NARUC

Winter Committee Meetings

Staff Subcommittee On Energy Resources & the Environment

Celebrating 40 Years

Updating State Interconnection Rules for Improving Technologies and Processes

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NRRI Colloquium
NARUC Winter Committee Meetings
Washington, DC – February 11, 2017

Outline of Presentation

1. How might new technical capabilities affect interconnection standards?
2. How might state rules and procedures be adjusted to reflect new technical standards?
3. How are today's best-practices currently addressing those changes?
4. What are possible future updates to state interconnection rules and procedures?

Research paper, co-authored by NREL Senior Engineer Michael Coddington, forthcoming March 2017

Recent state legislation (1)

- California 2016 AB2861 – DG expedited dispute resolution procedures (with the goal of 60-days or less). Also sets up "independent technical review panel" for resolving disputes. http://www.leginfo.ca.gov/cgi-bin/postquery?bill_number=ab_2861&sess=1516&house=A
- Iowa 2015 HF 548 – Requires disconnect devices for certain DG facilities, requires notice to local fire department. https://openstates.org/ia/bills/2015-2016/HF548/
- Maryland 2015 SB0353 – New interconnection agreement. Construction not to begin until after interconnection approval is received from the distribution utility. http://mgaleg.maryland.gov/WEBMGA/frmMain.aspx?pid=billpage&stab=01&id=sb0353&tab=subject3&ys=2015RS

Recent state legislation (2)

- Maryland 2016 HB440/SB811 – solar generator interconnection. Sets procedural timeline for utilities, that 90% of PTOs should be granted within 20 days of interconnection application approval. http://mgaleg.maryland.gov/webmga/frmMain.aspx?id=sb0811&stab=01&pid=billpage&tab=subject3&ys=2016rs
- South Carolina 2014 S1189 –Distributed Energy Resource Program Act, among other things directs SC Commission to promulgate interconnection standards for DG 2MW or less. http://www.scstatehouse.gov/sess120_2013-2014/bills/1189.htm

Recently closed interconnection dockets (1)

- California R1109011. June 2016, PSC approved rule changes. https://apps.cpuc.ca.gov/apex/f?p=401:56:0::NO
- Illinois Part 466. Rules amended January 2017. http://www.ilga.gov/commission/jcar/admincode/083/08300466sections.html
- Iowa RMU-2016-0003. December 2016, the IUB adopted amendments intended to make the rules more readable, transparent, and streamlined. https://efs.iowa.gov/efs/ShowDocketSummary.do?docketNumber=RMU-2016-0003
- New York 15-E-0557. March 2016, new rules provide "improvements [that] will foster more efficient and productive interconnection application submittal, review, and approval processes." http://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterSeq=49021&MNO=15-E-0557
- North Carolina E-100 Sub 101. May 2015, implements new rules; requires 2-year review of rules.
- Pennsylvania L-2014-2404361.

Recently closed interconnection dockets (2)

- North Carolina E-100 Sub 101. May 2015, implements new rules; requires 2-year review of rules. http://starw1.ncuc.net/NCUC/portal/ncuc/PSC/DocketDetails.aspx
- Pennsylvania L-2014-2404361. http://www.puc.state.pa.us/about_puc/consolidated_case_view.aspx?Docket=L-2014-2404361
- South Carolina 2015-362-E. April 2016. New rules. https://dms.psc.sc.gov/Web/Dockets/Detail/115677
- Texas 45078. December 2016 Order adopts new rules. http://interchange.puc.state.tx.us/WebApp/Interchange/application/dbapps/filings/pgControl.asp?TXT_CNTRL_NO=45078

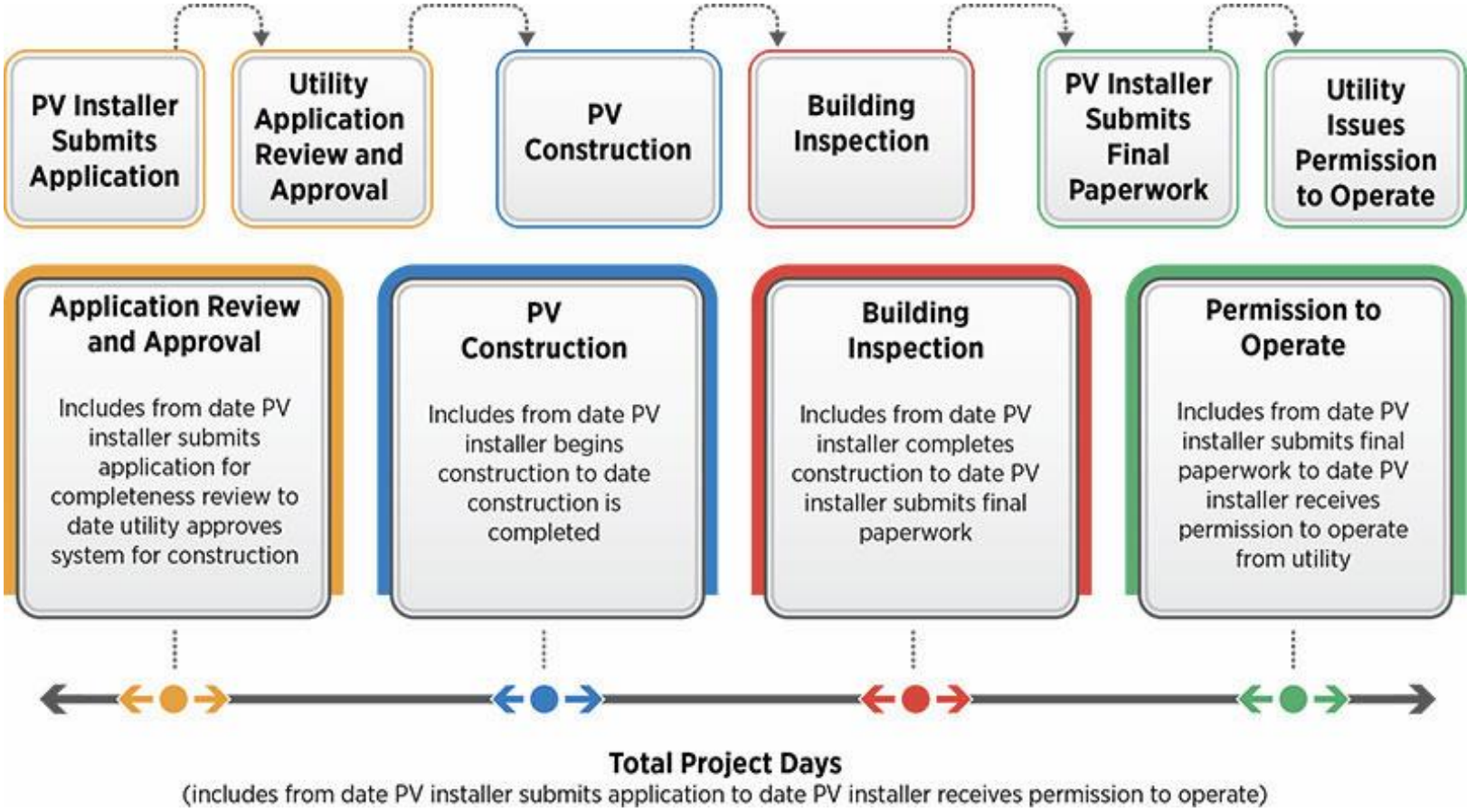
Open state interconnection dockets (1)

- Arizona RE-00000A-07-0609. ACC Staff-proposed rules pending. http://edocket.azcc.gov/Docket/DocketDetailSearch?docketId=14454&documentId
- Maine 2016-00268. Parties' comments on proposed amendments were filed 25 January 2017. https://mpuc-cms.maine.gov/CQM.Public.WebUI/Common/CaseMaster.aspx?CaseNumber=2016-00268
- Minnesota 16-521. January 2017 Order establishes a work group process for updating existing rules, based on FERC SGIP and SGIA, and technical standards based on newly revised national standards and other issues needing updating. https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showeDocketsSearch

Open state interconnection dockets (2)

- Nevada 16-01013. Interconnection is an issue in this proceeding about energy storage, including an interconnection stakeholder group and a filed "Interconnection Issues List." http://pucweb1.state.nv.us/puc2/Dktinfo.aspx?Util=All&AspxAutoDetectCookieSupport=1 and http://pucweb1.state.nv.us/PDF/AxImages/DOCKETS_2015_THRU_PRESENT/2016-1/14648.pdf

Typical interconnection process



Source: Barnes, Barnes, et al., 2016, *Comparing Utility Interconnection Timelines for Small-Scale Solar PV, Second Edition.* EQ Research. http://eq-research.com/wp-content/uploads/2016/10/EQ-Interconnection-Timelines-2016.pdf

Is there a problem? (1)

"[S]tandards activities should be perceived as developing, living documents that will advance in time and in stages… . [M]uch additional work still remain[s] before all major technical and administrative issues [are] resolved."

