



Non-Wires Solutions & NSPM for DERs

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Clean + Modern Grid

Regulatory and Business Innovation | Grid Integration | Electrification



Vision

A carbon-free energy system by 2050

Mission

To facilitate the electric power industry's **smart transition** to a clean and modern energy future.

Who Are We?



Smart Electric
Power Alliance

A membership
organization



Founded in 1992

Staff of ~50



Research,
Education,
Collaboration &
Standards

Based in
Washington, D.C.

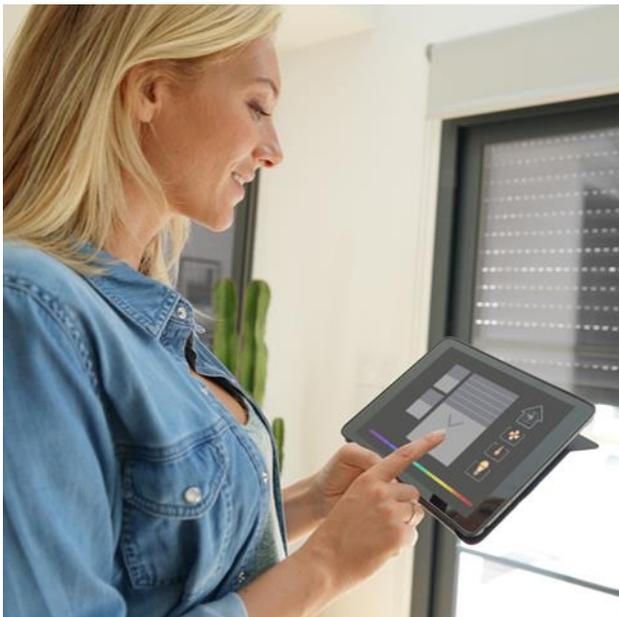


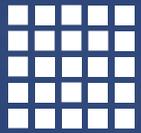
Unbiased

No Advocacy –
501c3



Technology
Agnostic





Smart Electric
Power Alliance

>1,150
Total Members

Membership

SEPA is an **alliance** of over 1,150 members made up of utilities, technology solution providers, regulators, and other stakeholders.



74%
of MWh sold

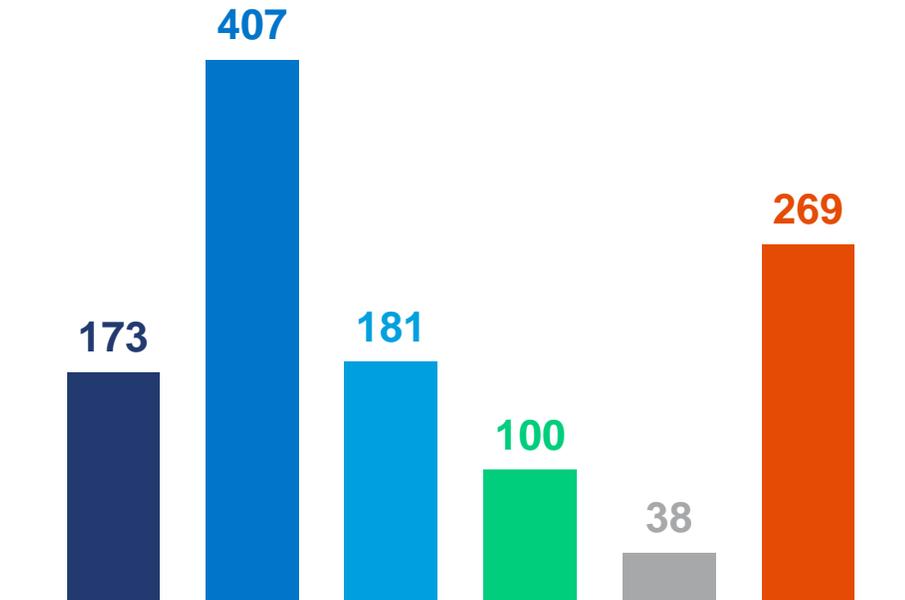


80%
of utilities with
carbon-free or net-zero
emissions goals



72%
of utility commissions

- Government/Non-profit/Education
- Public Power Utilities
- Cooperative Utilities
- Investor Owned Utilities
- Other Utilities
- Corporations





