Strategies for Improving Interconnection Prospecting Tools

Why grid transparency is necessary to enabling an efficient interconnection process.

SHAY BANTON

Pronouns: They/Them

Regulatory Program Engineer & Energy Justice Advocate

IREC

Interstate Renewable Energy Council (IREC)

IREC builds the foundation for rapid adoption of clean energy and energy efficiency to benefit people, the economy, and our planet.

Today's Guiding Questions

What	What is grid transparency and why is it important?
How	How are prospecting tools used in interconnection?
Ideal	What are the best practices and why do they work?
Future	What is next for prospecting and grid transparency?

What Is Grid Transparency?

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“

Grid transparency is providing customers and the public information about the grid.

”

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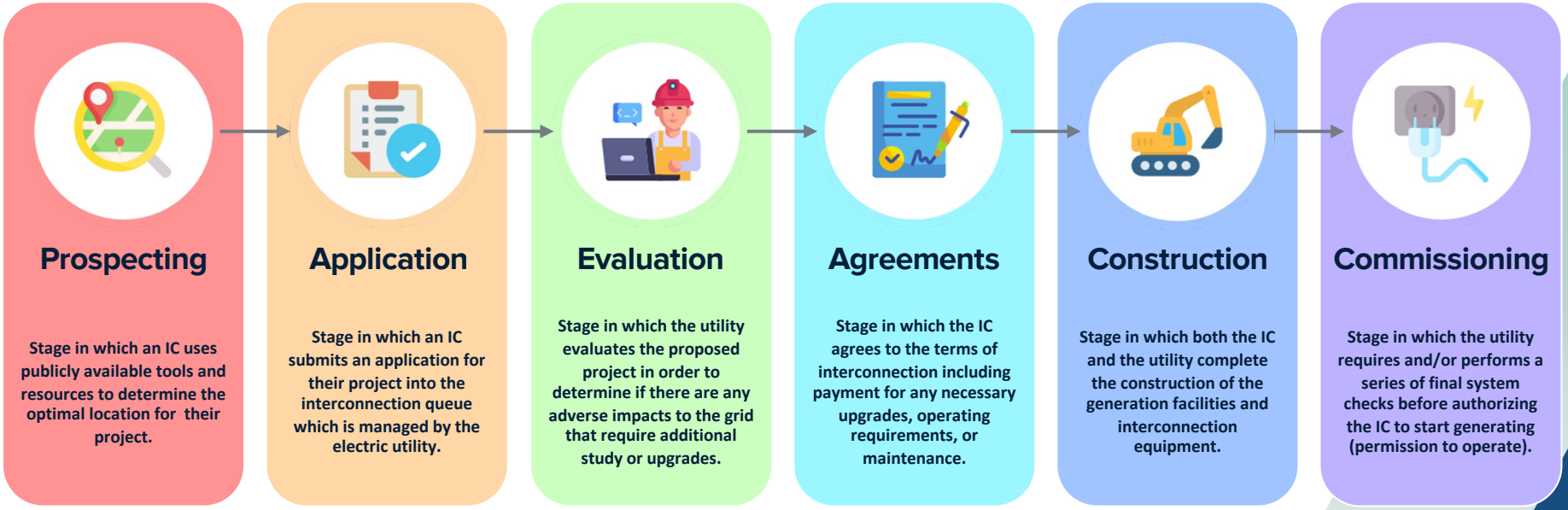
Who Uses Grid Data?

Who Uses Grid Data?

- **Regulators**
  - Monitor DER deployment trends
  - Distribution system planning
- **Local governments**
  - Design incentives and other programs
- **Stakeholders and NGOs**
- **Today's DER customers and developers**
  - DER siting and design
- **Tomorrow's innovative entrepreneurs**

Impact on the Interconnection Process

improving process efficiency for all stakeholders



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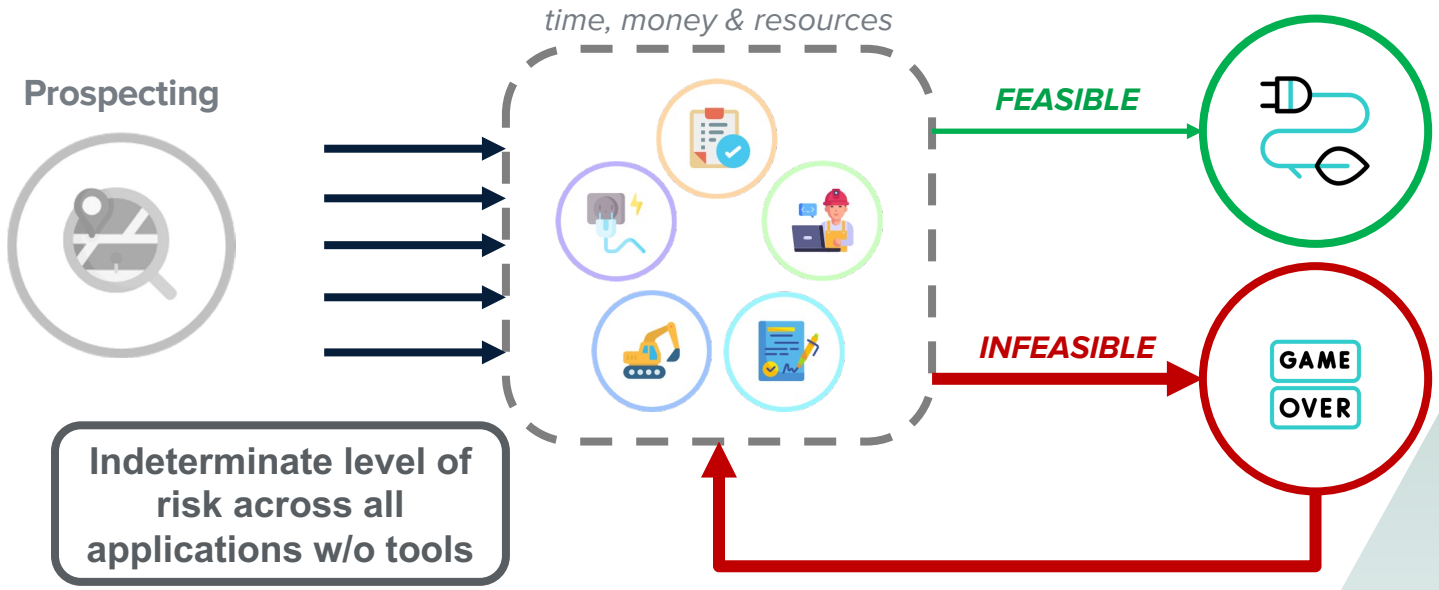

