National Council on Electricity Policy: Transmission and Distribution Coordination Resource Catalog

Contents

Introduction

Purpose of the T&D Resource Catalog

The NCEP T&D Resource Catalog documents an ongoing conversation about the intersection and coordination of the transmission and distribution systems. The documents contained in the resource catalog provide state electricity system decision-makers with examples and resources to support their decision making.

At its 2018 Annual Meeting, NCEP launched the theme, "Transmission & Distribution System Coordination in Planning, Operations, and Markets" in light of the increasing prevalence of distributed energy resources (DERs) on the grid and their current and potential future impacts at multiple levels of the electricity system. NCEP invited expert presenters and hosted a facilitated dialogue on members' questions and resources that might address their questions. NCEP released a Compendium of Resources based on the meeting in September 2018. Since then, new information has become available at an unprecedented rate, requiring an easy-to-update, accessible location: the Resource Catalog. At the 2019 Annual Meeting, NCEP expanded on the "Operations" theme and again held expert presentations and a facilitated dialogue, adding those examples and resources to the Resource Catalog. Future NCEP meetings will explore "Planning" and "Markets" in greater depth.

NCEP intends to keep updating this catalog as new materials become available. Please send any suggestions for additions to the Resource Catalog to Kerry Worthington at kworthington@naruc.org with your recommendations for where the resource(s) best belong in the tables.

Note: *Inclusion in the T&D Resource Catalog should not be constructed as an endorsement of the source or of the contents therein by NCEP, the National Association of Regulatory Utility Commissioners (NCEP's administrator), or the U.S. Department of Energy (NCEP's funder).*

Organization of the T&D Resource Catalog

The Resource Catalog is divided into three main categories with two subcategories. Below is the key to understanding what is in and out of scope.

Planning – Careful planning of new transmission and distribution infrastructure is critical for the successful integration of distributed energy resources (DERs) to the distribution system without negatively impacting the bulk power system. Several pilot projects and policy approaches have been used to support the planning of Transmission and Distribution (T&D) infrastructure. This section includes energy efficiency.

Operations – Grid operations are critical to the safe, reliable, and efficient delivery of electricity. Currently, distribution operators and regional transmission operators (RTOs) do not consistently have visibility and situational awareness of the location, status, and output of DERs. In the future, as DERs continue to grow in number and magnitude, T&D operators will need to establish and/or improve coordination and communication with each other in new ways to maintain reliable operation of their respective systems, and with the electric system as a whole. This section includes resilience, reliability, large customers, and electric vehicles.

Markets – Increased adoption of a range of DER technologies has the potential to change or activate retail and wholesale markets (i.e., at the distribution and transmission levels). Key to exploring the potential effects is understanding the benefits and services DERs provide; how utilities, distribution grid operators, and transmission operators value those services; and ultimately working out how and who will transact for these services. This includes state policies and incentives, rate design, and valuation.

Resource or Example -- Resources falling into these three categories are then split between being either (1) an **example** of a policy, or pilot project, or (2) a **resource** for either implementation or the marketplace of ideas (for example. "Planning – Example," "Planning – Resource," "Markets – Resource").

Column Titles

- **Date** – The date that the resource was published or last date accessed (e.g., for a website).
- **Publisher** – In lieu of author, we include the publisher or organization releasing the resource
- **Title** – Name of the resource
- **Resource Type**
    - Article – Article written or published by a journalist or journalistic institution
    - Blog –Article written and posted online by a non-journalist; can include opinion pieces; tend to be short and not technical.
    - Presentation – Presentations from conferences or webinars, PowerPoints, and InfoDocs
    - Press Release – Announcement intended for the media to report on, yet from the originating body
    - Report – Report includes guidance documents, plans, standards, white papers, and other peer-reviewed materials
    - Website – Includes links to individual Websites or entire websites
    - Docket – Includes any orders, filings, notices, staff reports, policies, or /tariffs from or submitted to a public utility commission or the federal energy regulatory commission(FERC)
- **Region Proxy (focused on regional transmission organizations)**