Source: Basso and DeBlasio, 2003, "IEEE P1547-series of standards for interconnection," In *Transmission and Distribution Conference and Exposition, 2003 IEEE PES* (Vol. 2, 556-61). IEEE. http://ieeexplore.ieee.org/document/1335335/

"Federal and state regulators are faced with the challenge of keeping interconnection procedures updated against a backdrop of evolving technology, new codes and standards, and considerably transformed market conditions."

Source: Fox, Stanfield, Coddington, et al., 2012, *Updating Small Generator Interconnection Procedures for New Market Conditions,* NREL/TP-5500-56790. http://www.nrel.gov/docs/fy13osti/56790.pdf

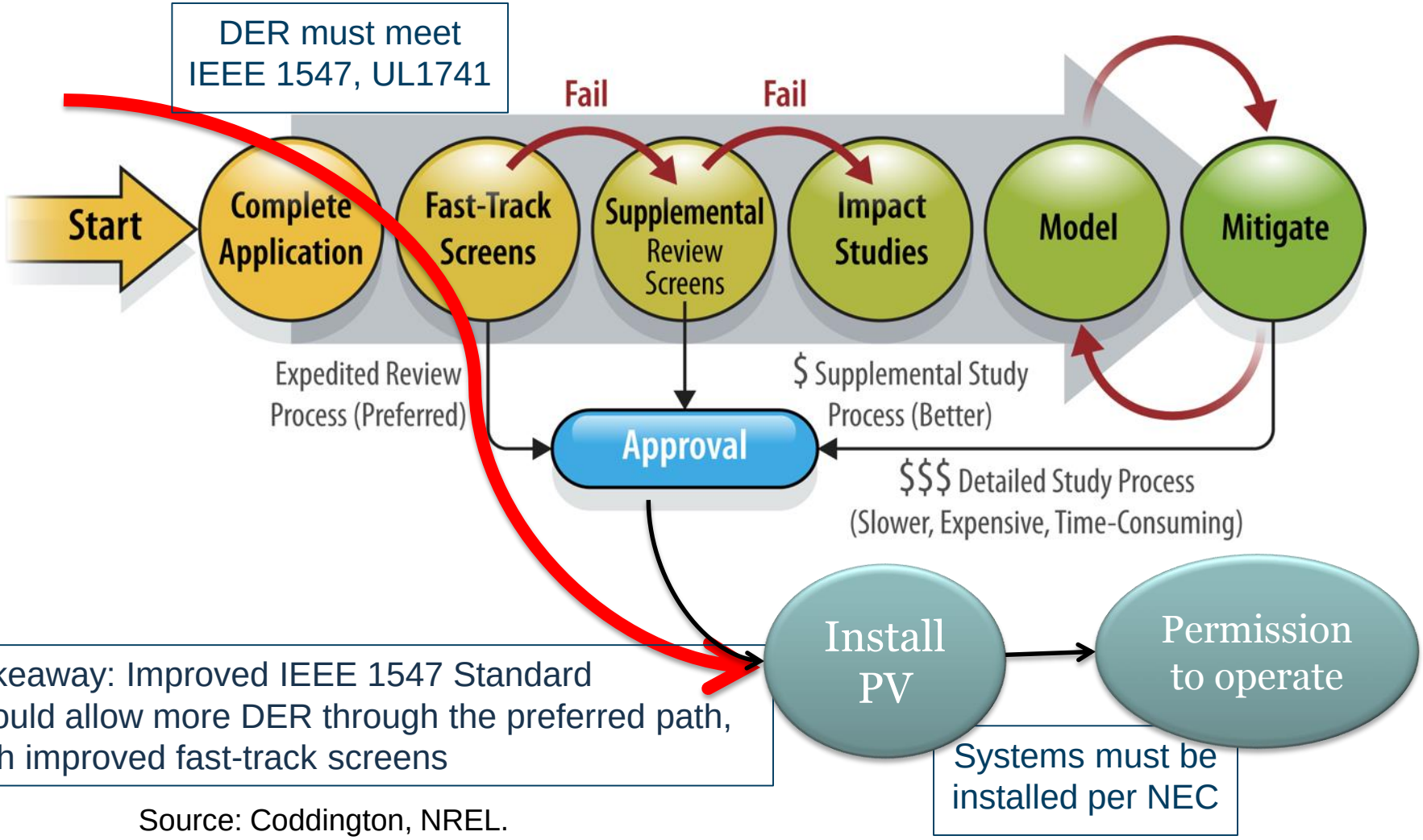
Is there a problem? (2)

	Residential (up to 10 kW)			Small Commercial (10–50 kW)		
State	Time Req. (business days)	Applications Exceeding Time Req. (%)	Median for Applications that Exceeded Time Req. (business days)	Time Req. (business days)	Applications Exceeding Time Req. (%)	Median for Applications that Exceeded Time Req. (business days)
CA	25	37%	38	25	47%	39
NY	15	38%	49	15	38%	60
NJ	13	52%	18	18	42%	27
CO	25	58%	50	30	45%	59
AZ	[20]*	53%	43	[20]*	54%	43

* 20-day threshold is assumed for analytic purposes, because Arizona has no interconnection timeframe requirements.

Source: Ardani, Davidson, Margolis, & Nobler, 2015, *A State-Level Comparison of Processes and Timelines for Distributed PV Interconnection in the U.S.*, NREL/TP-7A40-63556, http://www.osti.gov/scitech/biblio/1227804/

Typical utility review process



Source: Coddington, NREL.

New inverter technical capabilities

- The goal: "to make inverters integrated grid assets that are interoperable," and ensure DG will be "*good grid citizens*"
- Advanced Inverters (a.k.a. "Smart Inverters") can "respond automatically and autonomously *and* respond to direct communications signals from grid operators" to:
  - physically connect to or disconnect from the utility grid;
  - adjust generation level, power factor, reactive power;
  - set parameters for frequency and voltage ride-through; and,
  - maintain and communicate events log & operating history

Source: Reiter, E., K. Ardani, and R. Margolis, 2015, Industry Perspectives on Advanced Inverters, NREL/TP-7A40-65063, http://www.nrel.gov/docs/fy15osti/65063.pdf

New utility capabilities

- Fast, reliable distribution system modeling including all major DER resources
- Easily accessible maps showing substation and feeder "hosting capacity," to help focus attention on low-cost, good, better, and best locations for installing DG
- More and better mitigation techniques are enabling more DG on existing circuits

IEEE 1547 Standards Revisions are Coming

- Entire standard is open for revisions
- Already-identified topics include:
  - Voltage ride-through & frequency ride-through capabilities and variable settings for grid support, including Volt/VAR, Volt/Watt, frequency/Watt, etc.
  - Revised Power Quality settings and requirements
  - Intentional Island and Unintentional Island provisions
  - Secondary Network Interconnection Guidelines
  - Energy Storage systems
  - Grid Support functions and Interoperability

Additional IEEE 2030 Series of Smart Grid Interoperability Standards

- **P2030.1**—guide for electric transportation systems
- **2030.2-2015 (approved)**—guide for interoperability of electric storage systems
- **2030.3-2016 (approved)**—applications for electric storage, including testing procedures for safety and reliability
- **P2030.4**—guide for electric power systems control and automation installations
- **2030.5-2013 (approved)**—communications between the smart grid and consumers
- **2030.6-2016 (approved)**—guide for monitoring the effects and evaluating benefits of demand-response programs
- **P2030.7**—specifications for microgrid controllers
- **P2030.8**—standards for testing microgrid controllers

Best-practices to date

- Uniform state rules & procedures for all utilities
- Online & electronic interconnection applications
- Overall streamlined, transparent processes with open communication between utility & developers
- Simple, reliable project and application status tracking
- Rapid, robust grid-impact studies approaches, using sophisticated distribution system software modeling
- Supplemental screening options, optionally employing multiple low-cost problem-mitigation strategies, using a “safety valve” approach for simpler problems, thus avoiding more expensive impact studies
- “Solar-ready communities” actions to reduce soft-costs

Preliminary conclusions

Possible adjustments to state rules

- Implement greater transparency and state-wide consistency
- Incorporate autonomous and controllable advanced (smart) inverter functions for grid support
- Focus on how utilities plan their distribution system to support higher DG levels: require substation/feeder hosting capacity reports and maps?
- Tighten time frames for utility procedures, to accommodate improved modeling capabilities. Prepare for what happens if deadlines are missed too often.