Non-wires Solutions: Case Studies

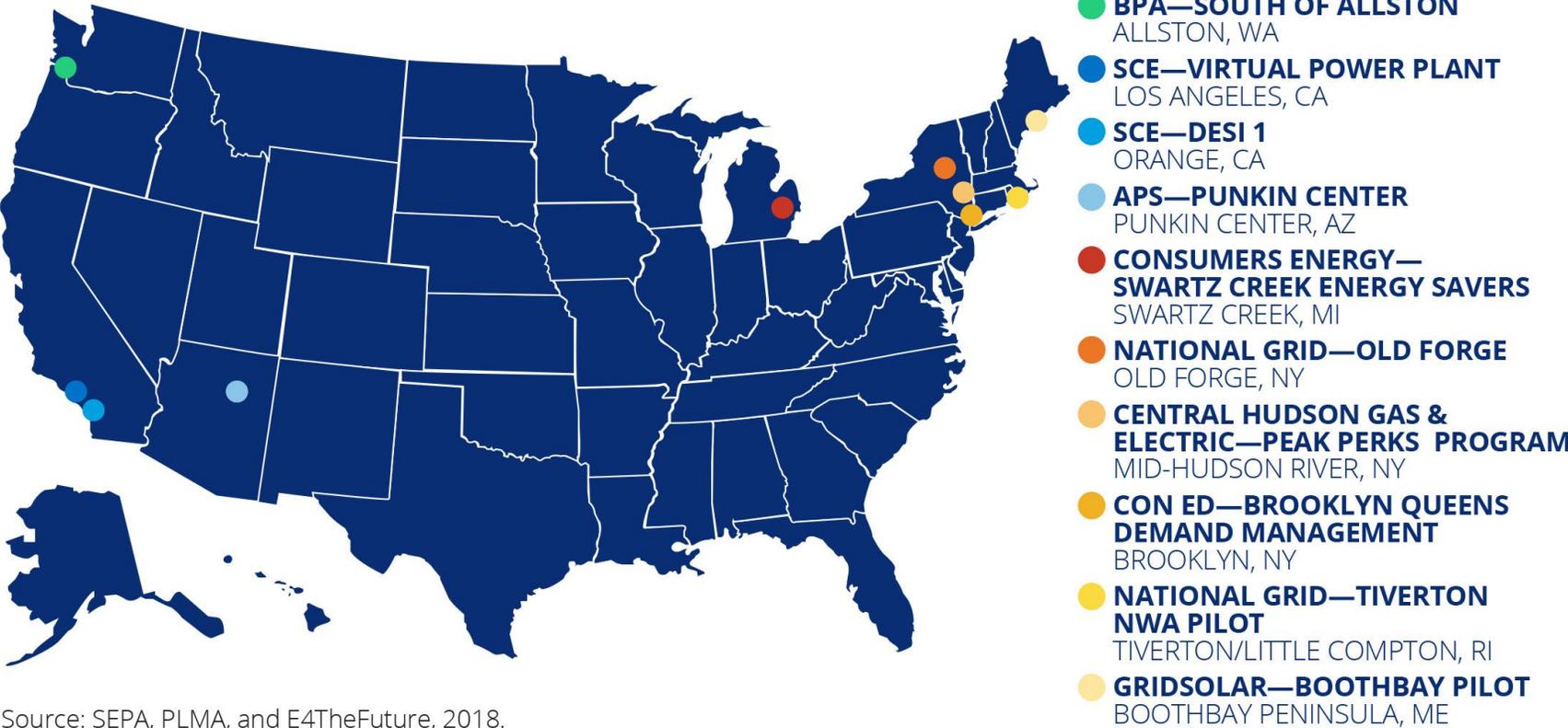
SEPA, PLMA & E4TheFuture (2018)



Selected NWA Case Studies



FIGURE 1: MAP OF TOP SELECTED NWA CASE STUDIES



Source: SEPA, PLMA, and E4TheFuture, 2018.

Report available

<https://sepapower.org/resource/non-wires-alternatives-case-studies-from-leading-u-s-projects/>

NWS Case Study: Consumers Energy - Swartz Creek Energy Savers Club

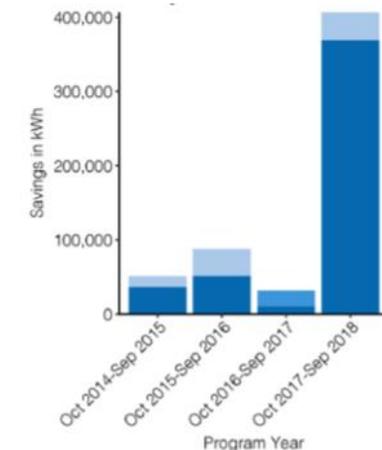
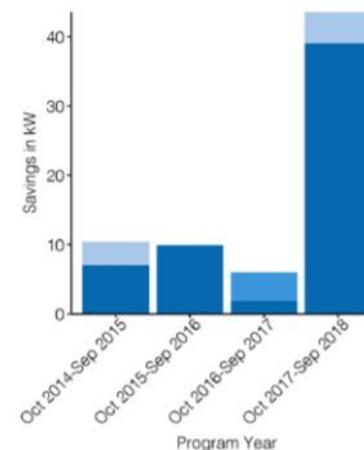