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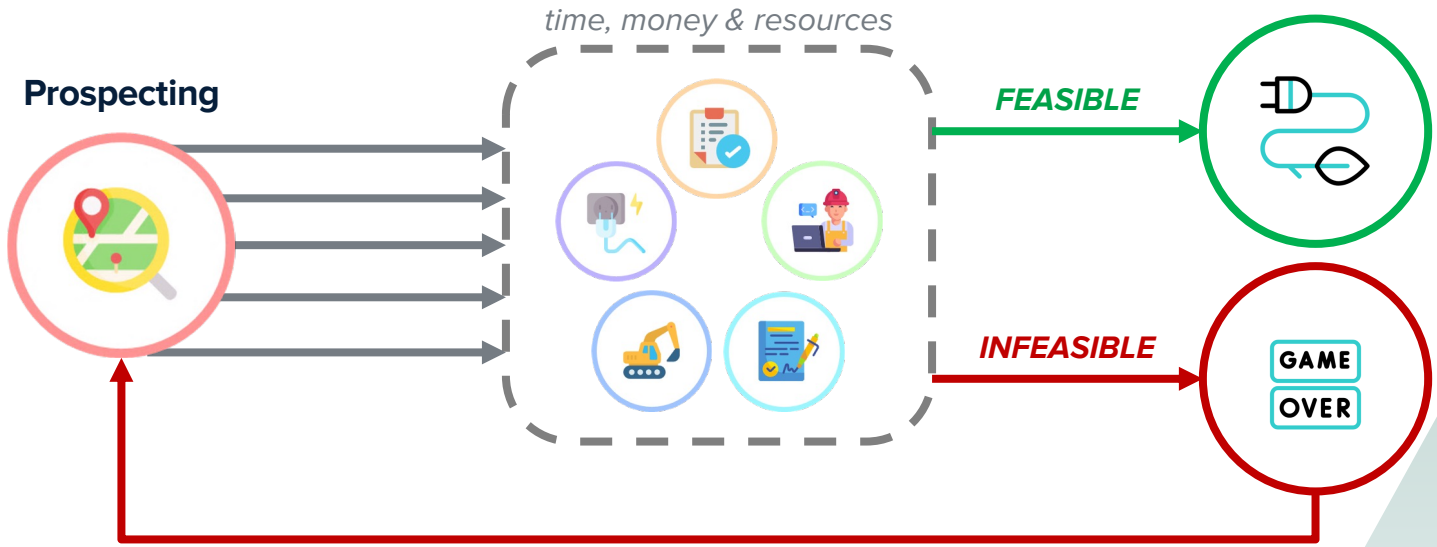

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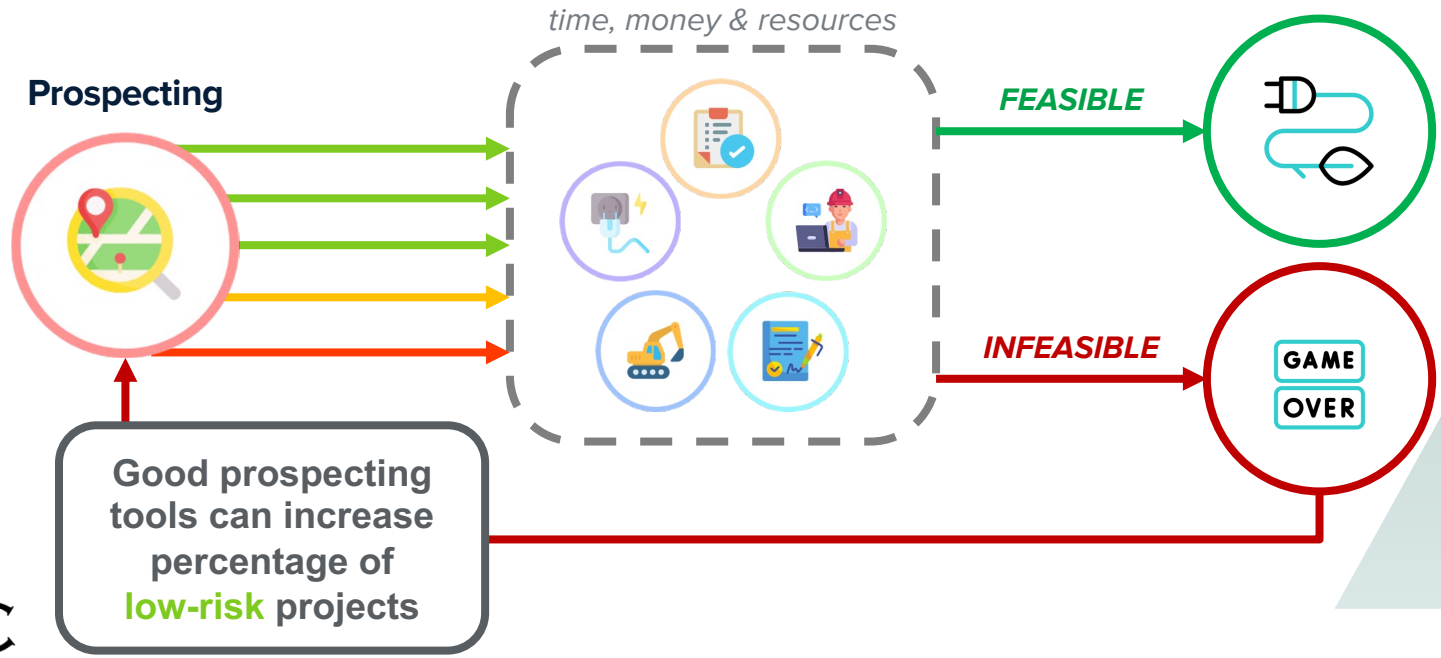

