undue negative consequences for some members of the community. These efforts should also educate and set expectations for the involvement of microgrid participants to ensure the stability and performance of a community microgrid.
   4. Achieving sustainable community support requires a diverse approach to planning and development. Methods should be identified and the roles of the different players determined (consumers, prosumers, businesses, utilities, water management companies, etc).
   5. Previous experiences on community engagement should be studied and analyzed to save time, effort, and money and raise the chances for successful community microgrids to be deployed.

d. Recommendations for Future Consideration

i. Staff should, with members of the working group as necessary, address the specific issue regarding a microgrid developer's need to seek exemption from Public Service Law to develop a multi-customer microgrid.

Working Group 2 Platform Technology
Subcommittee on Microgrids and Community Grids

II. Report

a. Final working documents from each subgroup

Each of the subgroups used a collaboratively edited working document to record findings. The formats of these working documents vary as each subgroup used the format most appropriate for that particular effort. Following the initial collaborative meeting, subgroups were formed to address specific topic areas (below: i – v). As the collaborative process evolved, the need to explore additional topic areas was identified and additional subgroups were formed (vi – vii). Attached, in this order, are the subgroups' final working documents. The statements in these documents do not represent a consensus of opinion of the entire Subgroup or Microgrid Committee.

i. Regulatory
ii. Economic & Financial
iii. Interconnections
iv. DSPP Planning
v. Ownership & Control
vi. Intrinsic and Extrinsic Values and Worth
vii. Social, Environmental, and Community Implications

DRAFT

REFORMING THE ENERGY VISION (REV)
WORKING GROUP II: PLATFORM TECHNOLOGY

SUBCOMMITTEE ON MICROGRIDS AND COMMUNITY GRIDS

Subgroup: Regulatory

Reforming the Energy Vision (REV)
Working Group II: Platform Technologies
Subcommittee on Microgrids and Community Grids: Regulatory

Summary

While concepts such as district energy and distributed generation are fairly established, microgrids as a defined entity are relatively new. As a result of their nascent being, they suffer to be correctly defined and thus regulated. Microgrids suffer from straddling the spaces between regulations designed for purposes their components may occupy, such as standby rates, without realizing the wholeness of the value they create to the system that may be different from those components. The Commission has had to evaluate microgrids on a case-by-case basis because they interact with the current regulations in a haphazard and ad hoc manner. By creating clarity around the definition of microgrids, their structure, and their value, the Commission will be able to standardize the process of regulating these entities. This clarity will provide for technical and economic certainty for microgrid developers and utilities.

As such, the Microgrids Regulatory Subgroup has identified several areas where PSC intervention, clarity, and guidance could enhance microgrid development. Because ownership is so essential to how a microgrid will engage with the associated regulations, this subgroup has delineated between single customer, multiple customer, and community microgrid ownership models. In addition, this group has identified areas where microgrids serving critical infrastructure could increase societal benefits necessitating different, if not special, treatment by the Commission. The attached table lists out the different ownership models and the various regulatory interactions they face. Below is a list of the top five legal and regulatory issues with a recommendation for possible Commission action on each issue.

Top 5 legal issues:

Obligation to serve:

- The Commission should clarify when the obligation to serve attaches and who is responsible when service is disrupted within a privately contracted PPA, is the utility still obligated as a provider of last resorts?

Qualifying Facility:

- The Commission should clarify the Qualifying Facility “at or near” test
- The Commission should clarify is there a limit on the number of unaffiliated “users.”

Standby Rates:

- The Commission should re-evaluate Standby rates.
- The Commission should drastically reduce and/or eliminate Standby rates for microgrids that service critical infrastructure.
- The Commission should expand the Campus-style tariff to all IOU territories. And evaluate expanding the Campus-style tariff to multiple customer microgrids.

Net Metering:

- The Commission should clarify net metering policies for microgrid owners who may have mixed assets on site. (CHP and solar, net metering should apply to qualifying assets within the grid and not be excluded from net metering because of the presence of other generation sources).

Standardized Interconnection:

- Islanding requires more technical interconnection process this should be standardized with a time limit on both the customer and utility side.
- The Commission should re-evaluate the size limitations in the SIR.
- The Commission should clarify interconnection standards with the DSPP.

Single	Multiple	Community	Critical Infrastructure
Franchise -Need for public right of way (ROW) access	Franchise -Need for public right of way (ROW) access	Franchise	Benefits Essential Public Service
Qualifying Facility -Generation type -Size	Qualifying Facility -50% Rule (for PURPA not NY) -Realistic Appraisal *Certain regulatory burdens lifted as an electric corp. *On its face does it comply, is it possible to comply and as it in the public interest *Guidance on how RA will apply to microgrids -Sell to others triggers EC status if not "at or near" -"Users" – is there a limit on unaffiliated users?	Qualifying Facility -50% Rule (for PURPA not NY) -Realistic Appraisal *Certain regulatory burdens lifted as an electric corp. *On its face does it comply, is it possible to comply and as it in the public interest *Guidance on how RA will apply to microgrids -Sell to others triggers EC status if not "at or near" -"Users" – is there a limit on unaffiliated users?	Integration with backup services - A lot of sites will already have robust backup generation that will directly compete with microgrid implementation
Standby Rates	Standby Rates	Standby Rates	Service of Critical Infrastructure during an emergency
Net Meter for QF and non QF assets	Net Meter for QF and non QF assets	Net Meter for QF and non QF assets	Reduced Regulatory burden -having some sort of efficiency threshold
Standardized Interconnection -Islanding -Size -Integration into the tariffs	Standardized Interconnection -Islanding -Size -Integration into the tariffs	Standardized Interconnection -Islanding -Size -Integration into the tariffs	Standardized Interconnection -Islanding -Size -Integration into the tariffs
	Obligation to serve -Does this attach to a QF?	Obligation to serve -Does this attach to a QF?	More favorable rate (no rate) to reflect societal value -Integration w/utility -PSC guidance on sites
	Campus Style Interconnection	Campus Style Interconnection	
	Hybrid Microgrid	Hybrid Microgrid	
	Operational Control Non Utility DER Compensation	Operational Control Non Utility DER Compensation	
		Sophistication of community planning capability	

REFORMING THE ENERGY VISION (REV)
WORKING GROUP II: PLATFORM TECHNOLOGY

SUBCOMMITTEE ON MICROGRIDS AND COMMUNITY GRIDS

Subgroup: Economic & Financial

Working Group Members

LEAD -- Kelly, John (Perfect Power Institute)
Bochenek, Scott (Iberdrola USA / NYSEG / RGE)
Cerbin, Andrea (Pace Energy & Climate Center)
Cinadr, Matt (Ecubed)
de Veer, Henrietta (Prime Solutions, Inc. / Energy)
Dobriansky, Larisa (General Microgrids)
Gallagher, James (NYS Smart Grid Consortium)
Kwit, Lewis (Energy Investment Systems rep NYC)
Levesque, Walter (DNV GL)
Ruotolo, Andrea (NYS Smart Grid Consortium)
Thomson, Greg (Clean Coalition)

Objectives

Overall Committee Objectives:

- Identify hurdles to developing single, multi-customer and community microgrids in New York State
- Identify opportunities (regulatory, technical, etc) to streamline development and reduce cost/risk of microgrids
- Identify opportunity pro/cons where applicable

Sub-Committee Objectives/Sub-heading:

Objectives
Maximizing grid value to customers and the grid
Minimizing utility impact
Attracting investment and innovation into microgrids with a focus on investment in islanding of critical facilities
Identify risk and cost issues that, once resolved, will improve the ability to finance microgrids

Working Subgroup Procedure

- Week 1: Poll sub-committee for input on
    - Objectives
    - Hurdles with pros/cons
    - Opportunities with pros/cons
- Week 1-4: Organize responses and convene a series of conference calls to discuss and prioritize input for each
    - Finalize objectives based on consensus at first meeting
- Week 2: Issue draft sub-committee response for final comments asking members to identify their top four hurdles/opportunities
- Week 3: Issue final sub-committee response for comment
- Week 4: Issue final sub-committee response

Economic/Financial Issues or Hurdles

Issue/Hurdle
ROI not sufficient (e.g. construction and transaction costs). Microgrids may not be economically feasible without participation in markets. Support to macrogrid currently not valued
Developers don't over size generators due to lack of incentives (e.g. islanding)
Lack of ways to finance non-utility owned microgrids
Risks are too high (e.g. revenue streams are not certain, the life cycle of energy assets is long, the future cost of energy and the markets for excess production are uncertain)