    - National – any resource that covers multiple regions, U.S. islands and territories (Hawaii, Puerto Rico, Guam, etc.). Includes Alaska.
    - Electric Reliability Council of Texas (ERCOT) – Texas.
    - Independent System Operator – New England (ISO-NE) – the New England states of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.
    - New York Independent System Operator (NYISO) – New York.
    - PJM Interconnection (PJM) – the Mid-Atlantic states such as Delaware, the District of Columbia, Kentucky, Ohio, Maryland, New Jersey, Virginia, North Carolina, and West Virginia.
    - Midcontinent Independent system Operator (MISO) – the mid-continent states such as Arkansas, Illinois, Indiana, Iowa, Minnesota, Missouri, Oklahoma, North Dakota, South Dakota, and Wisconsin.
    - California ISO (CAISO) – California.
    - Western Electricity Coordinating Council (WECC) – western states such as Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming (includes the Energy Imbalance Market, EIM).
    - Southeastern – includes southeastern states such as Alabama, Florida, Georgia, Mississippi, South Carolina, and Tennessee that are not in PJM or MISO.
    - International – any resource that covers outside of the U.S.
- **Topic** – either Planning, Operations, or Markets
- **Subtopic** – includes if it is an "example" or a "resource" and additional characteristics of the resource
- **Notes** – anything else notable about the resource, including if it is linked to other resources cited

Planning for a More Integrated Grid

Careful planning of new transmission and distribution infrastructure is critical for the successful integration of distributed energy resources (DERs) to the distribution system without negatively impacting the bulk power system. Several pilot projects and policy approaches have been used to support planning of Transmission and Distribution (T&D) infrastructure. This section includes energy efficiency.

Planning: Example Approaches, Policies, and Pilot Projects

Date	Publisher	Title	Resource Type	Region Proxy	Topic	Subtopic
2018-03	ICF	Idea Of "Suitability Criteria" Paves The Way For NWA	Blog	National	Planning	- Planning Example - Planning Approaches - NWA Suitability Criteria
2016-07	Joint Utilities Distribution System Planning Engagement Group	Summary Of Stakeholder Engagement Group Meetings On NWA Suitability,	Presentation	NYISO	Planning	- Planning Example - Planning Approaches - NWA Suitability Criteria - Distribution System Planning
2016-06	Acadia Center, Joint Utilities	NWA Suitability Criteria, For Joint Utilities Distribution System Planning Engagement Group	Presentation	NE-ISO	Planning	- Planning Example - Planning Approaches - NWA Suitability Criteria
2019-09	NYISO	NYISO Distributed Energy Resources (DER) Landing Page	Website	NYISO	Planning	- Planning Example - Planning Approaches
2017-01	NYISO	NYISO Report On Distributed Energy Resources Roadmap For New York's Wholesale Electricity Markets	Report	NYISO	Planning	- Planning Example - Planning Approaches - DER Roadmap
2018-03	CAISO	California ISO 2017-18 Transmission Plan	Report	CAISO	Planning	- Planning Example Planning Approaches - NWA
2018-03	PV Magazine	CAISO Approves Clean Energy, Storage, and System Upgrades To Replace Peaker Plant	Article	CAISO	Planning	- Planning Example Planning Approaches - NWA In Oakland, CA
2017-05	Xcel Energy	Xcel Advanced Grid Intelligence & Security Filing	Docket	WECC	Planning	- Planning Example Planning Approaches
2017-07	Denver Post	Xcel Energy Gets Go-Ahead To Modernize Power Grid and Recoup Costs	Article	WECC	Planning	- Planning Example - Planning Approaches