Supplementary regulatory approaches

- Revise rates to reward all kinds of DER capabilities that produce and deliver system benefits, through multiple revenue streams if necessary
- Encouraging utilities to fully integrate distributed resources into their planning processes, including electric/water/stormwater/wastewater utilities.

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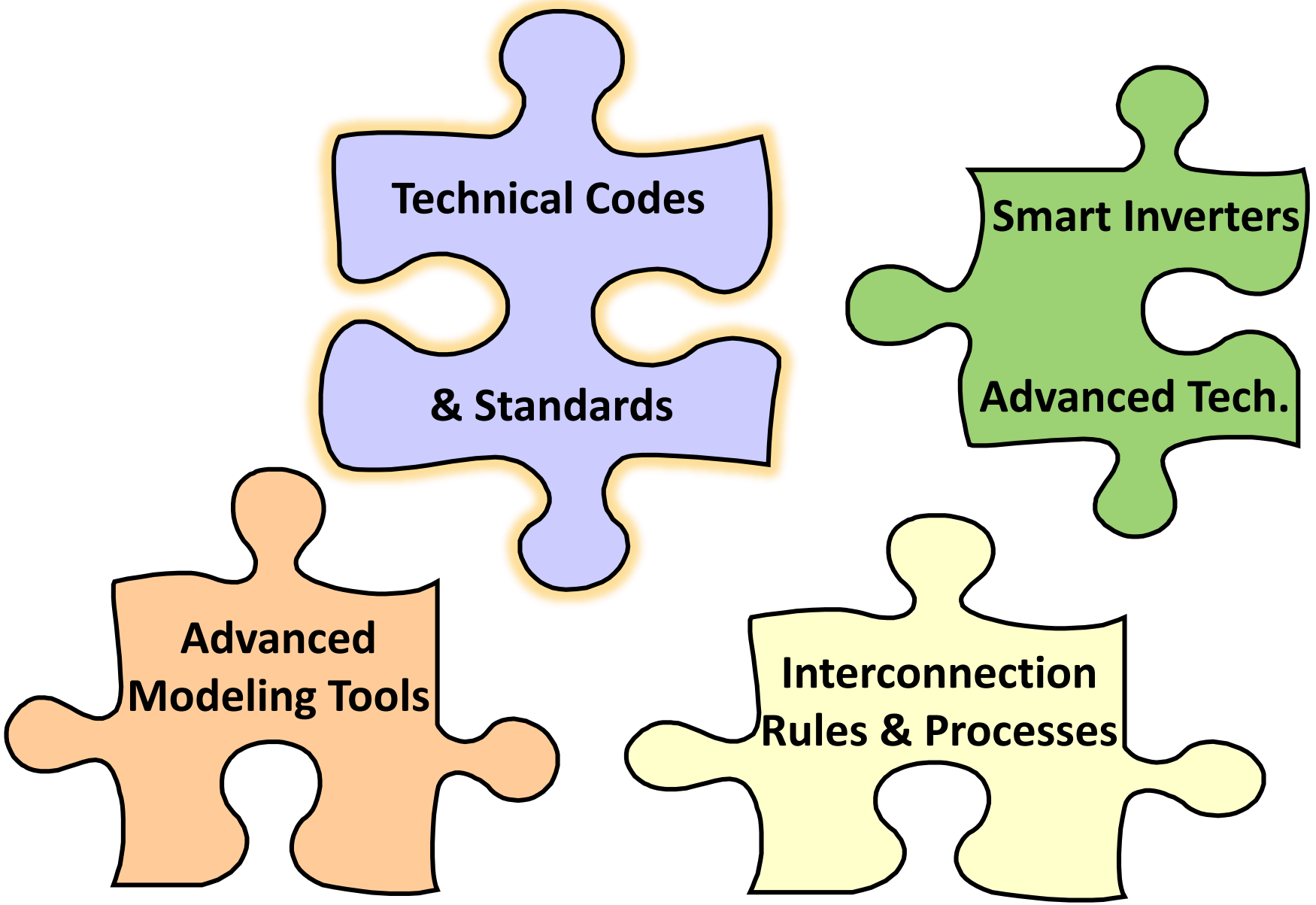
NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Power Systems
Engineering Center

Improving DER Interconnection with Updated Standards and Codes, Smart Inverters, and Distribution System Design

Michael Coddington, Principal Engineer
National Renewable Energy Laboratory

DER Interconnection Puzzle Pieces

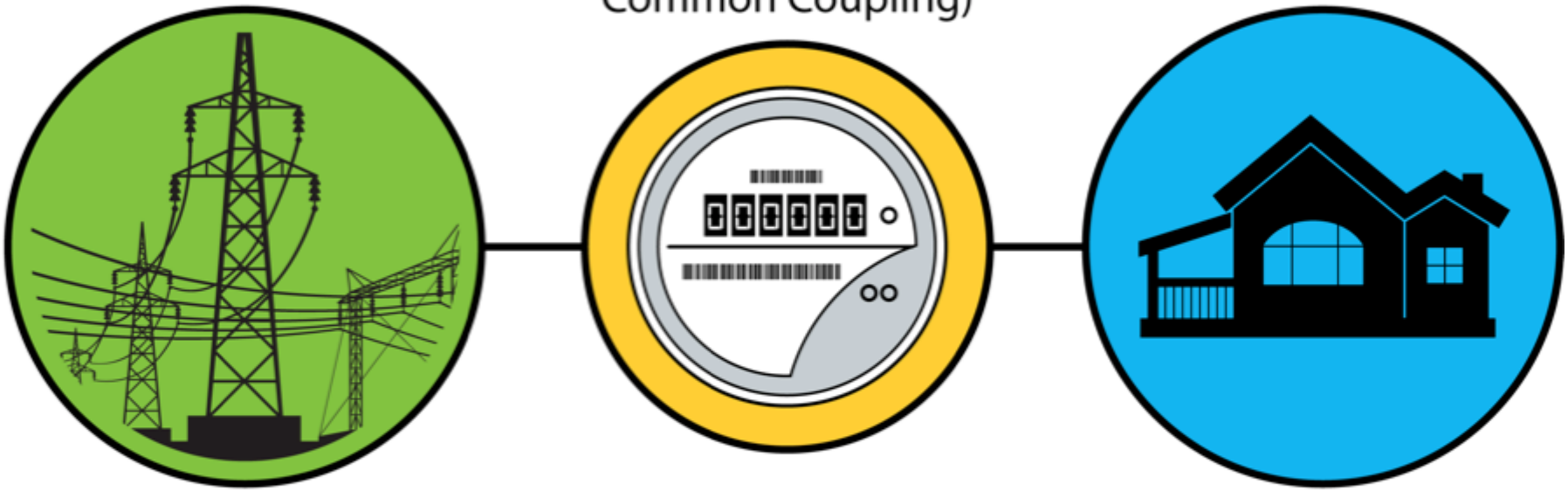


U.S. Interconnection Codes & Standards

Electric Utility
T&D Systems

PCC (Point of
Common Coupling)

Industrial, Commercial,
Residential Buildings



National Electrical Safety Code (NESC) and Utility Manual of Safe Practices

ANSI C84.1

**IEEE 1547 &
Family of Stds**

National Electrical Code (NEC)

**UL 1741
UL 1703**

IEEE 1547™ - Full Revision

Standard for Interconnecting Distributed Energy Resources with Electric Power Systems