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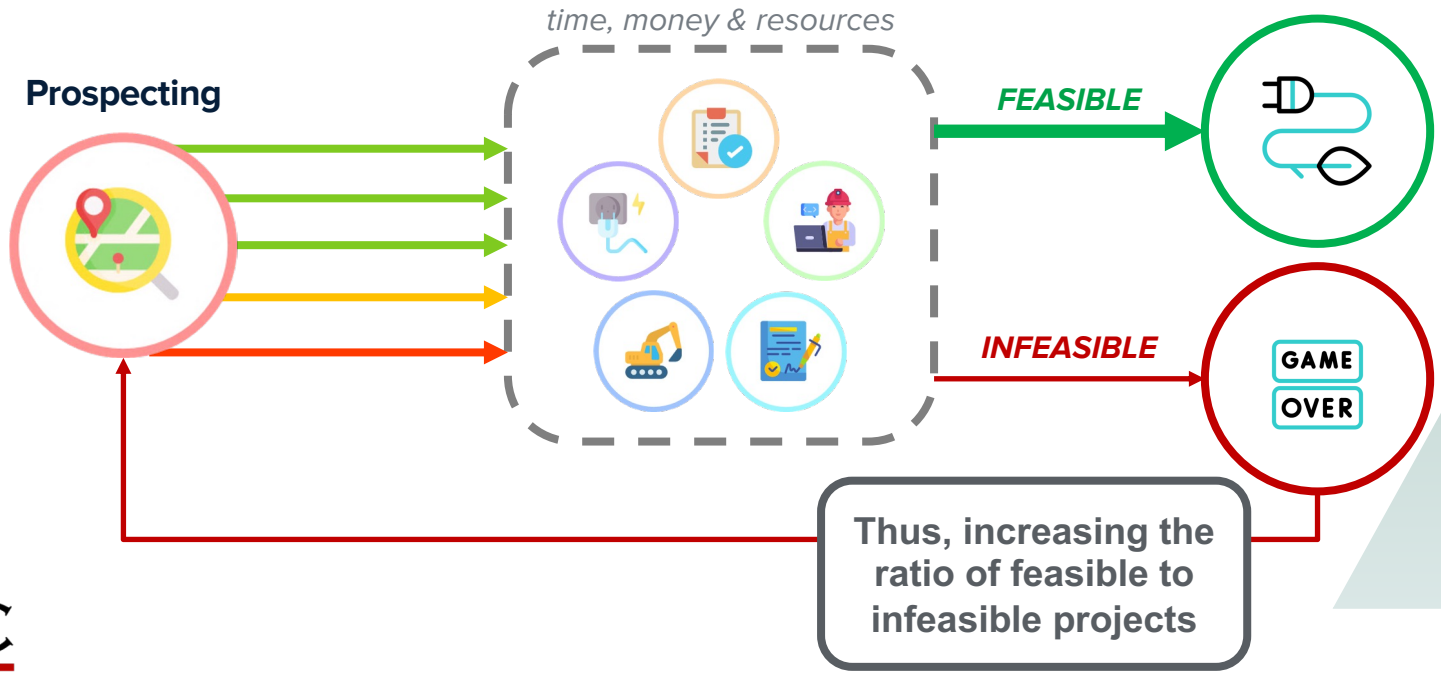

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Impact on the Interconnection Process