						- Grid Modernization
2018-05	Maryland Public Service Commission	Maryland Public Service Commission (PSC) Approval Of Time-Varying Rates	Docket	PJM	Planning	- Planning Example - Policy Approach - Approach To Approving Time-Varying Rates and Peak-Time Rebate - Rate Design
2015-08	Electric Reliability Council of Texas (ERCOT)	Concept Paper On Distributed Energy Resources In The ERCOT Region	Report	ERCOT	Planning	- Planning Example - Policy Approach
2018-05	Forbes	America's Utility Of The Future Forms Around Performance-Based Regulation	Article	National	Planning	- Planning Example - Policy Approach - Performance Based Regulation
2017-11	Xcel, Minnesota PUC	Re: Residential Time Of Use Rate Design Pilot Program Docket No. E002/M-17-775	Docket	MISO	Planning	- Planning Example - Pilot Project - Time Of Use Rate Pilot
2018-05	Star Tribune	Xcel Wins Approval For Pilot Program For Rates Varying By Time Of Day	Article	MISO	Planning	- Planning Example - Pilot Project - Time Of Use Rate Pilot
2017-12	Utility Dive	Has Xcel Minnesota Designed The Ideal Residential Time-Of-Use Rate?	Article	MISO	Planning	- Planning Example - Pilot Project - Time Of Use Rate Pilot
2017-04	Great River Energy	2018-2032 Integrated Resource Plan	Report	MISO	Planning	- Planning Example - Pilot Project - Utility-Controlled Water Heater Demand Response Pilot
2017	Hawaiian Electric Company (HECO)	HECO Grid Modernization Strategy Filing	Docket	Other	Planning	- Planning Example - Pilot Project - Grid Modernization - Integrated Grid Planning
2018-03	Hawaiian Electric Company (HECO)	HECO Integrated Grid Planning Report	Report	Other	Planning	- Planning Example - Pilot Project - Grid Modernization

						- Integrated Grid Planning
2018-01	San Diego Gas and Electric (SDGE)	Borrego Springs's Claim To Energy Fame: A Microgrid That Enhances Reliability	Article	CAISO	Planning	- Planning Example - Pilot Project - NWA - Microgrids
2019-09 last access	Lawrence Berkley National Lab	Microgrids Landing Page	Website	National	Planning	- Planning Example - Pilot Project - Lists Microgrid Projects
2016-10	The Sacramento Bee	Judge Dismisses Lawsuit By Man Who Says SMUD Smart Meters Are Health Hazard	Article	CAISO	Planning	- Planning Example - Pilot Project - Smart Meters As Health Hazard
2018-08	Connexus Energy	Connexus Energy's Innovative Solar Plus Storage Project Under Construction	Press Release	MISO	Planning	- Planning Example - Pilot Project - Solar plus Storage For Peak Demand
2018-11	Smart Electric Power Alliance (SEPA), E4TheFuture, and the Peak Load Management Association	Non-Wires Alternatives: Case Studies From Leading US Projects	Report	National	Planning	- Planning Example - Pilot Project - NWA

Planning Resources and References

Date	Publisher	Title	Resource Type	Region Proxy	Topic	Subtopics
2019-09, last access	California ISO (CAISO)	Distributed Energy Resource Provider (DERP)	Website	CAISO	Planning	- Planning Resource - DER Aggregation
2017-02	California ISO (CAISO)	CAISO Comments To FERC On Storage Participation In Markets	Docket	National	Planning	- Planning Resource
2017-06	Organization of MISO States (OMS)	OMS Approach On Distributed Energy Resources	Report	MISO	Planning	- Planning Resource

						- DER Integration - T&D coordination
2014-08	New York ISO (NYISO)	NYISO DER Study	Presentation	NYISO	Planning	- Planning Resource
2017-03	US Department of Energy	Modern Distribution Grid, Volume I: Customer and State Policy Driven Functionality, DOE Next Generation Distribution Grid (DSPx) Project	Report	National	Planning	- Planning Resource - State driven functionality
2017-04	US Department of Energy	Summary Of Electric Distribution System Analyses With A Focus On DERs, DOE Next Generation Distribution Grid (DSPx) Project	Report	National	Planning	- Planning Resource - Distribution System Analyses
2019-09, last access	Pacific Northwest National Laboratory (PNNL)	Grid Architecture Tutorials and Advanced Concepts For Architecture Of Electric Power Grids	Website	National	Planning	- Planning Resource - Grid Architecture Concepts
2015-10	Lawrence Berkeley National Laboratory (LBNL)	Distribution Systems In A High Distributed Energy Resources Future	Report	National	Planning	- Planning Resource
2018-05	Pacific Northwest National Laboratory (PNNL)	Distribution System Planning – State Examples By Topic	Report	National	Planning	- Planning Resource - State Case studies
2017-06	Sandia National Laboratory (SNL)	The Grid Analysis and Design For Energy Infrastructure Resilience In New Orleans	Article	National	Planning	- Planning Resource - Resilience
2017-11	Lawrence Berkley National Laboratory (LBNL)	Regional Transmission Planning A review of practices following FERC Order Nos. 890 and 1000	Report	National	Planning	- Planning Resource - Distribution planning
2018	GridLab	Integrated Distribution Planning: A Path Forward	Report	National	Planning	- Planning Resource