Economic/Financial Opportunities

Opportunity to Streamline	Pro	Con
Provide access to real-time, day-ahead, and other dynamic rates and make TOU or real-time the default rate	Markets are self-adjusting TOU is a critical price signal	No public market exists in all respects
Access to a wide array of ISO and distribution company ancillary service (e.g. power factor, voltage support)	More revenue streams	
Reduce uncertainty with physical connectivity standards, ownership business models and utility connectivity and use requirements		
Provide financing support (e.g. energy district)		Hard to establish a value for the "Commons"
Establish more reliable revenue streams		
Create a special "islanding rider" for critical facilities that offers special ancillary service payments in return for developing islanding capability and entering TOU/real-time rate (e.g. lower interconnect cost, distribution company ancillary service payments, etc…)		
Better economies of scale in generation (construction cost per kW and kWh of power)		
Lower transaction cost per MG with replicable business models and "routine" legal/finance processes		

REFORMING THE ENERGY VISION (REV)
WORKING GROUP II: PLATFORM TECHNOLOGY

SUBCOMMITTEE ON MICROGRIDS AND COMMUNITY GRIDS

Subgroup: Interconnections

Working Group Members

Session	LEAD -- Razanousky, Mike (NYSERDA)
	Currie, Bob (Smarter Grid Solutions)
	Cerbin, Andrea (Pace Energy & Climate Center)
	de Veer, Henrietta (Prime Solutions, Inc.)
	Cronin, Brian (CSA eng Services)
	Enayati, Babak (National Grid)
	Yang, Bo(Siemens PTI)
	Gillespie, Susan (Citizens for Local Power)
	Mirza, Zarin (Central Hudson)
	Thomson, Greg (Clean Coalition)
	Key, Tom (EPRI)

Objectives

Develop a list of the potential electrical interconnection issues and the potential solutions to these issues for microgrids in New York State. This would include findings and recommendations for the Department of Public Service (DPS) to review in REV proceeding.

Overall Sub Group Objectives:

1) Identify potential relevant electrical interconnection issues.
2) Identify potential solutions to these issues along with their opportunities(i.e; pros)and challenges (i.e; cons).
3) Develop key findings (i.e; facts) and recommendations (i.e; action items).

Working Subgroup Procedure

Week 1: Poll sub-committee for input on

- Objectives
- Opportunities/ Challenges with pros/cons
- Findings and recommendations

Week 1-4: Organize responses and convene a series of conference calls to discuss

Finalize objectives based on consensus at first meeting

Week 2: Identify relevant electrical interconnection issues. (completed)

Week 3: Identify potential solutions to these issues along with their pros and cons. (completed)

Week 4: Develop key findings and recommendations. (completed)

NYS Microgrid Sub Group: Interconnection Issues

Sub Group Objective #1

Interconnection Issues	Category
Interconnection standards (e.g. IEEE 1547) only allow for limited voltage and frequency ride through and the ability to actively control voltage.	Standards
Customer-owned do-it-yourself systems have used non-standard and unsafe equipment and configurations.	Safety
The microgrid controller technology is still not mature and in development.	Technological
There lacks sophisticated models to facilitate the operating and integration of microgrids.	Technological
No standard interconnection requirements that cover all cases of distributed energy resources installation.	Standards
Existing electrical infrastructure could require substantial modifications to accommodate microgrids interconnecting to macro grid.	Cost
Utility interconnection requirements are written primarily to ensure safe guard conditions and preserve grid reliability. Utility requirements may not be up-to-date- may not take into account newer technologies such as smart inverters, ride-through, voltage regulation and optimization schemes, and energy storage elements.	Procedural
Utility needs to act more like a partner in distributed energy resource interconnection, as opposed to “obligated to interconnect”.	Procedural
Utility does not include access to planning, design and operating details? Offerings from utilities on interconnection options are generally uni-directional and do not allow alternative solutions.	Procedural
Ability to backflow power, especially on network protectors, is crucial for distributed energy resource interconnection development.	Technological
No considerations for self-certified interconnection installations based on utility and state standards.	Procedural
Can considerations be made for pre-approved interconnection design groups in specific utility areas.	Standards
Would the microgrid interconnection owner be allowed, or have the responsibility, to maintain or repair the infrastructure associated with that microgrid.	Procedural
Would the microgrid operators be able to perform the work limited	Procedural

to the utility in the past? Can qualified workers perform the interconnection construction typically the responsibility of the utility; utilities hire contractors to perform utility work, can the microgrid hire these same or similarly qualified contractors directly to provide an overall cost savings.	
Communication infrastructure improvements required. The DERs on a planned microgrid should be capable of communicating with the microgrid point of common coupling to detect the formation of the microgrid.	Technological
Ability of DERs to have the adaptive protection setting capabilities. Microgrids become weak systems after isolation from the Area Electric Power System (EPS). The settings of the protective relays and advanced dynamic features i. e. Volt/VAR, Ride Through, etc should automatically be adapted in the microgrid mode of operation to maintain the voltage and frequency.	Technological
Potential power quality issues could increase due to the DER intermittency may be more severe than those of the grid connected mode because of the low stiffness factor in the microgrid.	Quality
Many simple microgrid configurations conform to existing requirements of utilities for location of distributed generation on standard urban and suburban electrical systems. Microgrids with multiple utility tie points generally do not conform to existing utility requirements.Microgrids interconnected to urban secondary network systems do not normally conform to current requirements.	Procedural
A microgrid at the scale of an entire urban secondary network could be technicallypossible, but requires massive changes .	Technological
Microgrids interconnection systems are susceptible to “hidden failures,” or systemic risks that are extremely difficult to detect under normal operations but can result in system failures under certain conditions.	Quality
If microgrid transitions are done offline (separate from the utility then re-energize), many interconnection issues can be alleviated.	Design
Microgrids introduce additional safety hazards during storm events, particularly from live, downed conductors and backfeeds.	Safety
High costs tend to be especially prohibitive for municipalities pursuing distributed energy resources interconnections. Especially around areas of strengthening system to support DER.	Cost
Need to have timely interconnection design, approval and construction.	Procedural
Ability to know the valuable grid areas for strengthening that distributed energy resources could improve or resolve.	Procedural

Microgrid control capabilities need continuous maintenance and support, including the periodic testing of control capabilities (i.e. not just at the time of interconnection) to ensure performance is consistent and reliable	Procedural
The interconnection process will have to evolve and be able to address the various types of microgrids, requiring new ways of working and new data to be exchanged between the microgrid owner/operator and the distribution utility. The connection process for DG is an example of where multiple new steps were required and implemented in many countries, especially when new technology was being deployed.	Procedural
In order to design the interconnection of a single or multi-site microgrid, and to incorporate this within distribution planning, it will be necessary to define some standard interconnection guidance including controls/services available from the microgrid.	Standards/Procedural
Follow grid voltage and frequency (operate in droop mode), the method is accepted practice but the specific settings are still an issue being addressed to various degree in interconnection standards, such as CA Rule 21, but not in NY.	Standards
Regulate real and reactive power (various modes and objectives, IEEE 1547a, MA Rule 1219), again this is allowed but settings and ways to coordinate distributed with convention means are lacking. Solution is usually called Distributed Energy Resource Management Systems (DERMS).	Technological
Communication link with balancing area operator, an issue for balancing load and generation in high penetration of DG or large microgrids.	Technological
Local generator and load protection (NEC 690, 705, EEI Interconnection Study, IEEE Std 446)	Safety
Level of immunity and ride thru for specified grid events, an issue for both the grid operator and the microgrid, this will get some help from new IEEE 1547, Grid codes, new CA Rule 21.	Technological
Expectations for availability and reliability as defined in IEEE 762, not defined for non-dispatchable generation.	Reliability
Maintain voltage and frequency (isochronous mode), a reliable master control and reference generator is needed. Assign dispatch priority and droop characteristics, a master control is needed. Load following and/or demand response, AGC with demand management will be needed. A master controller with algorithms for economic dispatch will be needed.	Technological
Synchronizing equipment and control. Automatic connect/disconnect equipment and control. Some generators in the micro-grid will need to change operating modes. Detect grid loss/fault. Receive commands to island. Re-Synchronize phase prior to reconnect.	Technological
Ability to Respond to high or low grid voltage and frequency to	Technological

provide support. Respond to variation in grid voltage and frequency to provide stabilization	