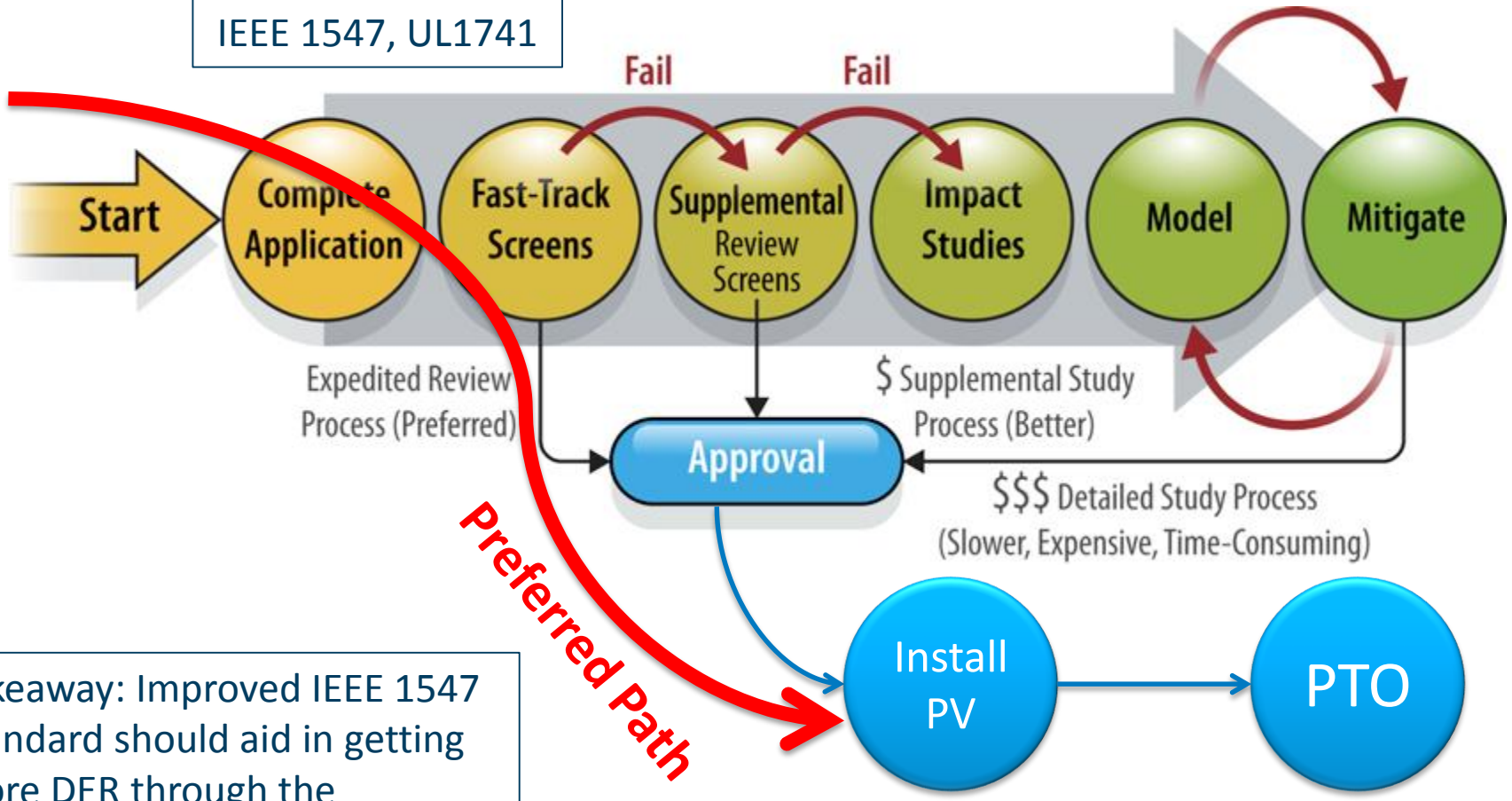
- Goal is an updated standard for higher levels of DER tied to utility distribution systems
- Significant focus on frequency ride through and voltage ride through – MUST STAY CONNECTED
- Major goal is to support voltage and frequency
- Utilize Smart Inverter functions while remaining technology neutral
- Harmonize with the California Smart Inverter Working Group and California Rule 21

IEEE 1547 Full Revision – Topics

- Voltage ride-through & frequency ride-through capabilities
- Some technology-specific requirements
- Variable settings for grid support, including Volt/VAR, Volt/Watt, frequency/Watt, etc.
- Revised Power Quality settings and requirements
- Intentional Island and Unintentional Island provisions
- Secondary Network Interconnection Guidelines
- Energy Storage system integration
- Grid Support functions and Interoperability

Classic Interconnection Process

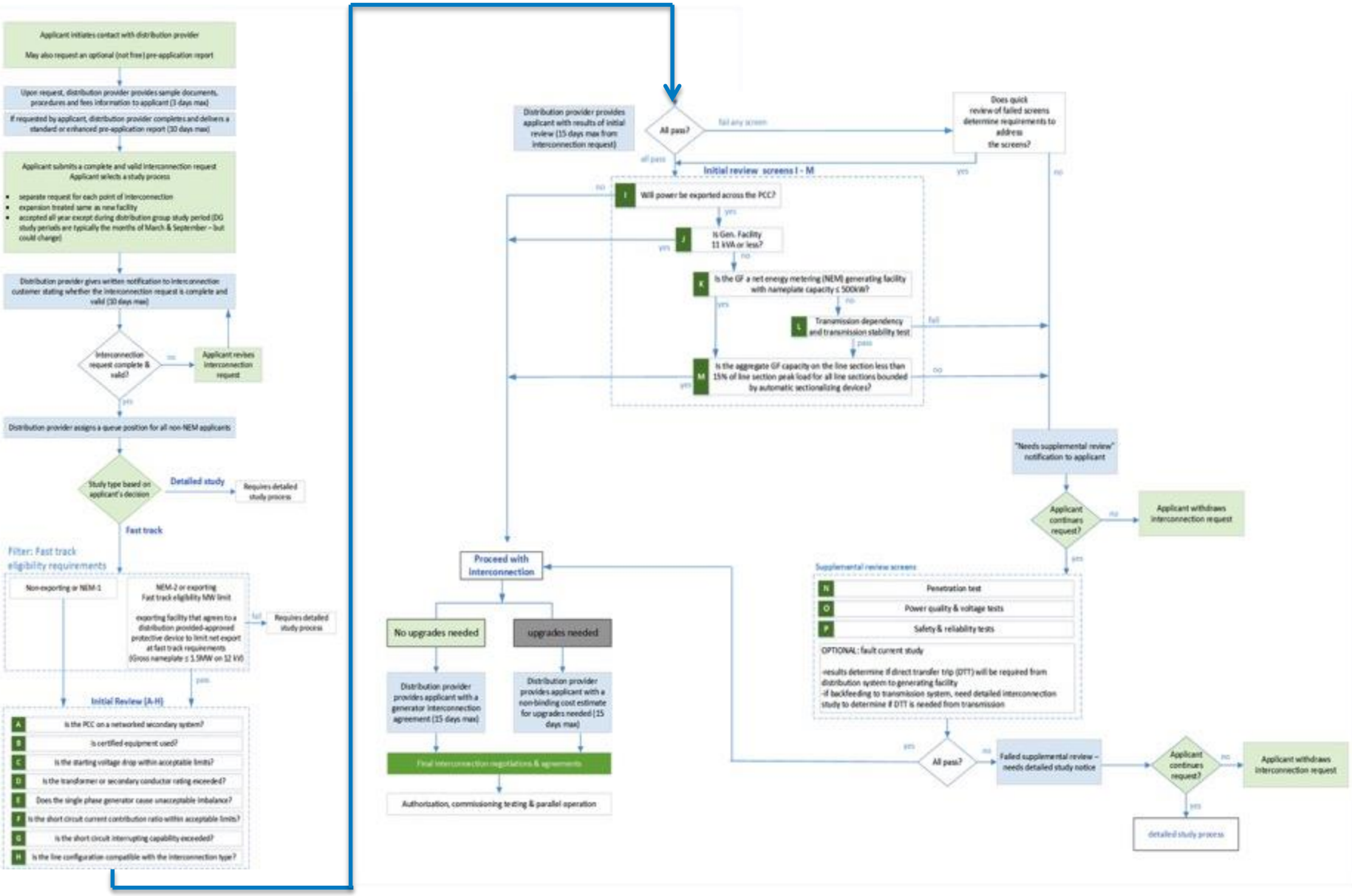
DER must meet IEEE 1547, UL1741



Takeaway: Improved IEEE 1547 Standard should aid in getting more DER through the preferred path with improved fast-track screens