						- Integrated distribution planning
2018-03	Center for Renewables Integration, GridPolicy	Alternative Transmission Solutions: A Roadmap To The CAISO Transmission Planning Process	Report	CAISO	Planning	- Planning Resource - NTA
2013	American Council for an Energy Efficient Economy (ACEEE)	Obtaining Credit For Energy Efficiency Policies and Programs In A State Implementation Plan	Report	National	Planning	- Planning Resource - Energy Efficiency
2018-05	Pacific Northwest National Laboratory (PNNL)	How and Where Distributed Energy Resources Impact Transmission and Distribution and Who Is Doing What About It, NCEP Annual Meeting 2018	Presentation	National	Planning	- Planning Resource
2018-05	Federal Energy Regulatory Commission (FERC)	Commission Actions On The Participation Of Storage and Distributed Energy Resources In Organized Wholesale Electricity Markets, NCEP Annual Meeting 2018	Presentation	National	Planning	- Planning Resource
2018-05	United States Department of Energy (U.S. DOE)	DOE Initiatives On The Intersections Of The Transmission and Distribution Grid, NCEP Annual Meeting 2018	Presentation	National	Planning	- Planning Resource
2018-05	Steve Rourke, Independent System Operator New England (ISO-NE)	How Distributed Energy Resources Are Impacting The New England Power System, NCEP Annual Meeting 2018	Presentation	National	Planning	- Planning Resource
2018-05	Honorable Bruce Williamson, Maine Public Utility Commission	Non-Wires Alternatives At Boothbay Harbor, NCEP Annual Meeting 2018	Presentation	National	Planning	- Planning Resource
2018-05	Ryan Fedie, Bonneville Power Authority (BPA)	Deferring Transmission System Expansion, NCEP Annual Meeting 2018	Presentation	National	Planning	- Planning Resource

2017-02	North American Electric Reliability Corporation (NERC)	Distributed Energy Resources: Connection Modeling and Reliability Considerations	Report	National	Planning	- Planning Resource
2014-01	PricewaterhouseCoopers (PwC), Global Energy, Utilities, and Mining	The Road Ahead: Gaining Momentum From Energy Transformation	Report	National	Planning	- Planning Resource - Sector trend analysis
2019-12, last accessed	Bonneville Power Authority	Non-Wires Working Group	Report	WECC	Planning	- Planning Resource
2019-02	Midcontinent Independent System Operator (MISO)	Miso January 30-31 Maximum Generation Event Overview	Presentation	MISO	Planning	- Planning Resource -
2019-12	National Conference of State Regulators (NCSL)	Modernizing the Electric Grid: State Role and Policy Options	Report	National	Planning	- Planning Resource
2020-1	Duke Energy	ISOP Stakeholder Webinars	Presentation	National	Planning	- Planning Resource
2020-5	Interstate Renewable Energy Council and GridLab	A Playbook For Modernizing the Distribution Grid, Volume 1	Report	National	Planning	- Planning Resource - Distribution planning

Evolving Grid Operations

Grid operations are critical to the safe, reliable, and efficient delivery of electricity. Currently, distribution operators and regional transmission operators (RTOs) do not consistently have visibility and situational awareness of the location, status, and output of DERs. In the future, as DERs continue to grow in number and magnitude, T&D operators will need to establish and/or improve coordination and communication with each other in new ways to maintain reliable operation of their respective systems, and with the electric system as a whole. This section includes resilience, reliability, large customers, and electric vehicles.