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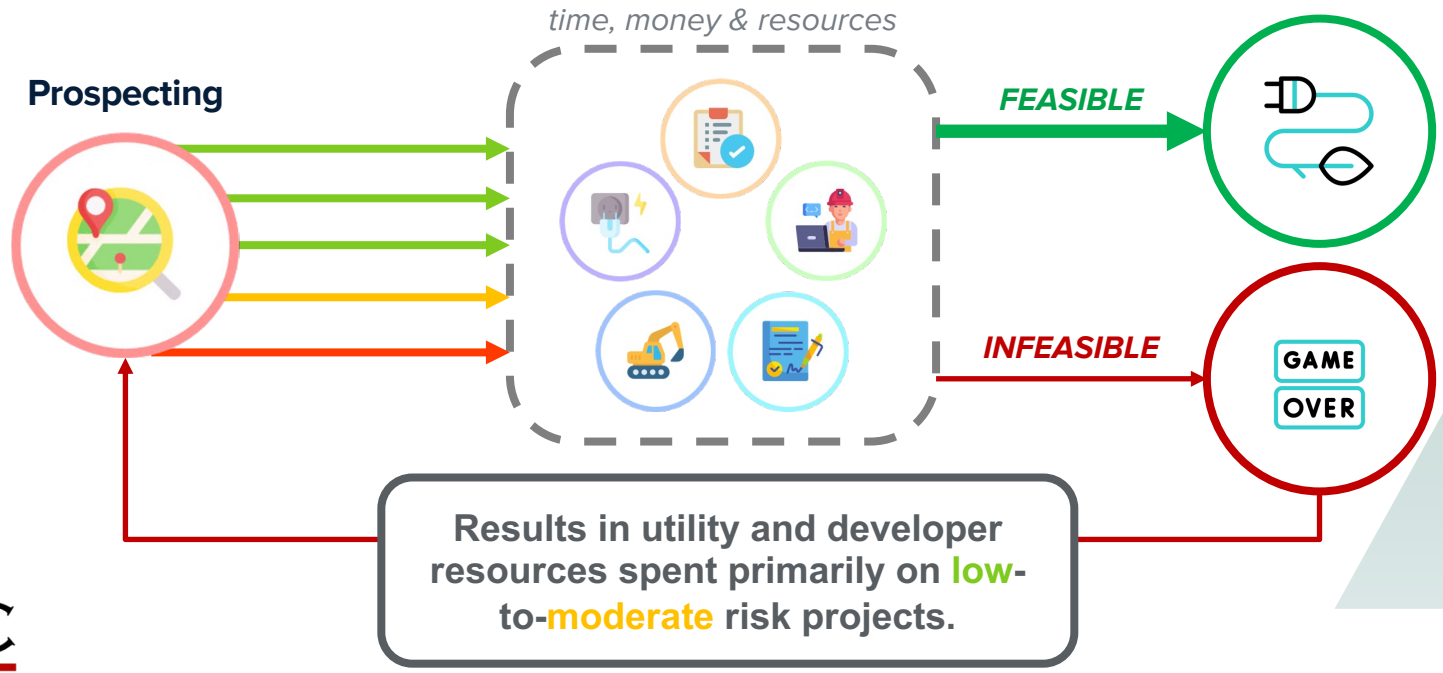

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Prospecting Tools as a method of Grid Transparency

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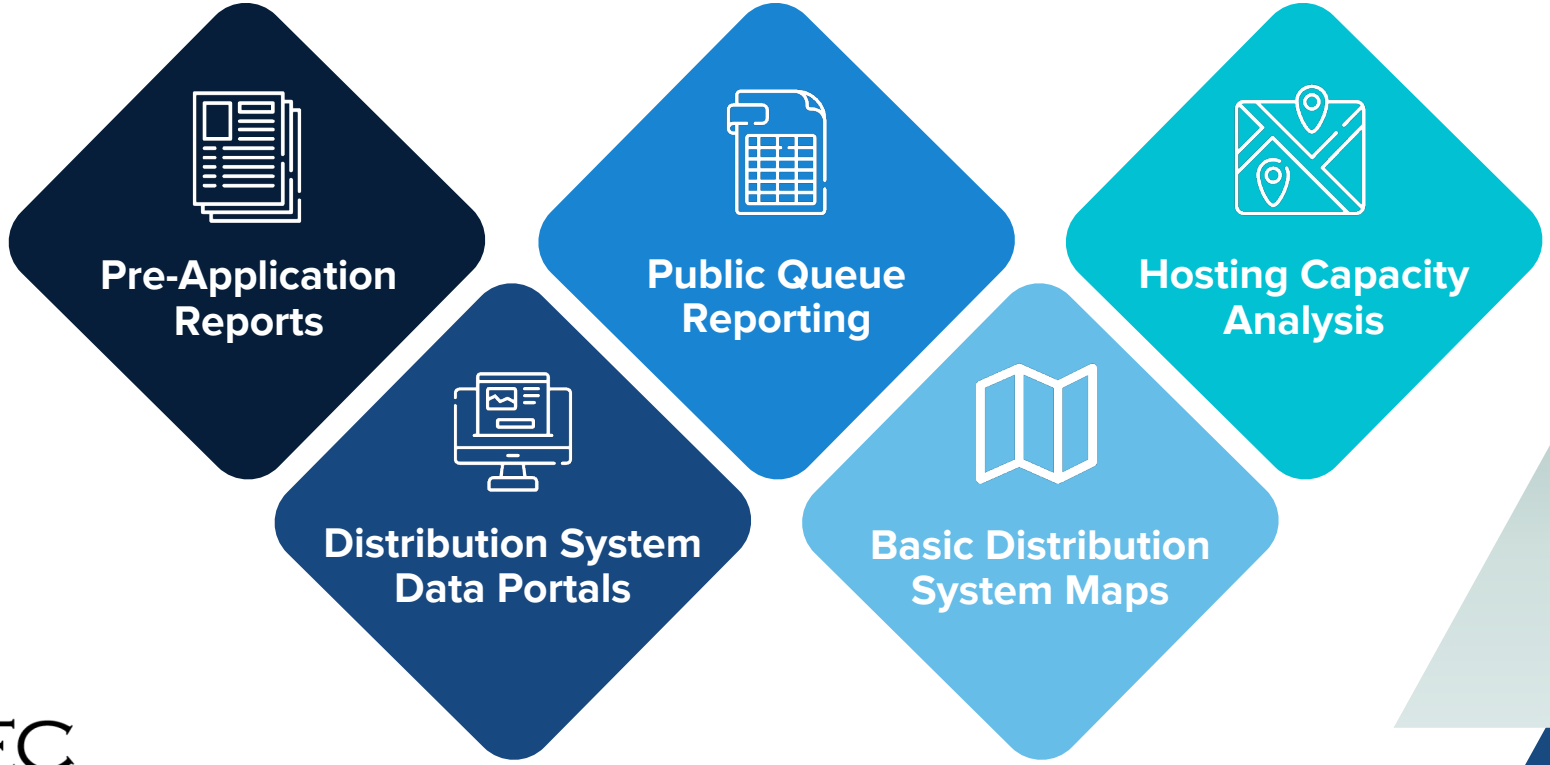
Prospecting Tools