Sub Group Objective #2

Potential Solutions	Category	**Opportunity (Pro)**	**Challenge (Con)**
Most of the issues identified above can be resolved by creation of a unified set of interconnection standards applicable both to utilities and microgrid developers.	Standards	Would vastly simplify the process	Takes time to develop & involves changes at PSC and utility level. FERC may also be involved.
NYS should adopt the provisions of FERC order 792 for smaller (under 20 MW) generator (or microgrid) interconnections that pertain to simplifying and assuring speedy completion of the interconnection application and approval process, including fast-tracking. However, NYS should *not* adopt wording in FERC order 792 indicating that the cost of related T&D upgrades is to be borne by the generator (or microgrid).	Procedural	Simplifies and expands fast-track procedures to assure timely response to DER interconnection requests	Utilities may resist pressure for standardization & simplification. On cost see the next Potential Solution.
Instead, NYS should adopt the rule on interconnections that is implemented in Germany, specifically: unless the cost is judged "unreasonable," the utility is responsible for the cost of interconnection as well as the cost of any optimization, strengthening, or extension of the grid to accommodate DER. This cost can be recouped in the next rate proceeding.	Cost	Adoption of this system would give an enormous boost to integration of DER. It would also help to control the cost of interconnection since utilities must prove reasonableness of their costs in rate proceedings, whereas currently DER owners are held hostage to utility estimates, which can be many times greater than independent engineering assessments.	May require legislation. Resulting rate increasesand diversion of costs to non-participants would have to be addressed in the regulatory process, for example by stand-by rates, or by other tariff provisions.
Once a device is Standard Interconnect Requirement certified, the utility should not need to review the internal operating functions.	Standards	Constant review of the same product is not required.	Individuals reviewing the design need to learn about the product.
Utilities could allow engineering companies to become certified to perform design of DER without review, with the exception of	Procedural	Allow for better understanding of utility design requirements and	Potential exists to slide from requirements and

audit. (Similar to DOB and other agencies.) Utilities should have the option to remove engineering firms from certification based on audit.		concerns to afford a shorter design time.	pre-approval may add burden to utility.
Utilities should have to provide the design review checklist they use to review DG applications.	Procedural	Allows interconnection design to address utility concerns.	Add burden to utility to identify requirements and may not address all conditions.
NYSERDA could sponsor a project to allow for construction and analysis of microgrid.	Technological	Directed research should allow for advancing of technology.	Too many players may prevent the desired goals.
Allow the use of public communication systems for secure data monitoring and potentially for control and protection of microgrid.	Technological	Capital expense for some projects may not allow some project from proceeding and may give useful operating data to operators of both the grid and microgrid.	New systems may cause concern with security and complicate integration of grid and microgrid systems.
Provide incentives to utilities to allow for microgrid operation, such as sharing the generation capacity penalty with the microgrid.	Cost	Utilities understand how their system operates; however, they may not understand how newer technologies may improve their operations.	If the risk and the reward is not shared one party is always at a disadvantage.
A full revision of the IEEE 1547 standard has now begun with the aim to release by 2018. The main revisions are likely to include: • Allowing for wider frequency and voltage ride through. • Definitions and requirements for interoperability and communications interfaces, referencing IEEE P2030 and P2030.2 guides. • Microgrids - in particular how the protection and anti-islanding schemes and settings will need to be modified. • DER on secondary grid networks.	Standards	• Address concerns from the vendor, customer and utility point of view. • Potentially loose the tolerance of conventional power grid to the integration of Microgrid	May not meet future Microgrid owner's needs
DOE initiated a FOA earlier this year to call for R&D activities around Microgrid controller, which will facilitate automatic operation of microgrid	Technological	The seed funding will trigger round of funding interests around the country	Takes time for mature products to hit the market
Potential for new sub-WG within 1547 to	Standards	Provide valuable	Model

address the modeling issue in a collaborative way via the development of a standardized library of DER models (proposed by Siemens PTI).		quantitative basis for operators to understand Microgrid or DG's dynamic behavior	standardization and verification are critical
Proper communication infrastructure needs to be installed to allow generators to detect the microgrid mode of operation, which may require different settings than the grid connected mode.	Technological		
Microgrid controller development- NYSERDA could hold a workshop on the microgrid controller to give the opportunity to the developers to present their technology and discuss the plans to move forward.	Technological		
Current 1547 revision will address voltage and frequency ride-through, intentional islanding, droop control, and optimization methods. It should also clearly define the standard's limitations, whether through an MVA limit or some other method.	Standards		
Conduct research and testing to examine the effects of multiple types of DG behind one PCC. (Started by University of Pittsburgh and NETL this summer.) Create a set of general inverter models that can be used with utility power flow software.	Technological	This will allow most microgrid interconnections to be modeled and their effects on the grid to be examined by the utility.	It is likely that not all proposed microgrids will fit these general models.
Update utility requirements to account for new technologies and reference new versions of standards like 1547. Pull from 1547 family of standards for recommended practices and application information. Utility must continue to review and update these requirements as microgrid technology evolves.	Standards/ Technological		
Utility creates a "fast track" approval process for certain pre-approved microgrid designs.	Procedural		Limited by location and size.
Utility creates a program to certify contractors in interconnection construction work that would otherwise be done by the utility.	Procedural	Cost savings to utility and customer.	
Require open transition between paralleling and microgrid operation.	Technological	Alleviates many interconnection issues (ex.	Even a short interruption to

		synchronization of DER and utility, protection requirements with both sources in).	some types ofcustomers may be unacceptable.
Utility creates a testing and maintenance schedule to ensure the proper operation of microgrids both in parallel and islanded modes.	Procedural		

Sub Group Objective #3

Findings	Category
Development of any new system should not be based on cost alone but should ensure all safety, reliability and other key electrical metrics being maintained or improved while reducing costs to foster competition. Microgrid installation and operation must increase the reliability of the electric supply to the local area and reduce the short term and long term operating expense to the utility.	Cost
Both sides of the microgrid (utility and non-utility) need to have an understanding of system planning, design and operations to allow for the grids to be dovetailed. Each party needs to understand how the other can have an impact on the electric, both positive and negative. Microgrid development should be considered as integration into an existing grid, not as a replacement of the existing grid. Laws and attitudes may need to be change to effect this change.	Procedural
New technology is not necessarily required to increase the number and scale of microgrids; however, it may allow for integration to occur where it was not possible using existing technology. Technological innovation must provide improvements to the existing electric system or the risk of their implementation may not be warranted. Isolated operation requires additional resources to adhere to performance standards, which does not allow for economies of scale and inevitably will lead to excessive stranded asset.	Technological
No Standards for interconnections of microgrids exist.	Standards
Numerous weak and cumbersome interconnection procedures	Procedural
Ability to backflow power on network protector systems	Technological
Many issues may be solved if a unified standard is created for utilities and microgrid developers.	Standards
Further research and testing must be done to predict inverter behavior during unexpected events. Utilities must be able to model	Technological/Quality

and predict an inverter's response to a fault on their system, as well as any potential power quality or stability issues that may be caused by the interconnection.	
Microgrid must be effectively protected both while islanded and paralleled with the utility.	Technological
The existing utility infrastructure may require substantial modifications to incorporate microgrid interconnections. A high level of microgrid control also requires an upgraded communications infrastructure.	Technological /Cost
Microgrid benefits may not outweigh the costs for some communities.	Cost
Utility requirements need to be updated for new technologies such as smart inverters and control / optimization methods.	Procedural
Microgrids must be maintained and tested at regular intervals to ensure correct operation, both in parallel and islanded modes.	Procedural
Many issues may be solved if load is open-transferred between the utility and the microgrid.	Design
Current distribution interconnection rules generally don't support advanced microgrid and all require approval of utility for the interconnection of a microgrid	Procedural
Utilities worry that microgrid may harm their overall reliability, while the microgrid developers/owners find it difficult to navigate through utility's legacy systems	Technological
Microgrid may violate franchise rules of local utilities.	Procedural

Sub Group Objective #3

Recommendations	
Development of new standards for interconnections	Standards
Development of new efficient procedures for interconnections.	Procedural
Development of new technologies to control power to flow in both directions on network protectors and for other microgrid systems.	Technological
Modifications to existing procedures should be undertaken to foster a cooperative environment to develop a more integrated interconnection process. Risk must be shared between all parties. Consideration should be given to having a qualified third party perform the design, construction and/or operation of microgrids.	Procedural
Mechanisms to reduce the cost of technology ,such as research and development, to enhance the development of microgrids should be re-evaluated to determine if the desired goals are being achieved.	Technological
Evaluate systems designs to include all generation (capacity) asset to	Design

be considered during normal operation and not considered during emergency operation. Designs should not be based on operation with specific equipment as the key component; but it should be based on functional requirements.	
New revision of IEEE 1547 will introduce new ride-through, communication, and control requirements. Coordinate standards work with effort.	Standards
Encourage research and testing on the effects of concentrated microgrids on power quality, stability, and reliability. Include provisions for multiple types of DER behind one PCC, or one DER with multiple PCCs. Create a set of general inverter models that can be used with utility power flow software.	Technological /Quality
Create “fast-track” approval process for pre-approved microgrid designs in certain areas.	Procedural/Cost
Create a program to certify contractors in interconnection construction work that would otherwise be done by the utility.	Procedural/Cost
Provide monetary incentives for utilities or developers to maintain and operate microgrids. Provide grants or sponsorships to defer the cost of microgrid development and construction.	Cost
New revision of IEEE 1547 will introduce new ride-through, communication, and control requirements. Coordinate standards work with effort.	Standards
The regulatory agency needs to address the revenue, cost and cost recovery of a microgrid for the ease of implementation	Procedural/Cost
Utility need to adjust their energy procurement and resource adequacy considerations to accommodate the development of microgrid	Procedural/Cost
NY consider adopting the German system in which the utility assumes the "reasonable" cost of any physical changes required for the MG interconnection & then applies it to rate negotiations.	Cost
NY should ensure that there is a level playing field when it comes to financing and operation of microgrids by diverse investors, owners, and operators.	Cost