Operations: Example Policies and Pilot Projects

Date	Publisher	Title	Resource Type	Region Proxy	Topic	Subtopic
2015-10	Smart Energy Consumer Collaborative	Why Smart Inverters and Its Standards Are Important To You!	Article	National	Operations	- Operations Example - Enhanced Visibility and Coordination - Interconnection - Smart Inverters
2019-09, last accessed	California Public Utilities Commission	California Rule 21 On Interconnection	Website	CAISO	Operations	- Operations Example - Enhanced Visibility and Coordination - Smart Inverters - Interconnection
2018-02	IEEE	IEEE 1547-2018 Interconnection Standard	Report	National	Operations	- Operations Example - Enhanced Visibility and Coordination - Smart Inverters - Interconnection - Standards
2015-04	IEEE	IEEE 1547 Standard and Conformity Assessment	Report	National	Operations	- Operations Example - Enhanced Visibility and Coordination - Interconnection - Standards

2018-04	ISO-NE	Earth Day 2018: Setting Regional Solar and Wind Power Records In New England	Blog	ISO-NE	Operations	- Operations Example - Enhanced Visibility and Coordination -
2019-09, last accessed	Federal Energy Regulatory Commission (FERC)	Small Generator Interconnection Standards (2016)	Docket	National	Operations	- Operations Example - Enhanced Visibility and Coordination - Interconnection
2018-06	Nevada Independent	Station Casinos, Biofuels Company Apply To Leave NV Energy	Article	WECC	Operations	- Operations Example - Enhanced Visibility and Coordination - Large Customer Defection
2017-07	Geekwire	Microsoft and Puget Sound Energy Get Ok For Clean-Energy Deal To Help Power Software Giant's Campus	Article	WECC	Operations	- Operations Example - Enhanced Visibility and Coordination - Large Customer Defection
2017-07	Washington Utilities and Transportation Commission (WUTC)	State Regulators Green Light Microsoft-PSE Renewable Energy Contract	Press Release	WECC	Operations	- Operations Example - Enhanced Visibility and Coordination - Large Customer Defection
2019-11, last accessed	California Public Utility Commission (CPUC)	Smart Inverter Working Group	Website	CAISO	Operations	- Operations Example - Enhanced Visibility and Coordination - Interconnection

						- Smart Inverters
2013-10	Electric Energy Online Magazine	How SMUD Deals With Big Data: Correlate, Analyze and Visualize It SMUD Implements Situational Intelligence To Facilitate Faster, Smarter Decisions	Article	CAISO	Operations	- Operations Example - Enhanced Visibility and Coordination
2019-09, last accessed	University of Minnesota Technical Assistance Project	Wastewater Treatment Plant Project: Energy Efficiency & Renewable Energy Generation	Website	MISO	Operations	- Operations Example - Operational Efficiencies
2018-02	CenterPoint Energy	Texas Strong: Hurricane Harvey Response and Restoration	Presentation	ERCOT	Operations	- Operations Example - Case Study In Resilience
2018-11, last accessed	U.S. Department of Energy – Better Buildings	Combined Heat and Power For Resiliency Accelerator	Website	National	Operations	- Operations Example
2018-11, last accessed	Florida Power & Light (FPL)	How We Prepare	Website	Southeast	Operations	- Operations Example - Storm Readiness
2018-05	Florida Power & Light (FPL)	First Responders, Along With State and National Stakeholders, Join FPL For Its Annual Storm Drill	Press Release	Southeast	Operations	- Operations Example - Storm Readiness
2015-10	U.S. Department of Energy	Climate Change and The U.S. Energy Sector: Regional Vulnerabilities and Resilience Solutions	Report	National	Operations	- Operations Example - Resilience
2019-12, last accessed	Smart Electric Power Alliance (SEPA)	Plug & Play DER Challenge	Project	National	Operations	- Operations Example - DER Integration

Operations Resources and References

Date	Publisher	Title	Resource Type	Region Proxy	Topic	Subtopic
2017-06	California-ISO	Coordination of Transmission and Distribution Operations In a High	Report	CAISO	Operations	- Operations Resource