Pre-Application Reports

Overview

- Customer requests data for specific Point of Interconnection
- Typically cost ~$300 per report
- Utilities typically respond with data in 10 business days

Pre-Application Reports

Requested Data

- Approximate **circuit distance** between proposed site and substation
- Number and rating of **protective devices** and number and type of **voltage regulating devices**, between proposed site and substation
- Whether or not **three-phase power** is available at the site and/or distance from three-phase service
- **Limiting conductor rating** from proposed Point of Interconnection to distribution substation

Pre-Application Reports

Requested Data Continued...

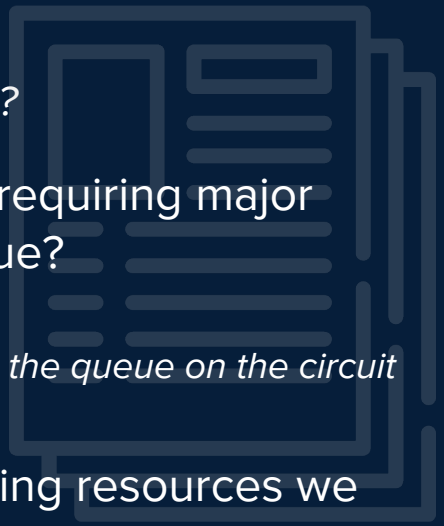
Typically includes the following info about the area of the grid (substation/area bus or bank and circuit) likely to serve the site:

- Total capacity of substation
- Aggregate existing generating capacity
- Aggregate queued generating capacity
- Available capacity of substation
- Is it an area, spot, or radial network?
- Substation (or transmission) nominal distribution voltage
- Nominal distribution circuit voltage at site
- Distance between site and substation
- Load profile (8760 hours)
- peak and minimum load data of line sections
- Limiting conductor rating
- Number and rating of protective devices and voltage regulating devices between the site and substation
- Availability of three-phase power and/or distance from three-phase service
- Existing or known constraints (e.g., electrical dependencies, short circuit interrupting capacity issues, power quality or stability issues, capacity constraints, or secondary networks
- Any other information relevant to the applicant

Pre-Application Reports

What sorts of questions do these reports help answer?

- **Developers –** What are my project's risks for requiring major grid upgrades before submitting into the queue?
  - *Is there a circuit nearby my proposed site?*
  - *How many projects are already interconnected or in the queue on the circuit or substation ahead of my project?*
- **Utilities –** How can we optimize the engineering resources we spend on evaluating queued projects?
- **Regulators –** How can we increase project retention rates throughout the interconnection process?



Distribution System Data Portals

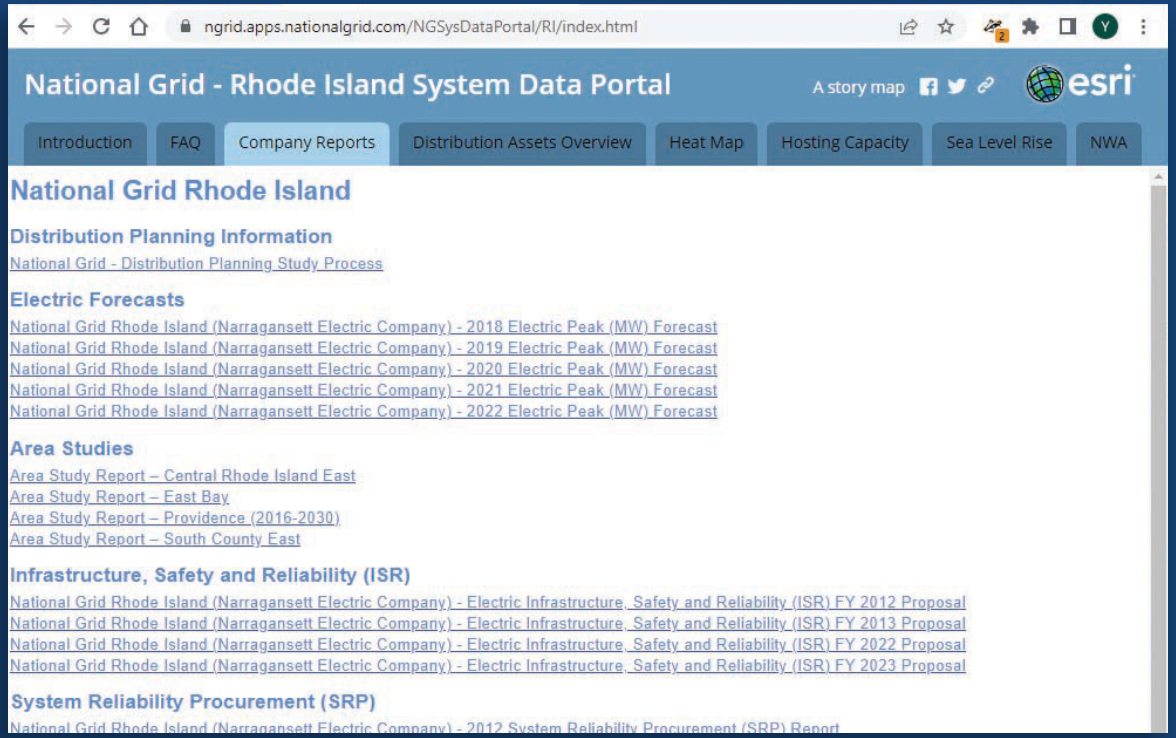
Overview

- Website with downloadable data sets and reports about distribution grid conditions and constraints