Overview:

- **Size and Location:** Up to 1.6 MW in Swartz Creek, Michigan, a small rural, suburban town southwest of Flint
- **Challenge/Opportunity:** Distribution grid constraint
- **Primary Drivers:** Internal management decision relative to regulatory mandate
- **Technology Focus:** Energy efficiency; demand response
- **Sourcing:** Customer program
- **Utility and other key allies:** Consumers Energy with ICF and Natural Resources Defense Council
- **Status:** Completed (December 2018)

Pilot Results:

- Total demand reductions due to EE programs was ~795 kW in City of Swartz Creek, ~363 kW on Swartz Creek substation
- Residential demand reductions due to EE and DR programs at key times of the year
- C&I customers saw reductions in both demand and total usage, but C&I DR was not used



Source: [Consumers Energy presentation, MI PSC meeting 2019](#)

NWS Case Study: Consumers Energy - Swartz Creek Energy Savers Club



SEPA Key Takeaways:

- **Load Forecasts are Dynamic.** Anticipated load growth at the substation did not materialize.
- **Program Start-up Components are Replicable.** Design projects so that the expense and effort that goes into structuring new programs can be replicated when launching in other locations.
- **Community Size and Economy are Limiting Factors.** Challenges with generating commercial and industrial investments in programs; potential to create a diverse set of DERs should be a key consideration in site selection.

Consumers Energy Lessons Learned:

- **Time of Peak.** Residential customers – and substations serving predominantly residential customers – do not always peak on weekdays when DR events are most easily called; Swartz Creek substation had annual peak on a Sunday (greater presence of C&I in load profile could address this).
- **Participation:** Offering bonus incentives increases participation.
- **Marketing & Communications**
 - Marketing must be targeted; direct customer contact is more effective than general broadcast advertising
 - Direct outreach by company is helpful, particularly with C&I customers; Company representatives can guide through options and process

NWS Case Study: Consumers Energy - Four Mile substation pilot



Overview:

- **Size and Location:** Up to 0.5 MW peak load reduction, Four Mile substation, Grand Rapids, MI
- **Primary Drivers:**
 - Defer \$2.5M-\$3M in future capital spending
 - Continue leveraging targeted EE and DR to address distribution capacity needs
 - Build on lessons learned from Swartz Creek
- **Selection Criteria**

Criterion	Target Range	Four Mile
Load relief needed	5%-20%	10%
Deferrable project cost	\$1M-\$3M	\$2.5M-\$3M
Expected upgrade need	3-5 years out	2023-2024
DSCADA available	Yes	Yes
Residential load share	≤40%	18%

Source: [Consumers Energy presentation, MI PSC meeting 2019](#)

NWS Case Study: Consumers Energy - Four Mile substation pilot



Quick Launch Program

Incorporating lessons learned from Swartz Creek:

- Increased (doubled or tripled) financial incentives up front for the Quick Launch
 - C&I customers to receive up to \$1,000 each for air conditioning, refrigeration, and lighting programs
 - Residential customers to received increased amounts for various programs
- Adding C&I DR as an option during full roll-out
- More targeted advertising plan
 - Emails, postcards, and mailings to residential customers on key programs (special emphases on bonus incentives)
 - Mailings to C&I customers
- More direct engagement with customers instead of community events
- Increased engagement with C&I customers and key trade allies

Load Profile		
	Swartz Creek	Four Mile
Residential Customers	3,800	3,500
C&I Customers	300	750
Residential Load Share	63%	18%
C&I Load Share	37%	82%

Residential Bonus Incentives		
Measure	Typical Incentive	NWS Total Incentive
HVAC- 14.5-14.99 SEER	\$50	\$100
HVAC- 15.0-15.99 SEER	\$150	\$300
HVAC- 16.0-16.99 SEER	\$200	\$400
HVAC- 17.0- 18.99 SEER	\$400	\$800
HVAC- 19.0-20.99 SEER	\$450	\$900
HVAC- 21.0 SEER or Higher	\$500	\$1,000
HVAC- AC Tune-up	\$50	\$150
AC Peak Cycling	\$25	\$50
Appliance Recycling	\$50	\$75

Source: [Consumers Energy presentation, MI PSC meeting 2019](#)

NWS Case Study: National Grid - Tiverton



Overview:

- **Size and Location:** 1 MW in Tiverton and Little Compton, Rhode Island
- **Challenge/Opportunity:** Distribution grid constraint
- **Primary Drivers:** Substation and feeder upgrade deferral; Internal management decision
- **Technology Focus:** Energy efficiency and demand response
- **Sourcing:** Customer program
- **Utility and other key allies:** National Grid, Whisker Labs, Opinion Dynamics Corporation
- **Status:** Began in 2012 and completed in 2017

Pilot Results:

- Deferred \$2.9 million feeder project over the five years (in conjunction with other projects)
 - Did not fully realize 1 MW of 2017 summer load reduction goal.
 - Cost-effective with a benefit-cost ratio of 1.40
 - Despite the unrealized load reduction, the substation upgrade was further deferred

TABLE 4: SUMMARY OF COST EFFECTIVENESS FOR THE TIVERTON NWA PILOT PROJECT								
SYSTEM RELIABILITY PROCUREMENT (SRP) — TIVERTON/LITTLE COMPTON SUMMARY OF COST EFFECTIVENESS (\$000)								
	2012	2013	2014	2015	2016	2017	2018	OVERALL
BENEFITS	\$179.0	\$1,325.4	\$1,033.3	\$1,281.1	\$687.7	\$568.0	\$0.0	\$5,074.6
FOCUSED ENERGY EFFICIENCY BENEFITS*	\$90.2	\$1,015.1	\$716.7	\$1,024.8	\$435.0	\$66.94	\$0.0	\$3,348.7
SRP ENERGY EFFICIENCY BENEFITS**	\$88.8	\$310.4	\$136.8	\$78.0	\$88.1	\$341.6	\$0.0	\$1,043.7
DEMAND REDUCTION BENEFITS***	\$0.0	\$0.0	\$5.6	\$6.8	\$5.3	\$11.3	\$0.0	\$28.9
DEFERRAL BENEFITS†	\$0.0	\$0.0	\$174.2	\$171.5	\$159.4	\$148.2	\$0.0	\$635.3
COSTS	\$133.4	\$672.4	\$569.3	\$1,029.4	\$611.1	\$510.9	\$90.8	\$3,617.4
FOCUSED ENERGY EFFICIENCY COSTS††	\$46.6	\$331.1	\$195.8	\$529.3	\$280.1	\$281.3	\$0.0	\$1,664.1
SYSTEM RELIABILITY PROCUREMENT COSTS†††, Δ	\$86.8	\$341.3	\$373.5	\$500.2	\$331.0	\$229.6	\$90.8	\$1,953.3
BENEFIT/COST RATIO	1.34	1.97	1.81	1.24	1.13	1.11	-	1.40

NWS Key Insights & Challenges



SUMMARY OF KEY INSIGHTS AND CHALLENGES		
PLANNING AND SOURCING	IMPLEMENTATION	
	PROJECT IMPLEMENTATION	TECHNOLOGY-SPECIFIC IMPLEMENTATION
Open and technology-agnostic approaches can help with project success	Plan for internal development	Launching energy efficiency first allows longer lead times for other DER solutions
Procurement processes and bidding responses require more time than originally anticipated	Community outreach helps overall reception and likelihood of project success	Demand response encompasses a wide range of technologies and was met with varying levels of success across six case studies
Uncertainty of load growth is a challenge for utilities but a strength for NWA	Recruitment and customer engagement requires a multipronged approach	Energy storage implementation has its share of obstacles, including: siting, reliability requirements, interconnection, and system impact challenges. These challenges are largely due to the nascency of storage technologies
Know as much about your service territory as possible to inform program recruitment		
Utilities often use a benefit-to-cost assessment to evaluate NWA opportunities		

Source: SEPA, PLMA, and E4TheFuture, 2018.



NSPM for DERs



What is the NSPM for DERs?