		Distributed Energy Resource Electric Grid				- Operations: DERs
2018-02	Federal Energy Regulatory Commission Staff	DER Technical Considerations for the Bulk Power System	Report	National	Operations	- Operations Resource - Operations: DERs
2014-05	National Rural Energy Cooperative Association	Cost and Benefits of Conservation Voltage Reduction (CVR) Warrants Careful Examination	Report	National	Operations	- Operations Resource - Operations: Transmission
2017-03	Idaho National Lab	Helping Operators Implement Line Rating	Report	National	Operations	- Operations Resource - Operations: Transmission
2019-11, last accessed	Electricity Infrastructure Security Council	Electric Infrastructure Protection (E-PRO) Handbooks	Website	National	Operations	- Operations Resource - Resilience - Critical Infrastructure
2019-11, last accessed	Louisiana Governor's Office of Homeland Security	Louisiana Governor's Office of Homeland Security	Website	Southeast	Operations	- Operations Resource - Resilience, storm preparedness
2006-03	Wiley and Sons (Ted Lewis, Professor of Computer Science)	"Critical Infrastructure Protection in Homeland Security"	Report	National	Operations	- Operations Resource - Resilience - Critical infrastructure
2019-03	North American Energy Reliability Corporation (NERC)	Grid Security Exercise (GridEx) IV Lessons Learned (cyber and physical attacks)	Report	National	Operations	- Operations Resource - Resilience - Critical infrastructure security
2018-05	Gridworks	Coordination Of Transmission and Distribution Operations In A High Distributed Energy Resource Electric Grid, NCEP Annual Meeting 2018	Presentation	National	Operations	- Operations Resource

2018-05	Hawaii Public Service Commission	Evolving Transmission and Distribution System Operations: A Hawai'i Snapshot, NCEP Annual Meeting 2018	Presentation	National	Operations	- Operations Resource
2018-05	New Jersey Board of Public Utilities	Presentation on Resiliency and Transmission Reliability Issues, NCEP Annual Meeting 2018	Presentation	PJM	Operations	- Operations Resource
2018-05	New Jersey Board of Public Utilities	Transmission and Distribution Interface for Resilience, NCEP Annual Meeting 2018	Presentation	PJM	Operations	- Operations Resource
2018-05	Midcontinent Independent System Operator (MISO)	Presentation on MISO's Efforts on Resiliency, NCEP Annual Meeting 2018	Presentation	National	Operations	- Operations Resource
2018-06	Federal Energy Regulatory Commission	Agenda for Technical Conference for Docket Nos. RM18-9-000 and AD18-10-000	Website	National	Operations	- Operations Resource
2018-05	Federal Energy Regulatory Commission (FERC)	Notice: Participation of Distributed Energy Resource Aggregations in Markets Operated by Regional Transmission Organizations and Independent System Operators; Notice Inviting Post-Technical Conference Comments	Docket	National	Operations	- Operations Resource
2019-09	IEEE Power and Energy Magazine	Grid Architecture Volume 17 – Number 5 – September/October 2019	Article	National	Operations	- Operations Resource - Grid Architecture - Operational Coordination - Local Energy Markets
2018-09	Energy Networks Association	Open Networks Future Worlds: Developing change options to facilitate	Report	International	Operations	- Operations Resource

		energy Decarbonization, Digitization, and Decentralisation				
2019-09	Pacific Northwest National Laboratory (PNNL) and Newport Consulting	Grid Architecture: Physical System, Operating Essentials and Coordination Principles, NCEP Annual Meeting 2019	Presentation	National	Operations	- Operations Resource - Grid Architecture
2019-09	Duke Energy	Integrated System and Operations Planning (ISOP) Overview, NCEP Annual Meeting 2019	Presentation	National	Operations	- Operations Resource -
2019-09	Public Utility Commission of Texas	Distributed Energy Resources, NCEP Annual Meeting 2019	Presentation	National	Operations	- Operations Resource -
2019-09	MPR Associates	Communications Across the Grid: using Smart Inverters to Standardize Visibility and Lower Costs at the Grid Edge, NCEP Annual Meeting 2019	Presentation	National	Operations	- Operations Resource - Communications
2019-09	WiredGroup	Communications Across the Grid: Investor-Owned Utility Communication Networks: Recent Developments for Regulator Consideration, NCEP Annual Meeting 2019	Presentation	National	Operations	- Operations Resource - Communications
2019-09	Burns & McDonnell	Communications Across the Grid: Interoperability, NCEP Annual Meeting 2019	Presentation	National	Operations	- Operations Resource - Communications
2019-09	Lorenzo Kristov	Communications Across the Grid: The What and Why of C-D-T Communications, NCEP Annual Meeting 2019	Presentation	National	Operations	- Operations Resource - Communications
2019-09	Stem	Examples of Communication Network Coordination: DER Communications	Presentation	National	Operations	- Operations Resource