REFORMING THE ENERGY VISION (REV)
WORKING GROUP II: PLATFORM TECHNOLOGY

SUBCOMMITTEE ON MICROGRIDS AND COMMUNITY GRIDS

Subgroup: DSPP Planning

TOPIC AREA: DSPP planning for microgrids

Focus Team:

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- "Henrietta DeVeer, Prime Solutions, Inc. / Energy Engineering"
- "John Kelly, Perfect Power Institute"
- "Lewis Kwit, Energy Investment Systems rep NYC"
- **"Rob Sheridan, National Grid" - LEAD**
- "Scott Bochenek, NYSEG/RGE"
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- Tom Key, EPRI

Introduction

- This subgroup brought together a diverse team of stakeholders to collaboratively identify key planning issues to be resolved to effectively integrate microgrids onto the DSPP platform.
- Team collaboration was fostered by:
  - Conference calls to set weekly objectives
  - Individual “off-line”contributions to the Deck
  - Identification of consensus items and a forum to present differing view points.
  - Weekly readouts to the larger Microgrid/Community Grid working group.

Purpose of DSPP Planning for microgrids

- To maximize the value realized from microgrids for all DSPP participants in an economic manner while ensuring compliance with applicable standards, codes, and service quality expectations in both interconnected and islanded modes of operation.

TOPIC AREA: DSPP planning for microgrids

Objectives:

- Identify market and technology platform issues to be resolved to effectively integrate microgrids in DSPP system planning.
  - Types of Planning
    - Planning for the evolution of microgrids on the DSPP
    - Distribution System Planning with microgrids
  - Issue areas:
    - Future State / Micro Grid Evolution
    - Planning Process
    - Planning Criteria
    - Roles and Responsibilities of Participants

The Envisioned Future State

- The integrated distribution system will be much more complex in the future than it is today!
- The DSPP is facing a dramatic shift in system dynamics with the significant expansion of solar PV, other distributed customer resources and microgrids.
- Microgrids will be deployed in all shapes and sizes.
- It is likely there will be no two identical advanced microgrids in the near-term because the drivers will vary, but it is necessary to establish the infrastructure to handle them all.
- Being unique, each and every microgrid will require engineering and planning to ensure load and generation can be dynamically balanced to ensure safe and reliable operation at the specific location and time.
- Enhancement and upskilling of the power distribution system AND the personnel planning, engineering, operating and maintaining these complex systems is necessary.

Future State – The Dynamic Microgrid

- A dynamic microgrid is defined as "a portion of a distribution grid that has the ability to independently separate itself from the main grid when under duress, be able to sustain itself in a stable manner for extended periods of time by crating a balance between supply and demand with its boundaries and then reattach itself to the main grid once normal operation has been achieved."
  - These microgrids have the potential to be a key element of the ultimate "self-healing grid." Allows the macrogrid to divide itself into smaller, self-sustaining grids, which can then be reattached to form the "regular" distribution grid.

Phases of Microgrid Evolution:

- Phase I – identification and formation of “natural microgrids” established within today’s distribution grid along “natural” boundaries; community resiliency projects will emerge, aggregating critical facilities; and nanogrids typically serving a single building or a single load.
- Phase 2 – natural microgrids created in phase I will start investing in newer and more sophisticated sensors, controls, and smart grid technologies, such as storage, DG and DR, allowing them to sustain energy needs both in the short term, in mission-critical models, and even for extended periods of time
- Phase 3 – formation of microgrids will accelerate in conjunction with a movement toward a “distributed grid architecture,” which would include a “layered” management control typology. These initiatives may include more financial commitment to obtaining local sources of energy, adding storage (e.g., with community energy storage or larger-scale storage devices), and integrating demand response and participation in wholesale markets more completely.
- Phase 4 – The utility system will form microgrids as required, based on the right supply-demand balance and the duration the microgrids will be required to operate in island mode.

General Issues

- Distribution planning complexity is increasing due to impacts of solar PV, EE, and wide swings in weather.
- DSPP lacks modeling tools, sensors, and software needed to analyze and optimize the system in support of a dynamic grid.
  - Much of the basic technology exists today, but some products are often not well matched and much of existing technology deserves improvements in reliability, two-way communications, and standardization.
- A Dynamic microgrid will require end-to-end communications with interoperability between systems across which transactive energy systems and mechanisms would operate. Currently, the grid is a hodge-podge of programs run by separate and disparate organizations including ISOs, distribution utilities, aggregators and retailers.
- There will be many asset owners and participants that need to actively, and frequently, engage in the planning process.
- For a coordinated control of microgrid/customer resources (generation, DR, storage), appropriate market mechanisms must be defined – price, actual control.

Opportunities

- Change DSPP processes to include microgrids as a resource to manage price, power quality, and balance system loads at any location within the system.
- Develop and deploy modeling tools, sensors, and software to manage and leverage microgrids and other customer resources
- Work collaboratively with communities to identify all critical facilities and plan for/maximize the value of islanding capability at these facilities.
- Leverage smart grid investments to provide DSPP with the automation and sensors needed to manage a new dynamic system model.
- Enable utility to deploy master controller to maximize the value of customer DER.
- Standardized models/representations of microgrid solutions and their sub-components to be utilized in system planning.

Planning Process: Outline

- DSPP System Analysis
  - Integrated modeling of microgrid systems in DSPP planning and operations model.
    - Participation of DER /Microgrid owners
    - Transparency/privacy
    - Model Maintenance
- Problem Identification
  - Accepted forecast scenarios
  - Accepted planning criteria
  - Prioritization of critical customers
- Solution Development
    - Multi-party options
    - Benefit/Cost Analysis
      - Costs and benefits may accrue to different parties
      - Location Marginal Pricing
      - Dynamic pricing
- Plan Approval
  - Governance
  - Cost Allocation
- Implementation / Integration
- Monitoring and Maintenance

Planning Process :Issues

- The future planning process will be more complex and interactive, require multi-dimensional analysis, require greater participation of multiple stakeholders, need to be responsive to higher degrees of uncertainty, and will require more frequent review to refresh system analysis.
- Queuing: Dealing with multiple simultaneous and interactive microgrid developments at the same time
  - Planning for the best 'system' level solution
  - Interactive nature of data and the results of planning studies for each customer
- Educating and managing the expectations of customers and participants:
  - Data
  - Timelines
  - Performance expectations
- Building and maintaining standardized models. Planning with microgrids will require on-going efforts of participants and will not be limited to one-time interconnection studies.
- Increased amount of necessary data, which must be cleansed, validated, and managed.
  - Privacy
  - Commercial sensitivity
- Risk: Who takes on the risk of dynamic pricing when 3rd party resources were planned for system benefit?
- Need to determine what level of system issue needs to included in the formal planning process before resolution.

Planning Process: Opportunities

- DER's and Microgrids need to be included/mandated in utility resource planning processes and regional reliability plans.
- Clear, concise and transparent planning policies published by the DSPP.
  - Standard interconnection and integration guidelines
    - Microgrids as a defined class of DG.
- Standardized Benefit-Cost analysis tied to predetermined values and remuneration schedules.
  - Microgrids should receive fair cost-benefit analysis, including time- and location-sensitive factors, in system planning.
- Defined governance for plan approval and cost allocation.
- Defined consequence of non-performance.

Planning Criteria: Outline

- Defining/Assigning Acceptable Risk
- Technical
  - Thermal, voltage, pf, reliability, safety, security, privacy, etc
- Time Horizon
- Implementation Timeliness
- Priority of Resources
- Availability/Dispatchability of Resources
- Benefit / Cost criterion
- Measurement and verification

Planning Criteria: Issues

- How to address marginal cost-benefit of interconnected DER vs Integrated Microgrid?
- How to address plans with multiple/cross functional benefits?
- How to allocate benefits and costs across multiple participants?
- How to incorporate local microgrids and the services they provide in supporting other local customers? E.g. relying on microgrid services rather than grid capacity, perhaps during outages or peaks?
- If microgrid is planned to be a required resource to meet local capacity requirements, there must be:
  - Guarantee of availability
  - time of use limitations on microgrid participants "taking" from the macrogrid.
- How to evaluate sunk/stranded investments of various parties?
- How to ensure timeliness of planning and implementation with increased complexity and number or participants?