Systems must be installed per NEC

Example Process – Southern California Edison

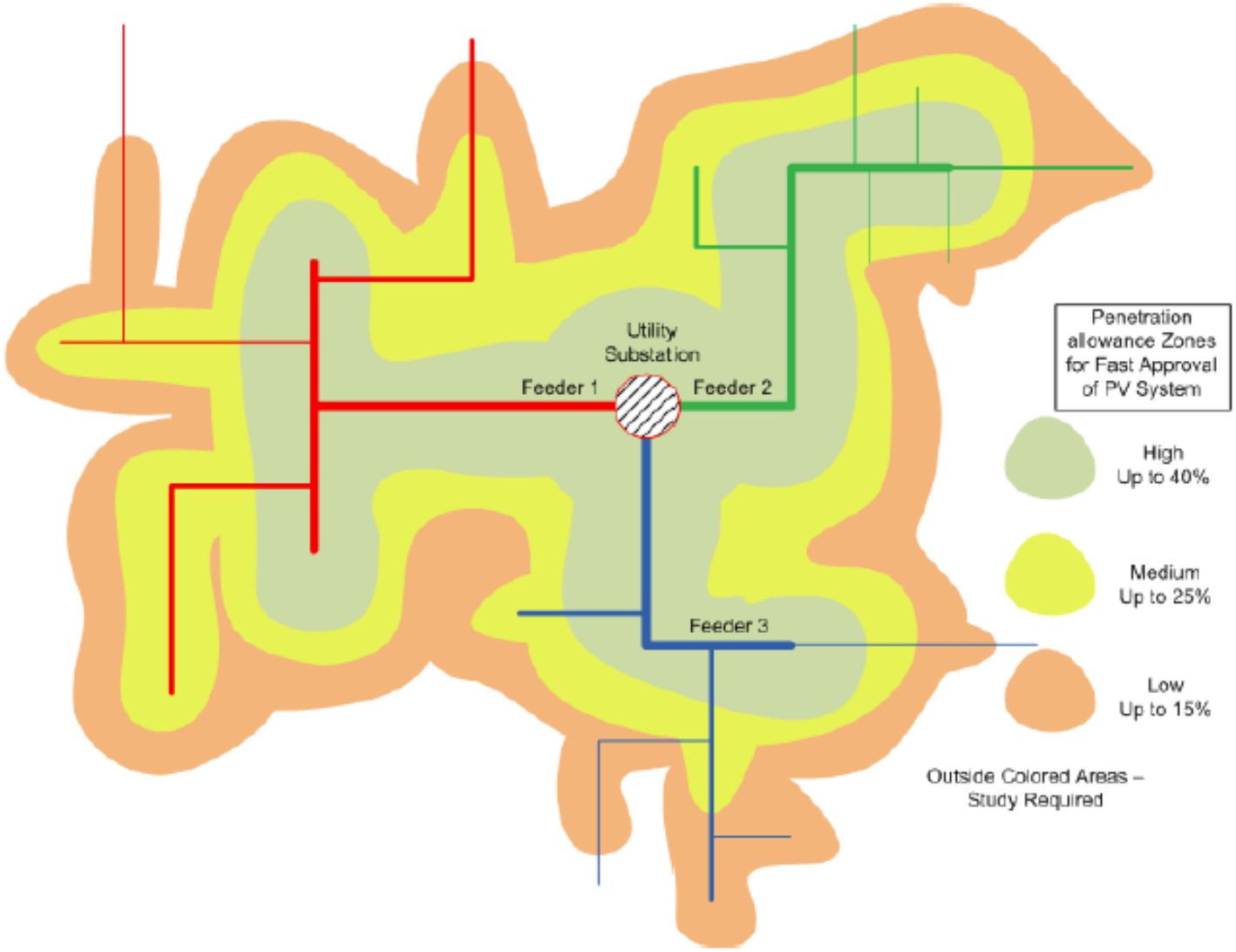


Original FERC SGIP Screens – FERC Order 2006

1. Is the application subject to the utility tariff?
2. **Aggregated DG <15% of Peak Load on line section** (2.2.1.2)
3. For connection to a spot network: DG is inverter-based, aggregated DG capacity is <5% of peak load & <50 kW
4. Aggregated DG contribution to maximum short circuit current is <10%
5. Aggregated DG does not cause protective device to exceed 87.5% of short circuit interrupting capability
6. DG interface is compatible with type of primary distribution line (wye/Delta)
7. For a single-phase shared secondary, Aggregated DG capacity <20kW
8. Resulting imbalance <20% of service transformer rating of 240 V service
9. Aggregated transmission connected DG capacity <10 MW for stability-limited area
10. Construction not required for interconnection

Screen 2.2.1.2, the "Penetration Screen", has invoked significant controversy and has been seen as a bottleneck in many regions/states/utility territories. One option is to utilize "Hosting Capacity"

Example of “Hosting Capacity Zones”



Hosting Capacity Roadmap Model

Stage	Consideration	Data Requirements	Output
1 – Distribution Indicators	Possible indicators such as - Estimated Minimum load Voltage class - Substations over a MW threshold typically indicative of substation backfeed	- Currently available data - Understanding the interconnection queue	- Provides an indication where certain substations/feeders may have high costs associated with interconnecting DER
Evaluations – Radial Systems		- All feeders modeled in service territory with regular updates for existing DER and queued DER mapped into planning models	
3 – Advanced Hosting Capacity Evaluations	- Refined nodal/section-based hosting capacity - Possible substation/transmission constraints - Operational and planning flexibility for changing configurations	- Transmission assessments and mapping of distribution-level impacts to transmission - Normal and reconfigured system models	- Refined hosting capacity evaluations that take into account additional criteria

New York Hosting Capacity Meeting 2016 - EPRI

Detailed Impact Studies

Most utilities employ one or more of the following study types

- Feasibility
- Facility
- Power Flow (common)
- Short Circuit (common)
- Voltage (common)
- Flicker
- Power Quality

Uncommon mentions

- Dynamic/Transient Stability
- Electromagnetic Transient

Common software

- SynerGEE
- CymDist
- Milsoft Windmil
- DEW
- ASPEN

Research Software*

- OpenDSS*
- GridLabD*

Common Mitigation Strategies

Type of Strategy in the Interconnection "Toolbox"
Upgrade a feeder or line section
Modify protection settings/fuses
Voltage Regulation Devices and Controls
Direct Transfer Trip
Advanced Inverters
Communication/Control Technology
Power factor controls
Grounding transformers
Reclosers

Interconnection Best Practices

- Open communication between utility & developer
- Online interconnection applications
  - Ease of tracking project status
- Rational screening approach
- Supplemental screening options
  - Proposed Supplemental Screens are somewhat complex, for now….
  - “Safety Valve” approach to solve simple problems and avoid impact studies is an excellent option (e.g. replace secondary or transformer)
- Standard impact study approach, software
- Cost-effective mitigation strategies
- Supportive regulatory organizations
  - Uniform state rules/processes for all utilities
- Overall streamlined, transparent processes

UL1741 SA – Standard for *Smart* Inverters

The UL1741 STP approved UL1741 SA in Sept. 2016

- Inverters with *Smart Inverter* functions can now be listed under UL1741 SA
- Utilities and state rules can now require UL1741 SA listed inverters (California requires all new inverters to be listed by September, 2017

Phase 1 - Smart Inverter Working Group Functions

Proposed Phase 1: Autonomous Inverter Functionalities Recommended as Technical Operating Standards within Electric Tariff Rule 21. The SIWG recommends the following **autonomous** inverter functionality modifications to the technical operating standards set out in Rule 21:

1. Support anti-islanding to trip off under extended anomalous conditions.
2. Provide ride-through of low/high voltage excursions beyond normal limits.
3. Provide ride-through of low/high frequency excursions beyond normal limits.
4. Provide volt/VAr control through dynamic reactive power injection through autonomous responses to local voltage measurements.
5. Define default and emergency ramp rates as well as high and low limits.
6. Provide reactive power by a fixed power factor.
7. Reconnect by “soft-start” methods.

NREL Power Systems Engineering Center

NREL … Providing Solutions to Grid Integration Challenges

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Staff Subcommittee On Energy Resources & the Environment

IREC
Interstate Renewable Energy Council, Inc.

Shaping our future with clean energy

Interconnection Standards: The "Rules of the Road" for the Grid

Sara Baldwin Auck
Director, Regulatory Program

February 11, 2017
NARUC Winter Committee Meeting
Washington D.C.

IREC Interstate Renewable Energy Council, Inc.