- Typically includes:
  - load profiles
  - distribution system asset information
  - distribution system planning assumptions & studies
  - other relevant data

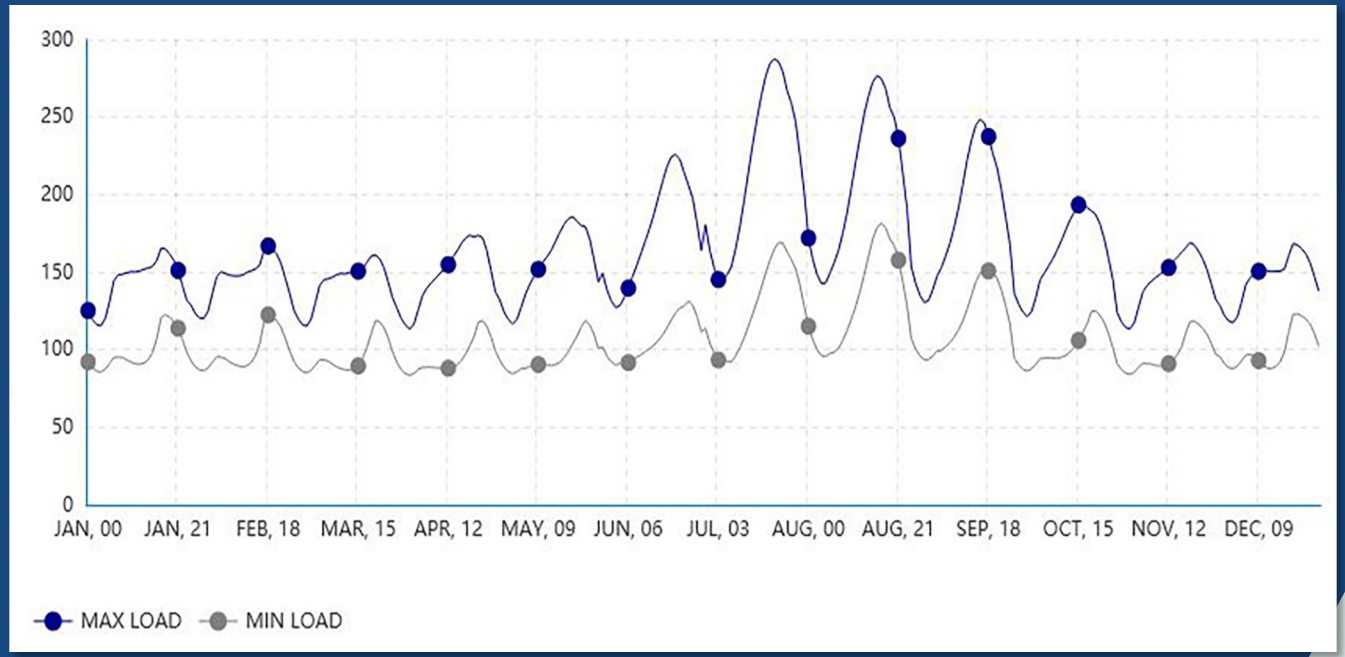
Distribution System Data Portals

Example from National Grid



Distribution System Data Portals

Example load profile obtained from a system data portal



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Distribution System Data Portals

What sorts of questions do data portals help answer?

- **Developers –** Are there any additional identifiable constraints that could increase my project's risk of requiring expensive upgrades?
  - *What are the load conditions of the circuit and substation?*
  - *Can I design my system to avoid exceeding any implied constraints?*
  - *Can energy storage provide the operational flexibility needed to avoid exceeding certain thresholds?*
- **Utilities –** Can we reduce our resources spent studying projects attempting to connect to already severely constrained systems?
  - *How can we fairly inform applicants of grid sections to avoid?*
- **Regulators –** How widespread are major grid constraints and would proactive planning efforts help to avoid bottlenecks?

Public Queue Reporting

Overview

- Regularly published queue reports detailing the status of all projects within the interconnection queue
- Can provide additional details such as:
  - Time within each stage of the review process
  - Interconnection costs assigned after evaluation
- Requires both a high-frequency update schedule and robust validation process to be useful