Planning Criteria: Opportunities

- Clear, concise and published criteria

Roles & Responsibilities of Participants: Outline

- Who are the participants?
  - DSPP
  - Microgrid Owner
  - Microgrid Participants
    - DER Owner / Aggregator
    - Consumer
  - NY ISO
  - Regulator
  - Stakeholder/Interveners

- Regulated vs Contractual Arrangements between participants
- Definition and governance rights of a participant

R&R of Participants: Issues

- More two-way communication required during the planning and operating stages, requiring a higher level of stakeholder engagement on the side of the utility.
- Making data available on the capability of microgrids, DER and the distribution grid in general – privacy, accuracy, etc
- Approval Authority
- Dispute resolution
- Ensuring a timely process
- How do the roles and responsibilities change when microgrid is operating in island mode versus interconnected mode?

R&R of Participants: Opportunities

- RACI diagram of Planning process to define roles and responsibilities of participants defining: Responsibility, Accountability, who shall be Consulted and who shall be informed at each process step.
- Defined Deliverables and targeted milestones for the planning process.
- Defined approval and grievance process.

Summary of Key Findings

To achieve the REV objectives, integrating DER's and microgrids into system planning is required, will increase the complexity of the planning process and requires the active participation of many participants.

To effectively perform integrated planning:

- The DSPP must include integrated DER and microgrid alternatives into system planning models, analysis, and system enhancement recommendations.
- A clear set of policies, standards and guidelines need to be created, communicated and maintained concerning the integration of DER's and microgrid systems with the DSPP. An appropriate and ongoing forum is likely necessary to develop, maintain and evolve these guiding documents to align with the capabilities and markets of the time.
- Defined Roles and Responsibilities must be developed and communicated for all participants engaged with integrating DER's and microgrids within the DSPP. A single entity representing the microgrid will likely be necessary to represent the microgrid in on-going planning processes even after the initial interconnection.
- To foster DER and microgrid penetration, proactive investment in modeling tools, sensors, software and skilled personnel are neccesary to leverage the potential benefits of these distributed resources.
- The DSPP should collaboratively work with Communities to identify potential microgrid opportunties.

Thank you for your attention!

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REFORMING THE ENERGY VISION (REV)
WORKING GROUP II: PLATFORM TECHNOLOGY

SUBCOMMITTEE ON MICROGRIDS AND COMMUNITY GRIDS

Subgroup: Ownership & Control

Reforming the Energy Vision (REV)
Working Group II: Platform Technologies
Subcommittee on Microgrids and Community Grids: Ownership and Control

Summary

Due to technological advances and the demonstrated benefits of resiliency during recent storm events, microgrids should be a significant consideration within the New York State Public Service Commission's proceeding entitled "Reforming the Energy Vision" (REV). Addressing issues of ownership and control is fundamental to microgrid proliferation throughout New York State. Currently several ownership and control models are being utilized to implement and operate microgrids; these models will be further refined and new models developed over time to satisfy evolving policy and technical realities.

Multi-user and community microgrid models require that ownership and control functions be viewed separately. Thus, ownership encompasses generation and distribution, and control includes administrative and technical operations when operating in parallel or in isolation from the macrogrid. The generic ownership category consists of single users, who are primarily owners of real estate served by the microgrid; this includes large-scale residential and mixed-use developments as well as MUSH institutions (military, universities, schools and hospitals). Among other models, microgrids may be owned by utilities or third parties that serve single and multiple-owner buildings. Multiple owners may also form new joint cooperatives to own and control multiple entities. Municipalities and communities, such as special energy districts, may also own and operate microgrids. A final category is the hybrid microgrid, in which separate entities own generation and distribution components and/or separate entities exercise ownership and operational control. The ownership structure and operational control of the microgrid is dictated by the consumers to be served and their service priorities.

The criteria for microgrid feasibility and ownership and control functions encompass a range of issues. The two primary drivers are lower energy costs and improved electric reliability. At the same time, social objectives include resiliency, a reduced carbon footprint and the deployment of renewable resources. The primary challenge to microgrid implementation has been the financial feasibility of the project. Financial feasibility can be improved by enhancing microgrid electric capacity to participate in wholesale and retail markets, as well as NYISO and utility demand response programs.

Further, to construct and operate microgrids in a more economically viable manner requires fundamental policy and regulatory reform. Instituting permanent reforms and consistent incentives, requires time, effort and analysis to ensure that unintended consequences will be minimized. To jump start REV objectives, an administrative policy pathway for microgrid implementation should be established to permit exemptions to existing regulations that represent barriers to REV achievement. To improve the return on investment and further "rev up" the REV, it is

recommended that robust incentives for microgrid development be established, calling upon the most visionary of smart grid technologies and opportunities. Such incentives have already promoted many instances of innovative microgrid technologies. Furthermore, access to private capital often requires credit enhancements, such as those under development by New York State's Green Bank. Programmatic elements upon which underwriting are based require "grandfathering" to insure that no "game changers" compromise the ability of the microgrid to service debt.

Utilities and microgrid professionals are formulating alternative models by which utilities offer services to own, operate and enhance microgrids. Current barriers to ownership are regulatory restrictions regarding ownership of electric-generating plants for commerce. For example, while utilities can own power-generating plants within a microgrid, there are market rules that make utility participation in the markets impractical. These should be reexamined within the context of microgrids.

Utilities should be permitted to compete to provide services within the microgrid configuration, including ownership and control functions as long as there are no conflicts with utility mandates to serve the macrogrid. Clearly, the one essential utility function is to establish technical connections and protocols for the interactivity of the microgrid to connect and disconnect from the electric grid. This interconnection, called the "point of common coupling," is essentially the purview of utilities in dialogue with microgrid developers and owners.

A number of diverse interests must be resolved. These involve the ability of microgrids to install and sell excess generating capacity to enhance economic feasibility, as well as the grid's ability to accept additional power. A governmental role in resolving disputes regarding the point of common coupling issues is also required. To facilitate microgrid implementation, government agencies may need to fund enhancements in the macrogrid to assure safety and achieve public objectives.

While microgrids represent practical opportunities to accomplish a new energy vision, existing regulations require reform. These include addressing the equity of today's high utility stand-by charges, eliminating restrictions regarding participation of CHP generators in the wholesale market, and reviewing utility franchise rights that restrict distribution and retail sales from microgrids to adjacent facilities beyond the boundaries that enclose the sources of generation. A somewhat granular example of the need for reform is the current restriction regarding the ability to combine solar electricity (PV) generation and an electricity storage system on the same meter. The REV specifically cites the advantage of combining storage with renewables to smooth out intermittent generation.

Finally, it is recommended that the PSC examine existing multi-building developments that are grid independent. Existing grid-independent demonstrations could be a wealth of information regarding barriers and benefits that could accrue to microgrids operating as remote microgrids or grid-connected microgrids.

Reforming the Energy Vision (REV)
Working Group II: Platform Technologies
Microgrid Committee

Ownership and Control Subgroup

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Introduction

The Ownership and Control Subcommittee discussed and documented strengths and weaknesses of microgrid ownership and control alternatives. Microgrids are likely to be owned and operated by consumers, private real estate entities, utilities, third parties, and combinations of public and private entities.

During the month of June, the subcommittee met twice weekly via conference calls to present findings, discuss issues, formulate policy and programming recommendations, highlight priorities, and identify hurdles and opportunities with respect to ownership and controls for microgrids in New York State.

Subcommittee Objectives

1. Identify, compare and contrast alternative ownership and operational/control structures.
2. Ownership structures can include separate ownership for generation and distribution (wires) function, within the microgrid.
3. Control should be defined to encompass technical and administrative responsibilities. We are using “Operation Control” to draw the distinction between ownership of the assets and control of energy distribution.
4. Identify criteria to evaluate pros and cons of model ownership structures.
5. Identify financing models for Microgrid implementations.

Subcommittee Objectives (continued)

6. Identify special issues that impact utility ownership and control of microgrids.
7. Assure attention to both newly planned and developed microgrids.
8. Identify (where possible) existing examples of microgrid ownership and control structures.
9. Identify regulatory and technical barriers related to ownership and control.
10. Review feasibility to sell power, ancillary services, and demand response into wholesale markets.
11. Develop a regulatory exemption pathway to permit development of demonstration projects not in conformance with regulatory barriers, in order to satisfy REV objectives.