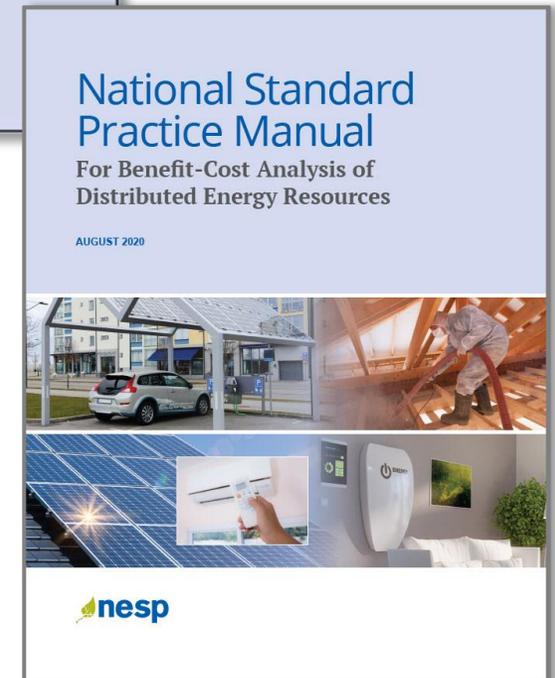
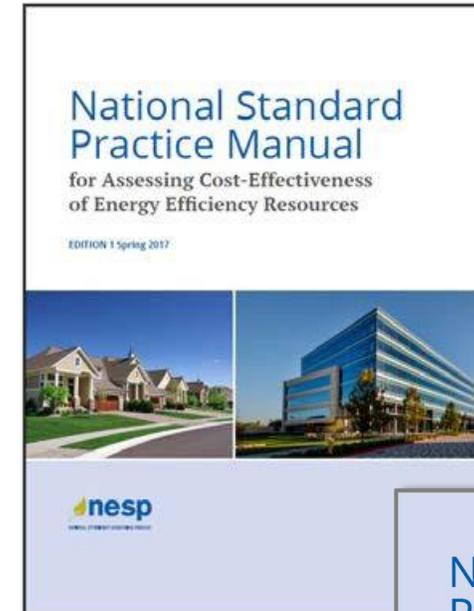
What: “NSPM for DERs” = *National Standard Practice Manual for Benefit-Cost Analysis for Distributed Energy Resources (DERs)* (2020).

- NSPM for DERs builds on NSPM for EE (2017)

Description: The 2020 NSPM for DERs provides a comprehensive framework for cost-effectiveness assessment of DERs. The manual provides a set of policy-neutral, non-biased, and economically-sound principles, concepts, and methodologies to support single- and multi-DER benefit-cost analysis (BCA) for: energy efficiency (EE), demand response (DR), distributed generation (DG), distributed storage (DS), and (building and vehicle) electrification. The manual is intended for use by jurisdictions to help inform which resources to acquire to meet the jurisdiction’s specific policy goals and objectives.

Who: Managed and funded by E4TheFuture (with support from US DOE via LBNL), developed by Multiple co-authors & Advisory group

NSPM is a ‘living document’ and will be updated and improved over time, adding case studies, addressing gaps, etc. contingent upon funding.



Why an NSPM for DERs?

- Traditional cost-effectiveness tests often do not address pertinent jurisdictional/state policies.
- Traditional tests are often modified by states in an ad-hoc manner, without clear principles or guidelines.
- DERs are treated inconsistently in many BCAs or valuations (i.e., in context of programs, procurement, pricing mechanisms, distribution planning, IRP, etc.)
- DERs are often not accurately valued.
- There is a lack of transparency on why tests are chosen and how they are applied.

NSPM for DERs: Audiences & Purpose



Audience: All entities overseeing/guiding DER decision (PUCs, SEOs, utilities, DER reps, evaluators, consumer advocates, and others)

Purpose: Guidance for valuing DER opportunities to inform policies and strategies that support state goals/objectives, such as:

- expanding EE/DR plans, strategies, and programs to a broader set of DERs;
- evaluating and planning for non-wires/pipes solutions;
- incorporating DERs into distribution system planning;
- achieving electrification goals, including EV goals;
- achieving environmental and carbon emission objectives.

Applies to:

- **Programs:** initiatives and policies implemented by utilities or other entities to encourage adoption of DERs
- **Procurements:** initiatives to procure DERs, whether built by a utility or procured from third-party vendors, e.g., competitive procurement
- **Pricing Mechanisms:** such as those designed to compensate DERs for their value to grid or to achieve other policy objectives (e.g., time-of-use rates, peak time rebates, critical peak pricing)

NSPM for DERs – BCA Framework



NSPM for EE (2017)	→	NSPM for DERs (2020)
'Resource Value Framework'		'NSPM BCA Framework'
'Resource Value Test'		'Jurisdiction-Specific Test' (JST)
6 Principles		8 Principles
7-step process to develop primary test		5-step process to develop primary test
Single DER analysis		Single- and multi-DER analyses
DERs covered: energy efficiency only		DERs covered: EE, DR, DG, DS, Electrification

NSPM for DERs – Principles



1. Recognize that DERs can provide energy/power system needs and should be compared with other energy resources and treated consistently for BCA.
2. Align primary test with jurisdiction's applicable policy goals.
3. Ensure symmetry across costs and benefits.
4. Account for all relevant, material impacts (based on applicable policies), even if hard to quantify.
5. Conduct a forward-looking, long-term analysis that captures incremental impacts of DER investments.
6. Avoid double-counting through clearly defined impacts.
7. Ensure transparency in presenting the benefit-cost analysis and results.
8. Conduct BCA separate from Rate Impact Analyses because they answer different questions.