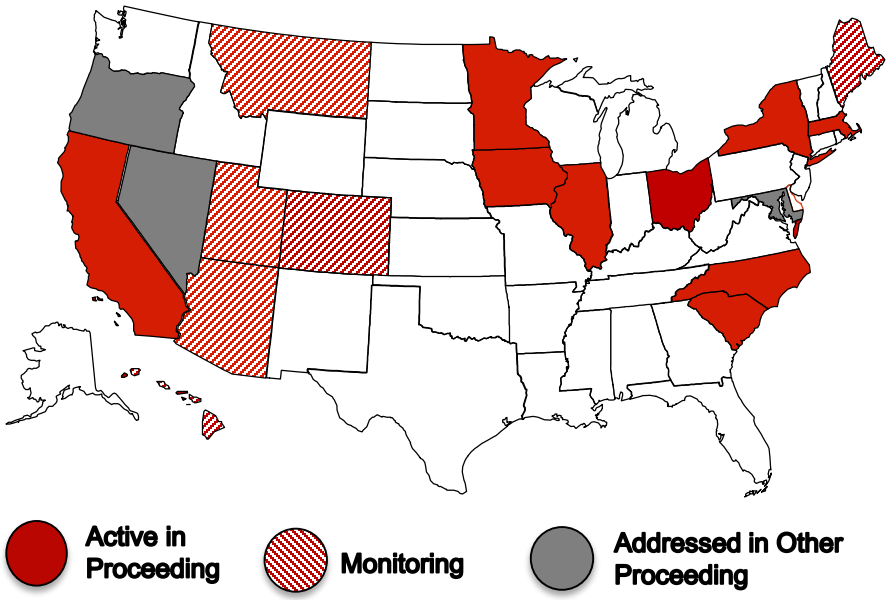
Our Mission: Increase access to sustainable energy and energy efficiency through independent fact-based policy leadership, quality work force development, and consumer empowerment.

Our Focus Areas:

- ✓ Regulatory: Policies and regulatory reforms that streamline grid integration and increase access to and optimize the widespread benefits of distributed energy resources.
- ✓ Workforce & Credentialing: high quality workforce training to ensure safety and reliability.
- ✓ Consumer Empowerment: Consumer tools to help inform clean-energy decision-making.

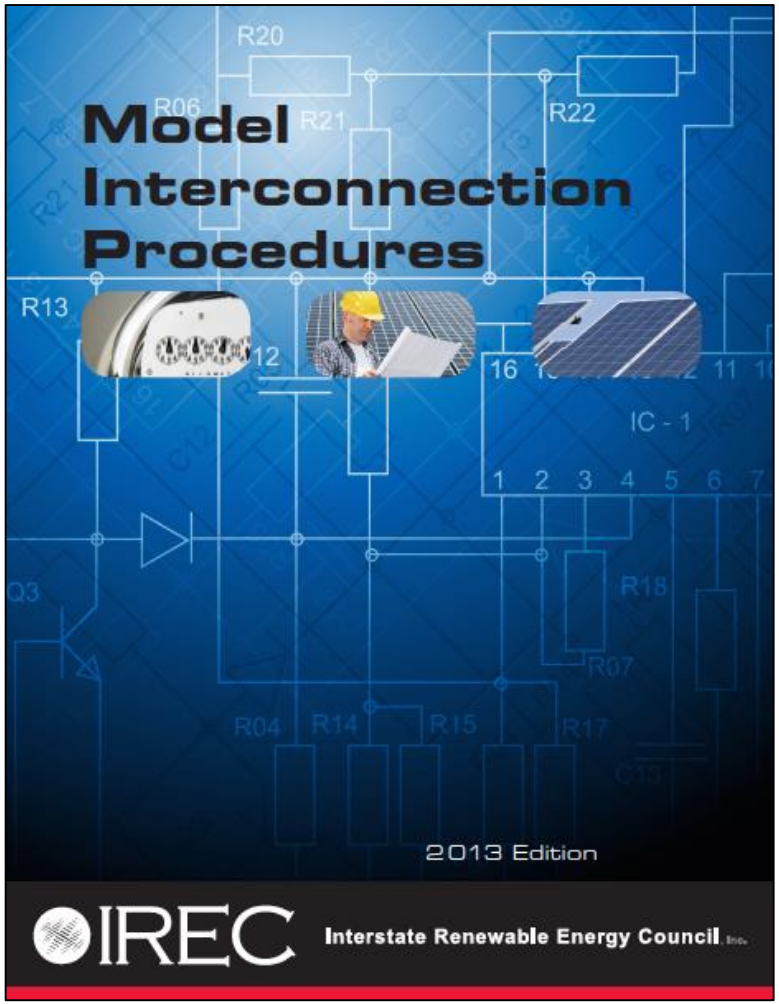
IREC's National Interconnection Work

- Independent, non-industry, public interest organization with a consumer focus
- Active in FERC Small Generator Interconnection Procedures (SGIP) development in 2013
- Leading participant in recent reforms in:
  CA, HI, IL, IA, MA, NY, NC, OH, SC
- Several states have adopted IREC's model rules



IREC's Recent Interconnection Engagement

IREC Model Interconnection Procedures



First developed in 2005, and updated in 2009 and 2013, IREC's Model Interconnection Procedures synthesize well-vetted, evidenced-based best practices for the safe and efficient connection of distributed energy resources to the utility grid.

Free Download at
WWW.IRECUSA.ORG

State Interconnection Standards: Rules of the Road

Gridlocked, inefficient, unpredictable

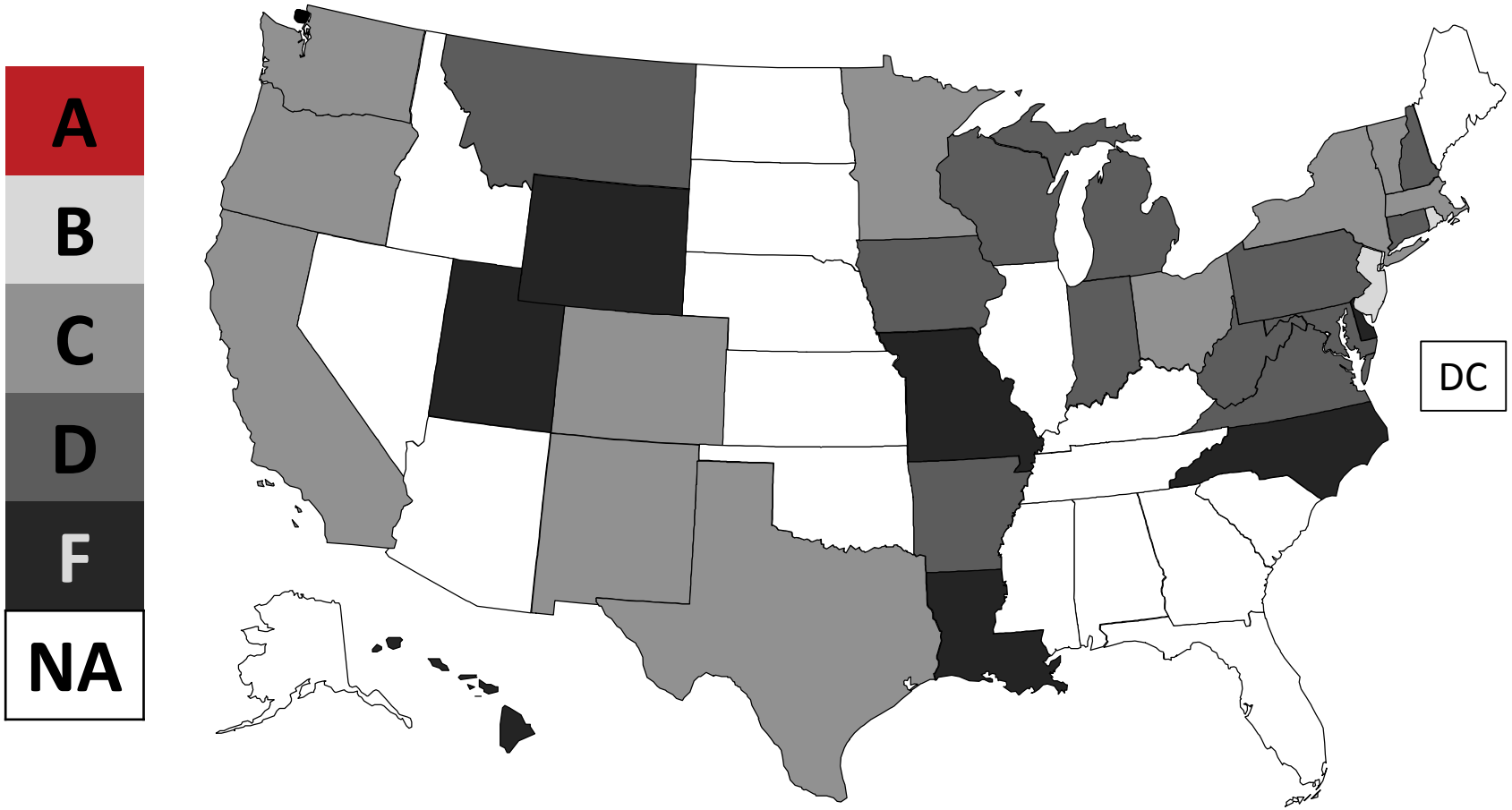
VS.