Finding: No Particular Model Will Drive Microgrid Development

I. Existing and Potential Ownership Models for Microgrids
   A. Single Users (real estate owners own and control the microgrid)
      1. Cooperative and condominium apartment complexes (including ancillary facilities)
      2. MUSH facilities (military, university, schools and hospitals)
      3. Office parks
      4. Other
   B. Municipal
      1. Special energy districts
   C. Utilities
   D. Joint Cooperative (multiple owners and users)
   E. Third Parties
      1. Alternative suppliers (or ESCOs, in NYS)
      2. Conventional energy service companies
      3. Other investor/practitioner entities
   F. Hybrid model (many iterations of separate entities performing ownership and operation functions)

Finding: No Particular Model Will Drive Microgrid Development

II. Existing Examples of Ownership and Control Models

A. Utility-owned microgrid

1. Consortium of Electric Reliability Technology Solutions (CERTS) demonstrations in Ohio owned by American Electric Power
2. Borrego Springs, CA, owned and operated by San Diego Gas and Electric (SDG&E)

B. Single-user microgrid (owner and consumer)

1. Grid-Connected: Coop City, Bronx, NY; Santa Rita Jail, Dublin, CA
2. Grid-Independent: Rochdale Village, Jamaica, NY

III. Hybrid Microgrid: Privately Owned Generation and Wires with Third Party Operational Control

IV. Multi-User/Joint Cooperative Ownership: Burrstone Energy Center, Utica, NY

Ownership and Control Issues/Topics

I. Factors Impacting Ownership Model

A. Aggregating Multiple Users/Uses of Diverse Ownership

B. Aggregating Multiple Users/Uses of Common Ownership

C. Existing Facilities

D. Planned Development

II. Regulatory Issues Impacting Cost of Ownership

A. Utility Standby Charges

B. Utility Net Metering Restrictions

C. Wholesale Market Opportunities and Restrictions (ISO restrictions of CHP to participate in curtailment programs)

D. Restrictions to Combine PV and Storage on the Same Meter (intended to eliminate arbitrage)

E. Franchise Requirements That Prohibit Microgrid Electricity Sales to Retail Market (outside of the microgrid)

Ownership and Control Issues/Topics (continued)

III. Operational Control Issues

A. Administrative Control Responsibilities

1. Economic and financial
2. Capital and operating expenses
3. Manpower needs
   a) *In-house staff*
   b) *Third-party contractors*
4. Investment needs
5. Introduction of DER's within the microgrid
6. Sale of resources outside the microgrid

Ownership and Control Issues/Topics

III. Operational Control Issues (continued)

B. Technical Control Responsibilities

1. Day-to-day operations while connected to the grid (when to purchase from the grid, when to dispatch available power to the grid)
2. Control as an island when disconnected from the grid
3. Control of dispatchable electricity in response to both capacity and distribution demand response programs
4. Timing to release stored electricity to the microgrid
5. Energy and demand management within the microgrid

Ownership and Control Issues/Topics (continued)

IV. Evaluation Criteria for Model Structures (pros and cons)

A. Achieves safety and reliability

B. Promotes renewable resource integration

C. Promotes energy storage

D. Promotes end user efficiency

E. Promotes excess capacity to meet grid shortages

F. Promotes excess capacity

G. Facilitates automatic and voluntary demand response curtailment

H. Promotes affordable energy prices

Ownership and Control Issues/Topics (continued)

V. Define Terms Used in REV Microgrid Discussions

A. Distributed service platform provider (DSPP)

B. Microgrid

C. Dynamic microgrid

D. Transactional analysis

E. Transactive energy

F. Net metering

G. Community microgrid

Microgrid Defined

A proposed definition of a microgrid includes grid-independent developments such as Wagner College in Staten Island, Rochdale Village in Queens, and Penn South in Manhattan. The latter two examples are large-scale residential developments.

Existing DOE definition: A microgrid is a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that act as a single, controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island mode.

Proposed definition: A microgrid is a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single, controllable entity with respect to the grid. A microgrid can be grid independent. That is, a microgrid can be either grid independent or able to operate in both grid-connected or island mode.

Key Findings and Recommendations

At the outset, it is submitted that diverse ownership and operational control models will drive microgrid development. There is no single model that is appropriate for all applications.

1. The Commission should consider inclusion of grid-independent developments within its definition of a microgrid.
2. The Commission should develop an administrative pathway to exempt pilot projects from existing regulatory barriers, to satisfy REV objectives.
3. The Commission should create opportunities for microgrids to develop power capacity that exceeds internal loads for participation in wholesale and retail markets.
4. Utilities should be exempt from regulations that prohibit them from owning plants and selling electricity within microgrids.
5. Utilities will play a critical role in defining requirements for the point of common coupling, to assure safety while permitting power flow between the grid and the microgrid.
6. Government or rate-based funding may be required to facilitate the strengthening of the grid to enable imported microgrid generation.

Thank you for your attention!

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REFORMING THE ENERGY VISION (REV)
WORKING GROUP II: PLATFORM TECHNOLOGY

SUBCOMMITTEE ON MICROGRIDS AND COMMUNITY GRIDS

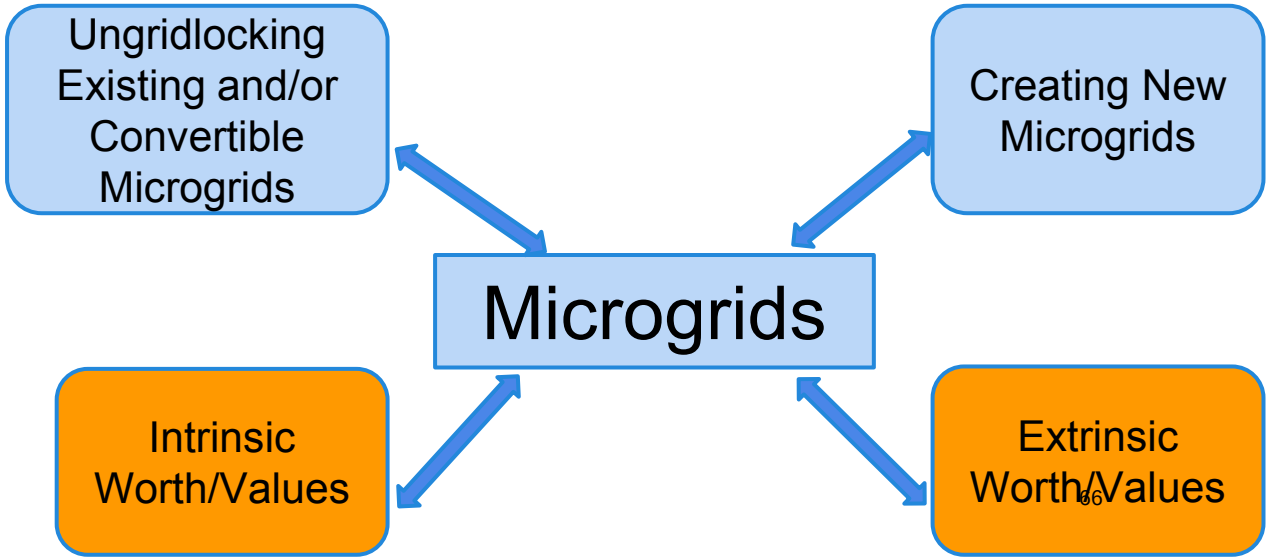
Subgroup: Intrinsic and Extrinsic Values and Worth

Reforming the Energy Vision (REV)
Working Group II: Platform Technologies
Subcommittee on Microgrids and Community Grids

Values-Worth Implications of Deployment of Microgrids in New York State

Sub-Group Objectives 2

- Define Intrinsic & Extrinsic Worth/Values of Microgrid Projects. Values Unique to Microgrids are marked with asterisks (*). This generally applies to all intrinsic Values.
- Examine Intrinsic & Extrinsic Worth/Values of Microgrid Deployment



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Intrinsic Goals of Microgrids Implementation (Slide-1) * 4

1. Improve efficiency, resiliency, reliability, power quality and security of the microgrid system's constituents (single end-user, multiple end-users and/or community).*
2. Improve resiliency for microgrid constituents during storm & similar events due to stand-alone & backup capability (this is pretty obvious but should certainly be here).*
3. Build upon existing investment (by all stakeholders) in DER resources and infrastructure --Free up and reposition gridlocked DER resources by linking them to new microgrid arrangements and investment*. Such DER resources could include: district energy, demand response, load management (BMS, etc.), clean heat and power, other distributed generation, storage, energy efficiency.*
4. Create leverage for new investment (by all stakeholders) in DER resources and infrastructure – Mobilize new investment using a "liberating" and/or "integrating" microgrid concept and technology* – "liberating" means not restricted to incumbents, existing technology, .
5. Provide opportunities for comprehensive projects (especially fast start projects that can scale out from pilot stages relatively quickly) that can be coupled to any number of loads, technologies, institutional devices, -- Enabling lead investments by end-users, competitive third party providers and utilities.