		Policy Themes, NCEP Annual Meeting 2019				
2019-09	Minnesota Public Utility Commission	Examples of Communication Network Coordination: Minnesota Statewide Interconnection Standards Update – Interoperability Considerations with IEEE 1547-2018, NCEP Annual Meeting 2019	Presentation	National	Operations	- Operations Resource
2019-09	Organization of MISO States	Examples of Communication Network Coordination: DER Communication from Customer to RTO, NCEP Annual Meeting 2019	Presentation	National	Operations	- Operations Resource
2019-09	IEEE	Examples of Communication Network Coordination: ICAP Program Pilot Projects – IEEE 1547 Conformity Assessment, NCEP Annual Meeting 2019	Presentation	National	Operations	- Operations Resource

The Potential for Markets

Increased adoption of a range of DER technologies has the potential to change or activate retail and wholesale markets (i.e., at the distribution and transmission levels). Key to exploring this potential is understanding the benefits and services DERs provide; how utilities, distribution grid operators, and transmission operators value those services; and ultimately working out how and who will transact for these services. This includes state policies and incentives, rate design, and valuation.

Markets: Example Policies and Pilot Projects

Date	Publisher	Title	Resource Type	Region Proxy	Topic	Subtopic
2019-11, last accessed	California Public Utility Commission (CPUC)	Distribution Resource Plan, Including Locational Net Benefits Analysis (LNBA) Filing and Working Group Reports	Website	CAISO	Markets	- Markets Example - DER Projects and Analysis
2019-11, last accessed	California ISO (CAISO)	Energy Storage and Distributed Energy Resources Three-Phase Plan	Website	CAISO	Markets	- Markets Example - DER Projects and Analysis - ISO Stakeholder Engagement
2019-11, last accessed	California ISO (CAISO)	Distributed Energy Resource Provider As Market Participant	Website	CAISO	Markets	- Markets Example - DER Projects and Analysis - DERs In Wholesale Markets
2017-12	Utility Dive	As Grid Modernization Accelerates, Which States Are In The Lead, and Why?	Article	National	Markets	- Markets Example - DER Projects and Analysis - Rate Design, Time Based - AMI
2018-01	Hawaii Senate	Hawaii SB2930 On Utility Compensation Reform	Docket	National	Markets	- Markets Example - State Policies - Utility Compensation
2017-03	Utility Dive	Have California's Efforts To Value Distributed Resources Hit A Roadblock?	Article	CAISO	Markets	- Markets Example - State Policies - DER Valuation