Principles are not mutually exclusive.

NSPM for DERs – Defining Your Primary Cost-Effectiveness Test



STEP 1 **Articulate Applicable Policy Goals**

Articulate the jurisdiction's applicable policy goals related to DERs.

STEP 2 **Include All Utility System Impacts**

Identify and include the full range of utility system impacts in the primary test, and all BCA tests.

STEP 3 **Decide Which Non-Utility System Impacts to Include**

Identify those non-utility system impacts to include in the primary test based on applicable policy goals identified in Step 1:

- Determine whether to include host customer impacts, low-income impacts, other fuel and water impacts, and/or societal impacts.

STEP 4 **Ensure that Benefits and Costs are Properly Addressed**

Ensure that the impacts identified in Steps 2 and 3 are properly addressed, where:

- Benefits and costs are treated symmetrically;
- Relevant and material impacts are included, even if hard to quantify;
- Benefits and costs are not double-counted; and
- Benefits and costs are treated consistently across DER types

STEP 5 **Establish Comprehensive, Transparent Documentation**

Establish comprehensive, transparent documentation and reporting, whereby:

- The process used to determine the primary test is fully documented; and
 - Reporting requirements and/or use of templates for presenting assumptions and results are developed.
-

NSPM for DERs – DER Benefits & Costs



Table 4-1. Potential DER Benefits and Costs: Electric Utility System

Type	Utility System Impact	Description
Generation	Energy Generation	The production or procurement of energy (kWh) from generation resources on behalf of customers
	Capacity	The generation capacity (kW) required to meet the forecasted system peak load
	Environmental Compliance	Actions to comply with environmental regulations
	RPS/CES Compliance	Actions to comply with renewable portfolio standards or clean energy standards
	Market Price Effects	The decrease (or increase) in wholesale market prices as a result of reduced (or increased) customer consumption
	Ancillary Services	Services required to maintain electric grid stability and power quality
Transmission	Transmission Capacity	Maintaining the availability of the transmission system to transport electricity safely and reliably
	Transmission System Losses	Electricity or gas lost through the transmission system
Distribution	Distribution Capacity	Maintaining the availability of the distribution system to transport electricity or gas safely and reliably
	Distribution System Losses	Electricity lost through the distribution system
	Distribution O&M	Operating and maintaining the distribution system
	Distribution Voltage	Maintaining voltage levels within an acceptable range to ensure that both real and reactive power production are matched with demand
General	Financial Incentives	Utility financial support provided to DER host customers or other market actors to encourage DER implementation
	Program Administration	Utility outreach to trade allies, technical training, marketing, and administration and management of DERs
	Utility Performance Incentives	Incentives offered to utilities to encourage successful, effective implementation of DER programs
	Credit and Collection	Bad debt, disconnections, reconnections
	Risk	Uncertainty including operational, technology, cybersecurity, financial, legal, reputational, and regulatory risks
	Reliability	Maintaining generation, transmission, and distribution system to withstand instability, uncontrolled events, cascading failures, or unanticipated loss of system components
	Resilience	The ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions

Table 4-2. Potential Benefits and Costs of DERs: Gas Utility or Other Fuel Impacts

Type	Gas Utility or Other Fuel Impact	Description
Energy	Fuel and Variable O&M	The fuel and O&M impacts associated with gas or other fuels
	Capacity	The gas capacity required to meet forecasted peak load
	Environmental Compliance	Actions required to comply with environmental regulations
	Market Price Effects	The decrease (or increase) in wholesale prices as a result of reduced (or increased) customer consumption
General	Financial Incentives	Utility financial support provided to DER host customers or other market actors to encourage DER implementation
	Program Administration Costs	Utility outreach to trade allies, technical training, marketing, and administration and management of DERs
	Utility Performance Incentives	Incentives offered to utilities to encourage successful, effective implementation of DER programs
	Credit and Collection Costs	Bad debt, disconnections, reconnections
	Risk	Uncertainty including operational, technology, cybersecurity, financial, legal, reputational, and regulatory risks
	Reliability	Maintaining the gas or other fuel system to withstand instability, uncontrolled events, cascading failures, or unanticipated loss of system components
	Resilience	The ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions

NSPM for DERs – DER Benefits & Costs

Table 4-3. Potential Benefits and Costs of DERs: Host Customer

Type	Host Customer Impact	Description
Host Customer	Host portion of DER costs	Costs incurred to install and operate DERs
	Host transaction costs	Other costs incurred to install and operate DERs
	Interconnection fees	Costs paid by host customer to interconnect DERs to the electricity grid
	Risk	Uncertainty including price volatility, power quality, outages, and operational risk related to failure of installed DER equipment and user error; this type of risk may depend on the type of DER
	Reliability	The ability to prevent or reduce the duration of host customer outages
	Resilience	The ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions
	Tax incentives	Federal, state, and local tax incentives provided to host customers to defray the costs of some DERs
	Host Customer NEIs	Benefits and costs of DERs that are separate from energy-related impacts
	Low-income NEIs	Non-energy benefits and costs that affect low-income DER host customers

Table 4-5. Potential Host Customer Non-Energy Impacts

Host Customer NEI	Summary Description
Transaction costs	Costs incurred to adopt DERs, beyond those related to the technology or service itself (e.g., application fees, time spent researching, paperwork)
Asset value	Changes in the value of a home or business as a result of the DER (e.g., increased building value, improved equipment value, extended equipment life)
Productivity	Changes in a customer's productivity (e.g., changes in labor costs, operational flexibility, O&M costs, reduced waste streams, reduced spoilage)
Economic well-being	Economic impacts beyond bill savings (e.g., reduced complaints about bills, reduced terminations and reconnections, reduced foreclosures—especially for low-income customers)
Comfort	Changes in comfort level (e.g., thermal, noise, and lighting impacts)
Health & safety	Changes in customer health or safety (e.g., fewer sick days from work or school, reduced medical costs, improved indoor air quality, reduced deaths)
Empowerment & control	The satisfaction of being able to control one's energy consumption and energy bill
Satisfaction & pride	The satisfaction of helping to reduce environmental impacts (e.g., one of the reasons why residential customers install rooftop PV)

Table 4-6. Potential Benefits and Costs of DERs: Societal

Type	Societal Impact	Description
Societal	Resilience	Resilience impacts beyond those experienced by utilities or host customers
	GHG Emissions	GHG emissions created by fossil-fueled energy resources
	Other Environmental	Other air emissions, solid waste, land, water, and other environmental impacts
	Economic and Jobs	Incremental economic development and job impacts
	Public Health	Health impacts, medical costs, and productivity affected by health
	Low Income: Society	Poverty alleviation, environmental justice, and reduced home foreclosures
	Energy Security	Energy imports and energy independence

Non-Wires Solutions

BCA Considerations and Challenges

Considerations

- Geo-targeting of DERs in high-value location
- Characteristics of traditional infrastructure project (type, timing, etc.)
- NWS technology characteristics
- Impacts beyond the targeted T&D deferral

Challenges

- Deriving granular locational and temporal values
- Accounting for option value
- Interactive effects between DERs
- Evaluating and measuring NWS impacts
- Accounting for system reliability and risk

The assessment of NWS cost-effectiveness depends on **where** the program or DERs are located, **when** they provide services, and the resulting benefits and costs.

NSPM for DERs – NWS Key Benefit-Cost Factors



Key Factors

Characteristics of Infrastructure Constraint

- E.g., T&D infrastructure constraint, the size of constraint, and the season and time of constraint.

Selected Technology Characteristics and Capabilities

NWSs can include a broad range of DER types, sizes/capacities, and locations (FOM or BTM). Diverse technologies included in an NWS will have different benefits and costs that they can simultaneously provide while addressing localized T&D constraints.

Existing Programs or Procurement

- E.g., if a NWS portfolio includes DER types that are based on an existing program or a new program.

Accounting for Other Electric Utility System and Non-Electric Impacts

- In addition to T&D deferral benefits, NWS cost-effectiveness should account for other electric utility system and non-electric impacts, to the extent they are relevant to a jurisdiction given its applicable energy policy goals (see Chapters 2 and 3).

NSPM for DERs – NWS Common Benefit-Cost Challenges



Common Challenges

Determining Locational and Temporal Value of DERs in an NWS

- Benefits and costs of NWSs should be estimated using sufficient locational and temporal detail to adequately represent the DER operating patterns and consequent benefits and costs.

Accounting for Option Value and Determining Project Lifetimes

- Whether an NWS initiative is new or is based on existing resources or programs with incremental benefits and costs should be accounted for in the NWS BCA.

Interactive Effects

- Cost-effectiveness analyses of NWS initiatives should account for interactive effects of DER types, especially the interactive effects on the total kW and kWh impacts of the DERs.