Intrinsic Goals of Microgrids Implementation (Slide-2) * 5

6. Provide a new power and energy usage/management option* for single end-user and multi-end-user facilities, contiguous and nearby campuses (applied to any institutional arrangement), and for communities that may or may not be part of municipal political sub-divisions, including counties. Communities may be affinity groups that have or may have physical link-ups.
7. Improve technical and economic efficiency for energy usage within the microgrid, provide new sharing of local resources.*
8. Exploit the opportunities to gain value from discriminating avoided electrical system losses (location (e.g. secondary network), temporal (annual, seasonal, weekly and diurnal), system conditions (congestion, reliability conditions, etc.)
9. Become breeding grounds for other economic activity such as retaining and expanding industry and commerce, economic development, job creation and so on. (Philadelphia Navy Yard Microgrid as example).
10. Provide Coherent “Branded” Opportunity to upgrade all forms of energy consumption and usage within the constituents of the microgrid.*
11. Provide localized construction & potential local control of assets.
12. And most Importantly provide additional streams of positive value (revenue) to participants in the microgrid to help justify the investment.

Extrinsic Goals for Microgrids Implementation in NYS (Slide-1) 6

Establish what overall purposes they can serve in New York State

1. Improve efficiency, resiliency, reliability, power quality and security of the electricity system.
2. Promote the dissemination of regulatory innovations, economic innovations and reliable technology, new smarter grid technology, and upgrading and revamping the electric creation and usage value chain.
3. Provide grid support (e.g. ancillary services, demand response, capacity) and allow transactive energy.
4. Serve as a source of power and power features to the local distribution network(s) and/or transmission grid and/or to loads in it.
5. Provide stand-by capability while maximizing grid services and customer benefit
6. Provide new business and regulatory options for utilities, customers, third parties, and/or communities for microgrid ownership, management and/or control

Extrinsic Goals for Microgrids Implementation in NYS (Slide-2) 7

7. Attract significant investment (public, third party, and utility investment).
8. Serve as a building block for grid modernization; grid – load interaction.
9. Reduce environmental impacts by integrating clean and renewable generation resources, demand response, energy storage, and other microgrid components.[transmission losses)
10. Address climate change modification, adaptation and resiliency.
11. Enhanced end-user awareness of & education about electrical power usage and systems for end-users and citizens generally, especially where microgrids entail municipal involvement.
12. Templates for implementation would be extremely helpful here to help municipalities and other polities plan and decide on feasibility, methodology, etc.

Additional Considerations 8

1. The benefits and costs of microgrids as presented by RMI and several National Laboratories were reviewed. That summary has not been vetted in detail in this exercise.
2. Social, community and environmental value issues have been split off from this sub-group's materials and topics.

Core Questions to Address Intrinsic and Extrinsic Values of MG Implementation 9

- Who is developing the microgrid? What is their direct interest? i.e. end-user, third party developer, service provider? This helps determine their intrinsic interests and helps delineate the interests that are extrinsic to their endeavors. For example, Princeton University Energy System wants microgrid status to help enlist investment/grant resources for a PV installation in addition to their cogeneration plant and system. The goal is intrinsic. The method advances social and environmental objectives.
- At what point in MG deployment do the MG developers have the capability to define their intrinsic interests and to anticipate their extrinsic interests? What is critical mass for a microgrid development? When does the critical mass attract private and public support? What needs to be done to liberate resources for smaller projects that can be replicated and scaled – up.
- How can microgrid development not be constrained to resources only available to large entities?
- How do intrinsic interests factor into start-up investment? Later rounds of investment?
- How does a DSPP (distribution utility or third party intermediary TPI) identify and optimize extrinsic values for the microgrid's participants?
- How else are extrinsic values realized besides via a DSPP?

Appendix: Top Points from MG Values/Worth Presentation

- Microgrids provide opportunities for fast start projects that can scale out from pilot stages relatively quickly and that can be coupled to any number of loads, technologies, institutional devices and lead investments -- enabling lead investments by end-users, competitive third party providers and/or utilities. Microgrids are not constrained to State leveraged funding.
- Existing DER investments are a prime starting point for value-added additions, e.g. demand response systems, retail access customer base, clean heat and power systems, district energy systems, other DG installations, load management systems, etc.
- Microgrids provide a new power and energy usage/management and investment option for existing and new single end-user and multi-end-user facilities, contiguous and nearby campuses (applied to any institutional arrangement) and for communities.
- Most Importantly microgrids can provide additional streams of positive value (revenue) to participants in the microgrid to help justify the investment.
- Intrinsic interests are a key factor in Microgrid start-up investment and in later rounds of investment.
- Extrinsic interests (values) need to be identified and optimized to justify investment by DSPP and/or Third Party Intermediary (TPI).
- Microgrids can provide grid support (e.g. ancillary services, demand response, capacity) and allow transactive energy.

REFORMING THE ENERGY VISION (REV)
WORKING GROUP II: PLATFORM TECHNOLOGY

SUBCOMMITTEE ON MICROGRIDS AND COMMUNITY GRIDS

Subgroup: Social, Environmental, and Community Implications

Reforming the Energy Vision (REV)
Working Group II: Platform Technologies
Subcommittee on Microgrids and Community Grids: Social, Environmental, and Community Engagement Microgrid Implications

Summary

Microgrids are a key component of the New York State Public Service Commission's proceeding entitled "Reforming the Energy Vision" (REV), and issues of social, environmental, and community engagement implications (pros and cons) are key when evaluating the sustainability of microgrid development in New York State.

Understanding the many social, environmental, and community engagement implications of microgrids helps us to better match one of the several models of microgrids that exist to the needs of a particular community.

The most basic social benefits of microgrid implementation would be improved energy literacy and increased energy ownership through community dialogue during microgrid development and operation. Properly publicized, a microgrid can offer accessible and familiar access to the entire arena of energy use and grid operations. The microgrid sends the messages that the community should consider energy use in many different kinds of decisions, and that the community can help manage energy use, so the microgrid's impacts range well beyond individual or household energy use.

Along similar lines of thinking, the microgrid is much like the community itself, distinct to the degree it chooses to be, self-sufficient in some respects, powerful on occasion, but linked to broader society as well. Microgrids have much in common with energy co-ops, and the operations and values of co-ops should be examined to best understand how microgrids can succeed. Microgrid development and operation also have much in common with major utility projects that require interaction with the community (e.g., plant or transmission siting, automated meter deployment). In a very real sense, the microgrid must be a community initiative or it will be an isolated science project.

Successful microgrid development requires more than community representation and passive 'participation'; it requires active advocacy from diverse community groups and political stakeholders. The community must embrace the microgrid as a significant step in advancing community interests and activities. The process of developing and operating the microgrid will thus be bound into many other important initiatives.

Finally, an understanding of social, environmental, and community engagement implications requires that standardized and transparent compensation mechanisms reflect those implications.

Recommendations

1. Social and environmental implications and obligations should be considered when evaluating microgrid projects.

2. A methodology to evaluate social and environmental implications of microgrids should be developed. Community objectives, priorities, and sensitivities should drive microgrid planning and development processes.

3. Opportunities for communities to participate in microgrid development should be created to better understand the needs of different customers, to ensure that planning and development of those projects do not exclude some sectors of the society, and that the projects do not have undue negative consequences for some members of the community.

4. Achieving sustainable community resilience requires a diverse approach to planning and development. Methods should be identified and roles the roles of the different players determined (consumers, prosumers, businesses, utilities, water management companies, etc).

5. Previous experiences on community engagement should be studied and analyzed to save time, effort, and money and raise the chances for successful community microgrids to be deployed.

Reforming the Energy Vision (REV)
Working Group II: Platform Technologies
Subcommittee on Microgrids and Community Grids

Social, Environmental, and Community Engagement Microgrid Implications.

Sub-Group Objectives

Part 1 (finished)

- Present Social and Environmental Implications (Pros and Cons) of Microgrid Projects (literature review)
- Expand the list of Social and Environmental Implications of Microgrid Projects (working group)
- Frame the best practices to involve the community in Microgrid Planning, Control, and Operation (examples within the U.S.)