Public Queue Reporting

Example spreadsheet from New York Utility

															APPLICATION REVIEW 10 business days				PRELIMINARY REVIEW 15 business days		
												Metering									
Company	Developer	Application / Job #	Division	City/Town	County	Zip Code	NYISO Load Zone	Circuit ID	Substation	PV (kWAC)	ESS (kWAC)	Metering (NA / NM / RNM / CDG)	Value Stack (Y/N)	Protective Equipment	Start Date	End Date	Calculated Duration	Application Approved Date (Utility)	Start Date (Must Match Application Approved Date)	End Date	Calcul Dura
CE			CE					19W06	Grasslands	0.00	5000.00	CDG	Y	Inverter	3/2/23	3/8/23	4	3/8/23	3/8/23	3/15/23	
CE							H	13W75	Buchanan	0.00	5000.00	CDG	Y	Inverter	3/2/23	3/8/23	4	3/8/23	3/8/23	3/16/23	
CE								7M31	Avenue_A	99.40	0.00	NM	N	Inverter	2/24/23	3/2/23	4	3/2/23	3/2/23	3/10/23	
CE								1M17	Sherman_Creek	120.80	0.00	NM	N	Inverter	2/21/23	2/24/23	3	2/24/23	2/24/23	3/10/23	
CE								6852	Water_St	99.40	0.00	NM	N	Inverter	2/21/23	2/24/23	3	2/26/23	2/26/23	3/1/23	
CE								1205	Corona_1	724.50	0.00	CDG	Y	Inverter	2/20/23	2/23/23	2	2/23/23	2/23/23	3/1/23	
CE			CE					12W92	Elmsford_No.2	0.00	1958.40	RC	Y	Inverter	2/17/23	2/25/23	4	2/25/23	2/25/23	3/9/23	
CE			CE					17W40	Harrison	0.00	4895.00	RC	Y	Inverter	2/17/23	2/22/23	2	2/28/23	2/28/23	3/13/23	
CE			CE					6981	Jamaica	0.00	5000.00	CDG	Y	Inverter	2/16/23	2/23/23	4	2/23/23	2/23/23	3/2/23	
CE								3886	Brownsville_1	12.00	4896.00	RC	Y	Inverter	2/15/23	2/24/23	6	2/24/23	2/24/23	2/24/23	
CE								3886	Brownsville_1	12.00	4896.00	RC	Y	Inverter	2/15/23	2/24/23	6	2/24/23	2/24/23	2/24/23	
CE								3886	Brownsville_1	12.00	4896.00	RC	Y	Inverter	2/15/23	2/24/23	6	2/24/23	2/24/23	2/24/23	
CE								214	FRESH_KILLS	12.00	3916.80	RC	Y	Inverter	2/14/23	2/21/23	4	2/21/23	2/21/23	3/1/23	
CE								1R81	FRESH_KILLS	12.00	4896.00	RC	Y	Inverter	2/14/23	2/21/23	4	2/21/23	2/21/23	3/1/23	
CE			CE					33R37	FRESH_KILLS	12.00	4896.00	RC	Y	Inverter	2/14/23	2/21/23	4	2/21/23	2/21/23	3/1/23	
CE			CE					33R37	FRESH_KILLS	12.00	4896.00	RC	Y	Inverter	2/14/23	2/21/23	4	2/21/23	2/21/23	3/1/23	
CE			CE					33R37	FRESH_KILLS	12.00	4896.00	RC	Y	Inverter	2/14/23	2/21/23	4	2/21/23	2/21/23	3/1/23	
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CE								5R28	Woodrow	12.00	4896.00	RC	Y	Inverter	2/12/23	2/16/23	3	2/16/23	2/16/23	2/23/23	
CE					od			6Q44	Glendale	240.00	0.00	CDG	Y	Inverter	2/10/23	2/13/23	1	2/18/23	2/18/23	2/21/23	
CE								4X48	Mott_Haven	12.00	4896.00	RC	Y	Inverter	2/10/23	2/13/23	1	2/17/23	2/17/23	3/2/23	
CE			CE					4X48	Mott_Haven	12.00	4896.00	RC	Y	Inverter	2/10/23	2/13/23	1	2/17/23	2/17/23	3/2/23	
CE			CE					4X48	Mott_Haven	12.00	4896.00	RC	Y	Inverter	2/10/23	2/13/23	1	2/17/23	2/17/23	3/1/23	
CE			CE					4X48	Mott_Haven	12.00	4896.00	RC	Y	Inverter	2/10/23	2/13/23	1	2/17/23	2/17/23	3/1/23	
CE								9B20	Brownsville_2	603.00	0.00	CDG	Y	Inverter	2/10/23	2/13/23	1	2/15/23	2/15/23	3/2/23	
CE								7X84	Parkchester_1	0.00	5000.00	CDG	Y	Inverter	2/10/23	2/16/23	4	2/16/23	2/16/23	2/28/23	
CE								6882	Jamaica	225.00	0.00	CDG	Y	Inverter	2/10/23	2/13/23	1	2/13/23	2/13/23	2/27/23	
CE								7891	Parkchester_1	724.50	0.00	CDG	Y	Inverter	2/9/23	2/15/23	4	2/15/23	2/15/23	3/2/23	
CE								9B20	Brownsville_2	724.50	0.00	CDG	Y	Inverter	2/9/23	2/15/23	4	2/15/23	2/15/23	3/2/23	
CE			CE					9B12	Brownsville_2	724.50	0.00	CDG	Y	Inverter	2/9/23	2/14/23	3	2/14/23	2/14/23	3/1/23	
CE			CE					9B20	Brownsville_2	724.50	0.00	CDG	Y	Inverter	2/9/23	2/16/23	5	2/16/23	2/16/23	3/3/23	
CE			CE					7Q84	Corona_1	724.50	0.00	CDG	Y	Inverter	2/9/23	2/13/23	2	2/13/23	2/13/23	2/27/23	
CE								7Q84	Corona_1	483.00	0.00	CDG	Y	Inverter	2/9/23	2/13/23	2	2/13/23	2/13/23	2/27/23	
CE								2X28	Bruckner	724.50	0.00	CDG	Y	Inverter	2/9/23	2/15/23	4	2/15/23	2/15/23	3/2/23	
CE								2X28	Bruckner	724.50	0.00	CDG	Y	Inverter	2/9/23	2/15/23	4	2/15/23	2/15/23	3/2/23	
CE								6Q84	Glendale	12.00	4896.00	RC	Y	Inverter	2/9/23	2/14/23	3	2/14/23	2/14/23	2/21/23	
CE								1895	Plymouth_St	724.50	0.00	CDG	Y	Inverter	2/8/23	2/9/23	1	2/24/23	2/24/23	2/24/23	
CE			CE					9B02	Brownsville_2	166.50	0.00	NM	N	Inverter	2/8/23	2/12/23	2	2/12/23	2/12/23	2/15/23	
CE	NineDot Energy, LLC	LDG-04042	CENY-BK	Brooklyn	Kings	11203	J	7B08	Bensonhurst_2	12.00	4896.00	RC	Y	Inverter	2/7/23	2/10/23	3	2/10/23	2/10/23	2/15/23	