Accounting for System Reliability and Risk

- Cost-effectiveness analyses of NWS initiatives should accurately forecast customer adoption and participation because risks from not meeting requirements pose challenges to the system.

NSPM for DERs – NWS Illustrative case study



Overview

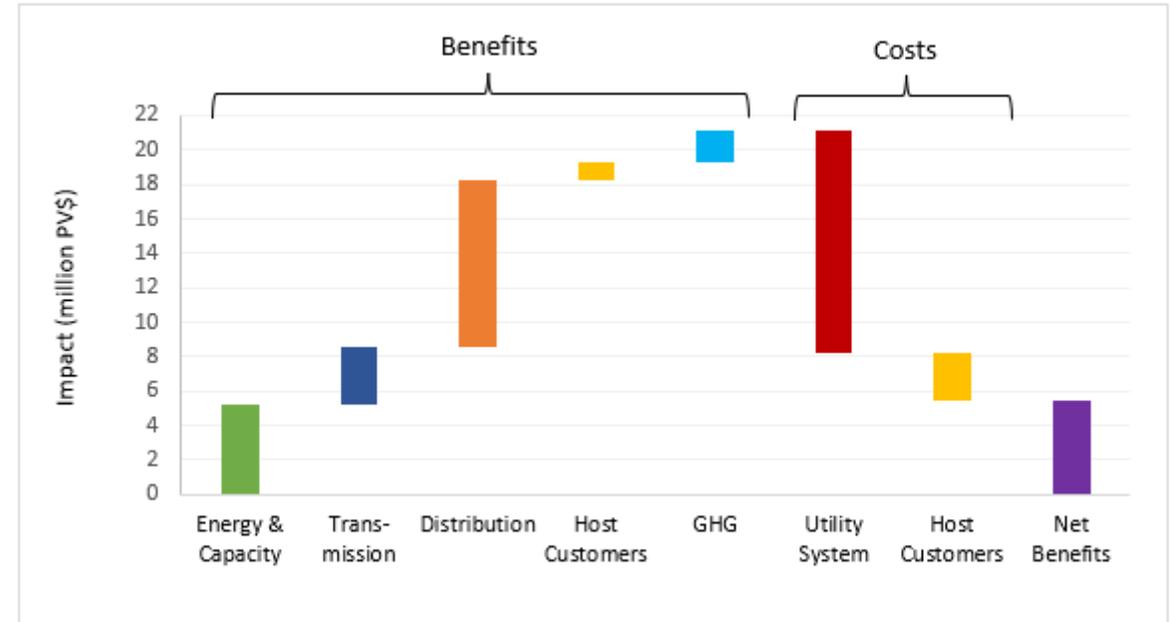
DER Types: BTM DERs in residential and commercial buildings: EE lighting and controls; DR Wi-Fi-enabled thermostats; DPV; and DS (thermal and battery storage)

The Jurisdiction-Specific Test: Includes utility system impacts, host customer impacts, and GHG impacts.

Key Assumptions:

- Assumes non-coincident with overall system peak (e.g., constrained distribution feeder peaks at 1-5pm, while system peaks at 5-9pm)
- Assumes system-peak hours entail higher marginal emissions rates than NWS = delivers GHG benefits.
- Assumes DER operating profiles where:
 - All DERs are operated to reduce the distribution peak, and some can reduce the system peak as well.
 - Storage discharges during the distribution peak hours and charges during the system off-peak hours.
 - DR reduces demand during distribution peak periods and/or shifts load from distribution peak periods to system off-peak periods.
 - Distributed PV resources generate during distribution peak periods and during a portion of system peak periods.
 - EE helps to reduce demand during distribution peak periods, as well as system peak periods.

Figure 12-1. Example of NWS Cost-Effectiveness



NSPM for DERs – Resources

The 2020 [National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy Resources](#) (NSPM for DERs)

- Download the [NSPM for DERs Summary](#) (20 pages)*
- Download the full guidance document: [NSPM for DERs](#) (300 pages)*
- Download the [NSPM for DERs Overview Presentation](#).
- [View media release](#) announcing publication
- [Webinars and Events](#)

2017 [National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources](#)

Case Studies:

- **New Hampshire** - [NSPM Case Study authored by NESP \(January 2019: NSPM for EE\)](#)
- **Arkansas** - [NSPM Case Study authored by NESP \(May 2019: NSPM for EE\)](#)
- **Minnesota** - [NSPM Case Study authored by NESP \(December 2018: NSPM for EE\)](#)
- **Rhode Island** - [NSPM Case Study authored by NESP \(December 2018: NSPM for EE\)](#)



Be in touch

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