Part 2 (moving forward)

- Present and generate methodologies to evaluate Social and Environmental Implications and Responsibilities of Microgrid Projects
- Create a best practices tool of involving the community in Microgrid Planning, Control, and Operation

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Social Implications of Microgrid Implementation

- Raising public awareness and fostering incentives for energy saving and GHG emission reduction
- Empowerment of individual energy management and conservation (e.g. awareness and ability to contribute to energy conservation and renewables at a personal/household level)
- Creation of new research opportunities in conjunction with educational organizations, academia.
- Economic development (jobs and in some cases tax revenues) - localized construction & potential local control of assets and microgrids can become breeding grounds for other economic activity
- Modernized infrastructure with sustainable and high quality energy supplies can attract high-tech business investment and expansion
- Resiliency for communities during storm & similar events due to stand-alone & backup capability.
- Enhanced system ability to integrate renewable resources with localized ancillary service provision
- Electrification of remote or underdeveloped areas.
- Avoided cost of outages, improved emergency response and public health and safety
- Implications to non-participants during outage events (e.g. providing regional centers of refuge and critical public services, and potentially supplying electricity to grid segments adjacent to the microgrid)

Social Implications of Microgrid Implementation (cont'd)

- Reduced strain on distribution system and transmission system during times of system stress
- Microgrids offer opportunities for comprehensive and diverse pilots to better understand:
  - New technologies
  - New value creation methodologies and compensation mechanisms
  - New utility business and regulatory models
  - New planning approaches
  - How customers and communities can become engaged
  - Exposures to impediments to progress
  - Ability to attract high-quality investors through the development of new financing models for local energy project development

Core Questions to Address Social and Community Engagement Implications

What are the primary objectives of the microgrid?:

1. Greater local resilience, ability to withstand emergency events, and maintain critical public services for community and region
2. Faster recovery from utility outages.
3. Locally optimized alternatives to replacing aging and fragile utility feeders, substations, etc.
4. Exploiting local energy supplies (keeping energy dollars local), becoming more efficient and energy self-reliant (improving energy independence)
5. Reducing environmental footprint and supporting renewable energy and conservation
6. Attracting high-tech business with 21st-century infrastructure
7. Providing utility grid support, ancillary services to improve regional utility service quality and reliability

Core Questions to Address Social and Community Engagement Implications (cont'd)

Community Involvement:

1. Who are the decision makers? Are community members represented?
2. Is the community involved in planning the microgrid project?
3. How are energy data and decisions controlled? (e.g., are decisions controlling microgrid issues made privately or publicly? By whom?) Are processes transparent and non discriminatory?
4. Is the microgrid project implemented in a diverse way (i.e. it involves and serves different types of stakeholders and customers)? Is anybody excluded? (In other words: Are all members of the community fairly represented in this community microgrid project?)
5. Is there a clear delineation between the utility's grid and the community microgrid? How are responsibilities and risks apportioned?
6. Do we have standardized and transparent compensation mechanisms to reflect social and economic costs/benefits?

Core Questions to Address Social and Community Engagement Implications (cont'd)

Cost considerations:

1. How do you factor social implications into the cost/benefit analysis of the microgrid project? What standardized methodologies do you use for calculating value streams which are embedded in compensation mechanisms?
2. Are there affordability conditions to be built to assist customers?
3. What are the local economic impacts of the microgrid project?
4. How the proposed rates affect microgrid customers?
5. How do we evaluate the impact of microgrids on building Community Resiliency?

Environmental Implications of Microgrid Implementation

- Shift toward renewable or lower emission (e.g. natural gas) fuels.
  - Reduction in emissions of greenhouse gases
  - Reduction in air pollutants (e.g. SOx, NOx and particulate matter emission reductions): a regional reduction vs. local reduction analysis is needed
  - Valuation methodologies that provide support for combined renewables/natural gas-fired generation and CHP that reduce project risk, increase fuel diversity and provide a portfolio hedging strategy
- Adoption of more efficient energy supply solutions (e.g. combined heat and power applications, fuel cells), as well as optimized demand-side management
- Reduction of physical footprint required for power generation (Water, Land)
- Fuel diversity - Reduction of reliance on external fuel sources and prices
- Climate change mitigation and adaptation/resilience measures
- Avoided or deferred power generation plant construction
- Avoided or deferred T&D construction
- Reduction in system energy losses with greater use of local energy sources

Core Questions to Address Environmental Implications

1. How will environmental implications be factored into the cost/benefit analysis of the microgrid project? (e.g. a carbon tax would be one mechanism)
2. What standardized, transparent valuation methodologies are used to support the creation of compensation mechanisms that monetize those environmental costs/benefits identified and quantify those value streams?
3. How do we define and evaluate the environmental impacts of microgrids?
4. How would the microgrid incorporate efficient and low/no-emissions self-generation and displace higher-emissions central station generation?
5. How do we optimize fuel diversity within a microgrid? What are the criteria?
6. How can microgrid technologies be used to increase renewable energy penetration in the macro grid?

Aspects of Community Engagement

1. Reach out to all customers connected to the Microgrid network and share the vision of energy conservation, conventional and renewable generation, smart meter access and training through personalized load study.
    i. Who will be the operator of the microgrid and have the performance and maintenance responsibility? Municipal? Commercial?
    ii. How would the prosumer (transactive energy market) approach create new frameworks to involve microgrid participants?
    iii. How would the utility be involved in the community engagement process?
    iv. How would microgrid planning and engagement include other infrastructure services and utilities, including water and wastewater, telecommunications, transportation, emergency response, land use and zoning, etc.
2. Provide individual training to evaluate baseline and peak consumption patterns and begin the process of connecting energy conservation with local renewable energy strategies.
3. Introduce energy storage and begin the process of helping customers understand load shifting and storage strategies.

Aspects of Community Engagement (cont'd)

4. Help customers understand electrical load vs renewable energy generation opportunities and limitations.
5. Assemble all customer loads and renewable/energy storage models with the ultimate goal of installing enough renewable energy to offset net annual electricity consumption.
6. Provide training on electric vehicle mobility through the charge station units connected to the microgrid. Demonstrate potential consequence of poor EV load management and opportunities through EV/ES harvesting.
7. Perform comprehensive outreach and education program to educate customers and help them exploit smart energy and green energy systems, and optimize their energy consumption to save money and contribute to more robust local energy system operations.

Community & Stakeholder Engagement

Examples in several states illustrate various approaches to engaging communities and other stakeholders in efforts toward local resilience and energy assurance planning. Most initiatives focus on engagement with municipal/county government leaders, utility industry representatives, and major C&I customer groups. General public outreach has been limited.

CALIFORNIA
CaLEAP – California Local Energy Assurance Program

- Planning, tools, and assistance for community energy assurance
- Convened workshops, performed outreach to industry, community, and government stakeholders

CONNECTICUT
Connecticut DEEP microgrid initiative

- State grant program for community microgrid projects
- Provided feasibility analysis, microgrid webinars, meetings

MASSACHUSETTS
DER Community Clean Energy Resiliency Initiative

- State grant program, supporting municipal energy resilience projects
- DER contractors to serve as standing technical advisers for communities

Community & Stakeholder Engagement (Cont'd)

MINNESOTA
DER DG and CHP workshop programs

- Outreach and education re: distributed generation, CHP, efficiency
- Convened workshops among industry, government, customer groups

NEW YORK
New York Rising

- Provide assistance to communities damaged by Hurricane Irene, Tropical Storm Lee and Super Storm Sandy
- A bottom-up, community-specific initiative
- Identify innovative resiliency projects

New York Prize

- NY Prize is a $40 million competition aimed at jump-starting several "independent, community-based electric distributions systems" across the state.

- Community-driven projects

Summary

To sum, we have identified many new social and environmental values of microgrids that we have added to those found in the literature review. We understand that those values are key to evaluate the social and environmental sustainability of the microgrid projects. Going forward we will present and generate methodologies to evaluate and analyze those values.

Regarding community engagement, we have identified some good practices ideas and examples. We believe that a good understanding and review of those practices would save time and remove barriers in future microgrid developments. Moreover, there is no single model that is appropriate for all communities. Moving forward, we will summarize the different models of community engagement and present with a methodology to evaluate which model might be the most convenient for different microgrids and community types.

Summary (cont'd): Bullet Points

1. Social and environmental implications and obligations should be considered when evaluating microgrid projects.
2. A methodology to evaluate social and environmental implications of microgrids should be developed. Community objectives, priorities, and sensitivities should drive microgrid planning and development processes.
3. Opportunities for communities to participate in microgrid development should be created to better understand the needs of different customers, to ensure that planning and development of those projects do not exclude some sectors of the society, and that the projects do not have undue negative consequences for some members of the community.
4. Achieving sustainable community resilience requires a diverse approach to planning and development. Methods should be identified and roles the roles of the different players determined (consumers, prosumers, businesses, utilities, water management companies, etc).
5. Previous experiences on community engagement should be studied and analyzed to save time, effort, and money and raise the chances for successful community microgrids to be deployed.

Thank you for your attention,
and thanks to all the members of the working group!

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Reforming the Energy Vision (REV)
Working Group II: Platform Technology

Subcommittee on Microgrids and Community Grids

Appendices

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Plovnick, Amy (Microgrid Alliance)
Ruotolo, Andrea (NYS Smart Grid Consortium)
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Thomson, Greg (Clean Coalition)
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Subgroup Volunteers

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Cerbin, Andrea (Pace Energy & Climate Center)
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Crahen, Evan (National Fuel)
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Murray, Frank (NRDC)
O'Connor, Mark (NYPA)
Orsini, Lawrence (PECI)
Pearson, Arthur W. (Lockheed Martin)
Plovnick, Amy (Microgrid Alliance)
Rush, Rebecca (DERP Technologies)
Salter, Raya (NRDC)
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