Streamlined, efficient, predictable

Evidence-Based Interconnection Standards: A Regulatory Tool

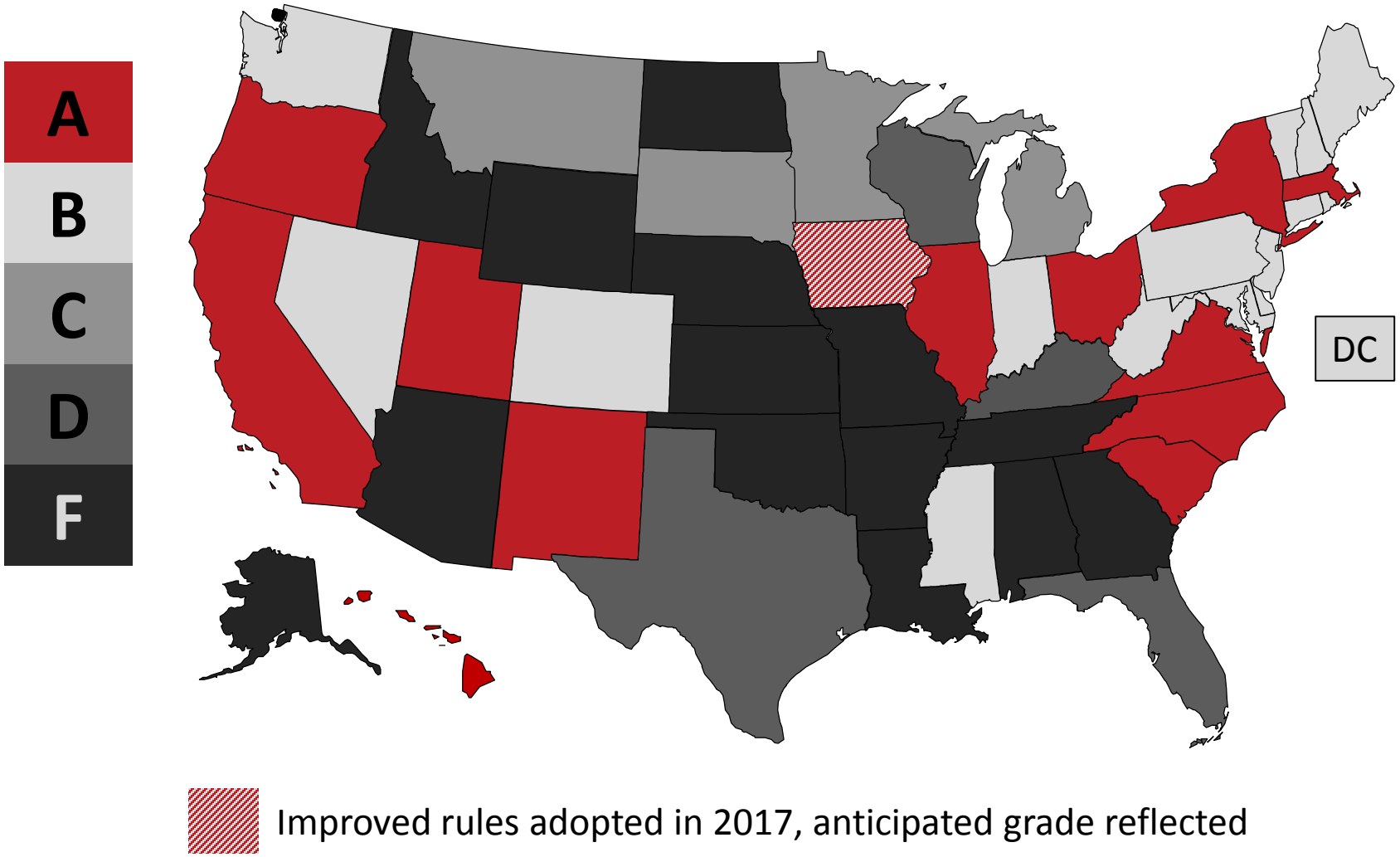
- ✓ Ensure grid safety and reliability
- ✓ Enable more streamlined and cost-effective integration and interconnection of distributed energy resources (DERs) to the grid
- ✓ Help utilities and states manage healthy DER market growth
- ✓ Gain greater visibility into our distribution system
- ✓ Avoid gridlock
- ✓ Build solid foundation for state grid modernization efforts
- ✓ Support DER policy goals and implementation
- ✓ Ensure accountability among developers and utilities alike

2007 State Interconnection Grades



Note: Scoring Criteria has changed several times since 2007.
NA grade in 2007 applied to states without statewide interconnection standards.

2016 State Interconnection Grades



Improved rules adopted in 2017, anticipated grade reflected

Key Issues to Address with Interconnection Standards

- Applicability
- Processes & Timelines
- Technical Requirements
- Fees
- Transparency & Data Sharing
- Cost Allocation
- Dispute Resolution
- Enforcement
- Reporting & Tracking

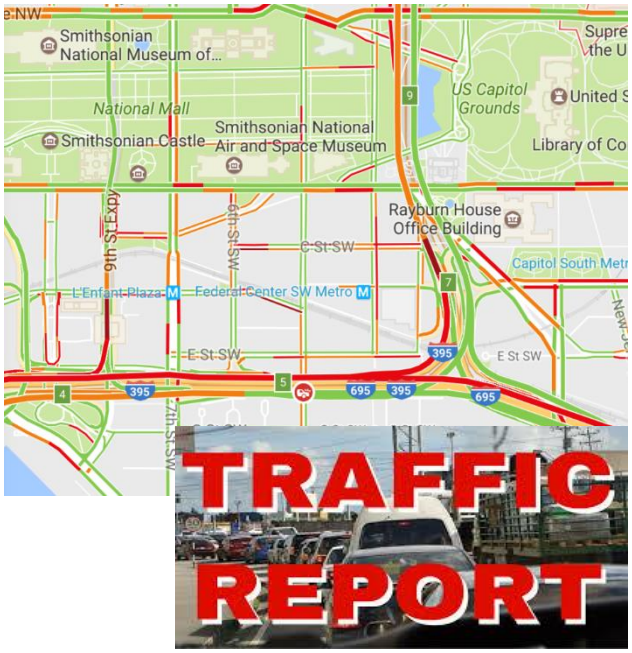
Timelines

- Electronic application submittal & signatures
- Electronic tracking
- Meter installs
- Construction of upgrades
- Queue-clearing
- Internal utility processes to avoid the backlog
- Enforcement Mechanisms!

For more info on timelines, check out IREC's *Connecting to the Grid* Blog Series, also featured on Greentech Media: http://www.irecusa.org/regulatory-reform/interconnection/

Transparency & Data Sharing

- Information about ”the road ahead” to ensure process runs smoothly and helps to avoid backlogs.
- Determine which areas of the grid have higher penetrations and thus are more likely to require costly interconnection review or upgrades
- Yield more strategically located projects on the grid, thus optimizing benefits and minimizing costs.
- Tools to enhance transparency:
  - Pre-application reports
  - Distribution system maps
  - Public interconnection queues (e.g., Xcel public queue for Community Solar Gardens applications in MN)
  - Interactive websites to monitor interconnection progress
  - Online portals with automated management and screening

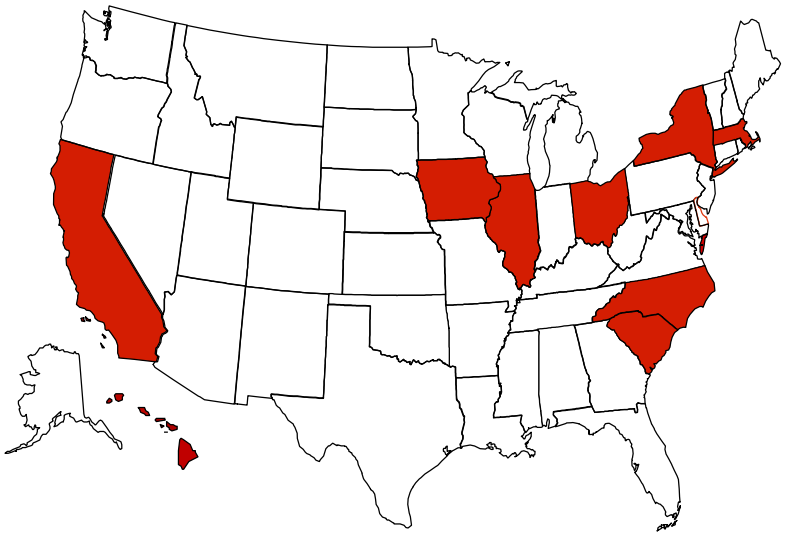


For more info, check out IREC’s *Connecting to the Grid* Blog Series, also featured on Greentech Media: http://www.irecusa.org/regulatory-reform/interconnection/