Market Resources and References

2016-03	Analysis Group	The Value Of "DER To "D": The Role Of Distributed Energy Resources In Supporting Local Electric Distribution System Reliability	Report	National	Markets	- Markets Resource - DER Valuation
2018-02	Federal Energy Regulatory Commission (FERC)	FERC Annual Demand Response Reports, Docket No, Ad18-10-000	Report	National	Markets	- Markets Resource - Demand Response
2016-12	Georgia Public Service Commission (PSC)	Georgia Renewable Cost Framework	Docket	Southeast	Markets	- Markets Resource - Benefit/Cost Analysis
2018-01	Gridworks	Sustaining Solar Beyond NEM: How Customer Owned Solar Compensation Can Evolve In Support Of Decarbonizing California	Report	CAISO	Markets	- Markets Resource - DER Valuation - Net Energy Metering
2017-08	Lawrence Berkeley National Laboratory (LBNL)	Demand Response Advanced Controls Framework and Assessment Of Enabling Technology Costs	Report	National	Markets	- Markets Resource - Demand Response - Control
2017-03	Lawrence Berkeley National Laboratory (LBNL)	Demand Response Advanced Controls Framework and Assessment Of Enabling Technology Costs: California	Report	CAISO	Markets	- Markets Resource - Demand Response
2019-11, last accessed	Northwest Conservation Council	Demand Response Advisory Committee (DRAC)	Website	WECC	Markets	- Markets Resource - Demand Response
2014-01	PricewaterhouseCoopers (PwC), Global Energy, Utilities, and Mining	The Road Ahead: Gaining Momentum From Energy Transformation	Report	National	Markets	- Markets Resource
2016-05	Rocky Mountain Institute (RMI)	A Review Of Alternative Rate Designs	Report	National	Markets	- Markets Resource - Rate Design
2015-08	Rocky Mountain Institute (RMI)	The Economics Of Demand Flexibility	Report	National	Markets	- Markets Resource - Demand Valuation
2018-05	Rocky Mountain Institute (RMI)	The Economics Of Clean Energy Portfolios: How Renewable and Distributed Energy Resources Are	Report	National	Markets	- Markets Resource

		Outcompeting and Can Strand Investment In Natural Gas-Fired Generation				
2018-06	Rocky Mountain Institute (RMI)	The Economics Of Electrifying Buildings: How Electric Space and Water Heating Supports Decarbonization Of Residential Buildings	Report	National	Markets	- Markets Resource - Electrification
2017-10	City of Sacramento	2017 Electric Vehicle Strategy	Report	CAISO	Markets	- Markets Resource - Electric Vehicles
2019-11, last accessed	City of Sacramento, Sacramento Municipal Utility District	Time Based Rates For Electric Vehicles	Website	CAISO	Markets	- Markets Resource - Rate Design - Electric Vehicles
2018-05	Rocky Mountain Institute	Grid Service Requirements On A Changing Grid	Presentation	National	Markets	- Markets Resource - Grid Services
2018-05	National Regulatory Research Institute (NRRI)	Weaving The DER Pieces Together In The "Land Of Steady Habits"	Presentation	National	Markets	- Markets Resource
2018-05	PJM Interconnection	Distributed Energy Resources In PJM Market Integration Considerations	Presentation	PJM	Markets	- Markets Resource
2018-05	North American Electric Reliability Corporation (NERC)	DER Connection Modeling and Reliability Considerations	Presentation	National	Markets	- Markets Resource
2018-05	American Council for an Energy Efficient Economy	What We Can Learn From Experiences With Energy Efficiency In Regional Markets	Presentation	National	Markets	- Markets Resource - Energy Efficiency
2019-03	Grid Modernization Lab Consortium (GMLC)	A Valuation Framework For Informing Grid Modernization Decisions: Summary	Report	National	Markets	- Markets Resource - Valuation
2019-03	Grid Modernization Lab Consortium	A Valuation Framework For Informing Grid Modernization Decisions: Guidelines	Report	National	Markets	- Markets Resource - Valuation

2019-03	Grid Modernization Lab Consortium	Review Of Selected Standards In Support Of Valuation Guidelines Development	Report	National	Markets	- Markets Resource - Valuation
2018-04	American Council of an Energy Efficient Economy	Valuing Distributed Energy Resources: Combined Heat and Power and The Modern Grid	Report	National	Markets	- Operations Resource - Resilience Valuation - Energy Efficiency
2019-11	Lawrence Berkeley National Laboratory (LBNL)	How To Estimate The Value Of Service Reliability Improvements	Report	National	Markets	- Operations Resource - Reliability Valuation
2012-04	Federal Energy Regulatory Commission (FERC) staff	Arizona-Southern California Outages On September 8, 2011: Causes and Recommendations	Report	CAISO	Markets	- Operations Resource - Resilience, BES
2019-09	IEEE Power and Energy Magazine	Grid Architecture Volume 17 – Number 5 – September/October 2019	Article	National	Markets	- Operations Resource - Grid Architecture - Operational Coordination - Local Energy Markets