Pre-Application Report

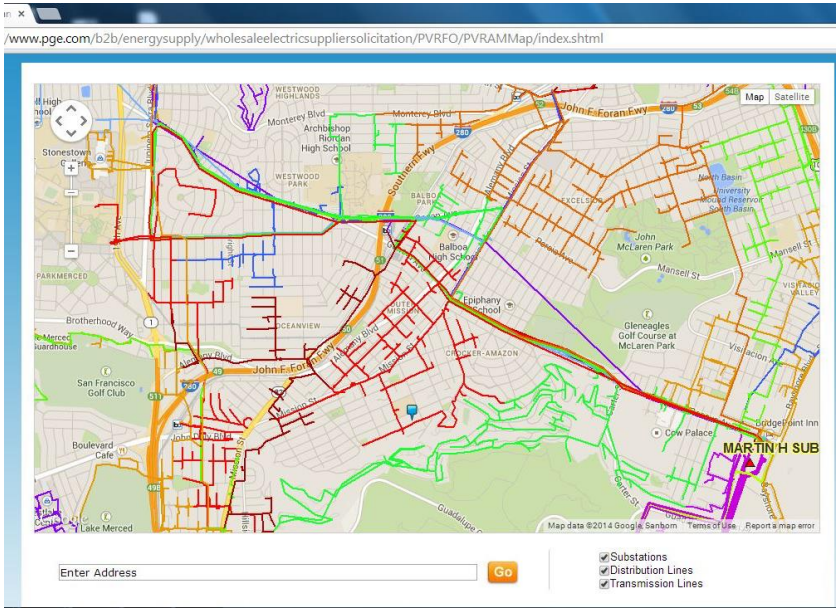
- *Voluntary* report about known conditions at specific point of interconnection
- Nominal fee, paid by applicant
- Typically produced by the utility in ~10 days
- 10-13 pieces of information provided
- Information enables developers to roughly determine time and cost of interconnection
- Utilities and Developers say: used and useful

Where are pre-application reports being used?



System Maps

- Publicly available maps that provide information about system conditions
- Level of information provided:
  - Just the basics: voltage, available capacity
  - Preferred or “Good/Bad”: color coding to indicate whether it is likely to be an easy or difficult point of interconnection
  - Actual full hosting capacity information
- Best if done in conjunction with pre-application reports
- Where are maps in place? CA, DE, MA, IL, NY, HI with varying degree of detail and usability



Source: PG&E

Reporting & Tracking

- Transparency regarding the interconnection queue can be beneficial for interconnection applicants as well as utility regulators and others interested in understanding the process.
- Allow visibility into the number of applicants ahead of you that require utility review before, thereby giving them a more realistic sense of review timing.
- Can help show where applicants earlier in the queue are located, and therefore help later applicants determine which areas of the grid have higher penetrations of distributed generation and thus are more likely to require costly interconnection review.
- A public interconnection queue and regular reporting can also help to identify bottlenecks or other problems for utilities and regulators to address.
- As new requirements are implemented, helpful to know whether they are actually working to reduce time and costs for all parties. Regular reporting is key to achieving long-term improvements to the process.
- Automating manual systems to save time and energy over time.
- See CA, MA, and HI for best examples.

"Fast Track" Eligibility

Section III.B.2.a of IREC's *Model Interconnection Procedures* incorporates a table-based approach to Level 2 eligibility.

Line Voltage	Level 2 (Fast Track) Eligibility	
	Regardless of Location	On ≥ 600 amp line and ≤ 2.5 miles from substation
≤ 4 kV	≤ 1 MW	≤ 2 MW
5 kV – 14 kV	≤ 2MW	≤ 3 MW
15 kV – 30 kV	≤ 3 MW	≤ 4 MW
31 kV – 60 kV	≤ 4 MW	≤ 5 MW

Notes: NREL's *Updating Small Generator Interconnection Procedures for New Market Conditions* explains the Fast Track process and the rationale for adopting a table-based approach to eligibility.

Section 2.1 of the FERC SGIP also incorporates a Fast Track Eligibility table. FERC relies on similar numbers that were negotiated during the tariff review process.

Supplemental Review

- Concept: Additional time and resources for a "closer look" to evaluate whether a project that failed initial Fast Track review screens *really warrants full study*
- Projects should undergo the level of review really necessary to assess potential safety/reliability impacts
- Include three technical screens that provide more structure to the review process:
  - 100% of Minimum Load (daytime min for solar)
  - Safety & Reliability
  - Voltage & Power Quality

❖ Fast Track Process + Supplemental Review → allows more projects to receive expedited process, when appropriate. Together, they save time and resources for applicants and utilities, while still ensuring safety and reliability.

- Currently CA, MA, HI, OH, IL, IA use this approach

Notes: Section 2.4 of the FERC SGIP describes its Supplemental Review process.
IREC's *Model Interconnection Procedures* incorporate a nearly identical supplemental review process in Section III.D.
NREL's *Updating Small Generator Interconnection Procedures for New Market Conditions* explains the rationale for a transparent supplemental review process.

Cost Containment

- Cost Predictability
  - Cost guides
  - Typical scenarios
- Cost Accuracy
  - Detailed estimates
- Cost Certainty
  - Cost Envelope
  - CA Rule 21
  - MA

Dispute Resolution

- Best way to avoid disputes are clear rules with concrete technical requirements and timelines.
- Even the best drafted rules cannot envision every scenario
- Dispute Resolution
  - Clear process before a formal complaint
  - Ombudsperson at Utility and/or Commission (i.e., utility interconnection point person, regulatory person to deal with mediating disputes)
  - Technical master

Applicability – Don't forget Energy Storage!

- Establish transparent, non-discriminatory, timely and cost-effective statewide interconnection standards that address energy storage
- Revise or clarify the existing definition of eligible generator to include energy storage.
- Apply and streamline existing technical review process for conventional "generation" and "load" sources seeking to interconnect.
- Allow applicants to define operating constraints and incorporate them into the binding interconnection agreement.
- Identify and specify how cost allocation rules apply to energy storage systems, particularly where it is determined that a grid-related upgrade would be required for both the charging (load) and discharging (generator) functions of storage.
- Clarify when energy storage systems need to submit an interconnection application, and what level of review each type of system will need to undergo.
- Address "non-exporting" energy storage systems, which may require little to no review.
- States should work with FERC to ensure a clear answer emerges such that energy storage projects can offer their full range of services without encountering unnecessary jurisdictional hurdles.

Coming Spring 2017 – New IREC Resource →

IREC Interstate Renewable Energy Council, Inc.

For More Information

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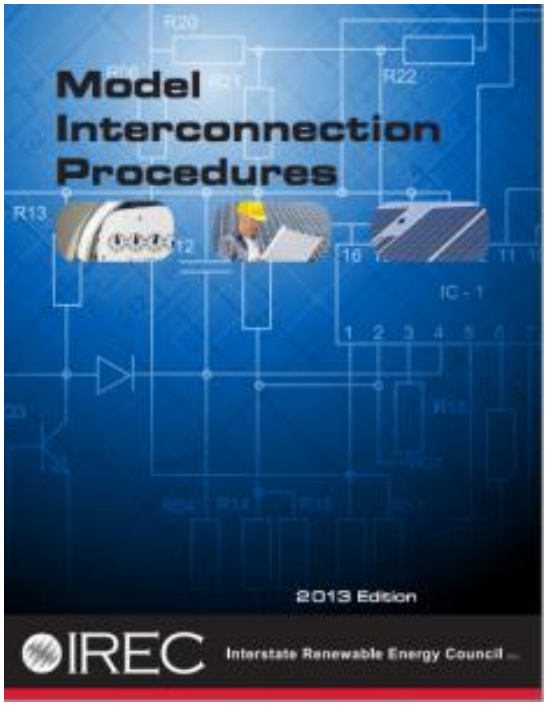

NARUC

Winter Committee Meetings

Staff Subcommittee On Energy Resources & the Environment