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Public Queue Reporting

Simplified queue reporting spreadsheet

Project Details	Circuit & Substation	Data of Submittal	Current Step in The Process	Study & App. Costs	Upgrade Costs
Project A – 10 kW	Cir. 18-223 Hawking Sub.	1/20/2023	Complete - PTO	$300	$0.00
Project B – 500 kW	Cir. 55-323 Curie Sub.	1/21/2023	Facility Study	$5,000	$15,000
Project C – 5 kW	Cir. 55-323 Curie Sub.	3/2/2023	Complete - PTO	$300	$0.00
Project D – 3 MW	Cir. 18-223 Hawking Sub.	3/2/2023	Withdrawn	$25,000	$4,215,000
Project E – 100 kW	Cir. 18-223 Hawking Sub.	6/15/2023	Application Review	$5,000	N/A

Public Queue Reporting

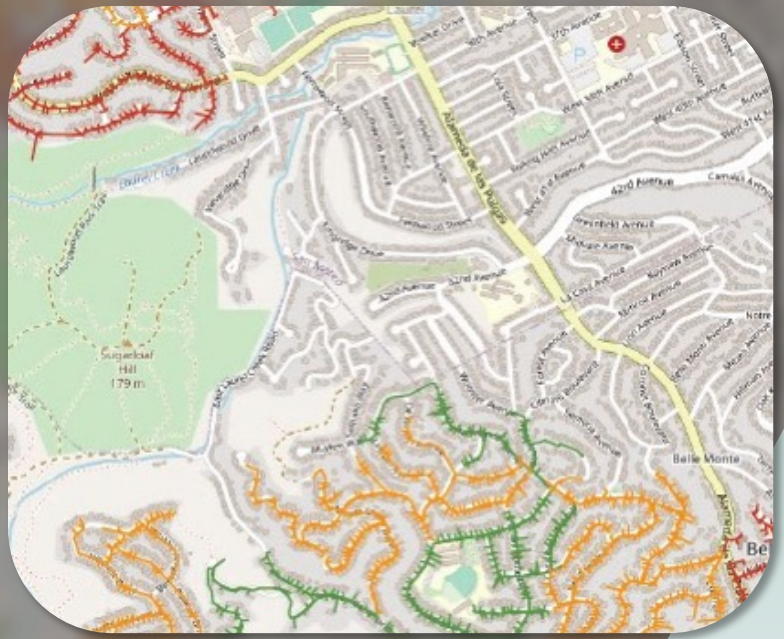
What sorts of questions do queue reports help answer?

- **Developers –** How many projects are queued before mine and do they tell me anything about the costs that my project may incur?
  - *Have any of these projects triggered expensive upgrades?*
  - *Could these upgrades be required for my project if they withdrew?*
- **Utilities –** Where can queue processing improvements be made or other prospecting tools be improved to better direct projects?
- **Regulators –** Is the interconnection process working as intended and are rule revisions needed to improve it?
  - *Are utilities fulfilling their processing timeline obligations?*
  - *What is the average process duration of 10-500 kW projects?*
  - *What are the average upgrade costs for 2+ MW projects?*

Basic Distribution System Maps

Overview

- Map of distribution system assets and feeder lines
- Typically includes pop-up boxes that display grid data



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Basic Distribution System Maps

Examples of Requested Data

Substation Data

- Name or identification number
- Voltages
- Substation transformers nameplate rating
- Existing Generation (weekly refresh rate)
- Queued Generation (weekly refresh rate)
- Total Generation (weekly refresh rate)
- 8760 Load profile by substation and transformer
- Percentage of residential, commercial, industrial customers
- Currently scheduled upgrades
- Has protection and/or regulation been upgraded for reverse flow (yes/no)
- Number of substation transformers and whether a bus-tie exists
- Notes (include any other relevant information to help guide interconnection applicants, including electrical restrictions, known constraints, etc.)

Feeder Data

- Name or identification number
- Which substation the feeder connects to
- Feeder voltage
- Number of phases
- Which substation transformer the feeder connects to
- Feeder type: radial, network, spot, mesh etc.
- Feeder length
- Feeder conductor size and impedance
- Service Transformer rating
- Service Transformer daytime minimum load
- Existing Generation (weekly refresh rate)
- Queued Generation (weekly refresh rate)
- Total Generation (weekly refresh rate)
- 8760 Load profile
- Percentage of residential, commercial, industrial customers
- Currently scheduled upgrades
- Federal or state jurisdiction
- Known transmission constraint requires study
- Notes (other relevant information to help guide interconnection applicants)

Basic Distribution System Maps

What sorts of questions do these maps help answer?

- **Developers** – Where else can I site my project to avoid high upgrade costs caused by major grid constraints?
  - *How far is my project from the substation?*
  - *What other circuits are in the area that may be more suitable for interconnection?*
  - *Can I find land nearby that would be better for interconnection?*
- **Utilities –** Can we inform applicants where exactly they should avoid submitting projects after determining constraints through studies?
- **Regulators –** Can we better monitor interconnection rules or understand distribution planning needs with infrastructure maps?

Hosting Capacity Analysis (HCA)

Overview

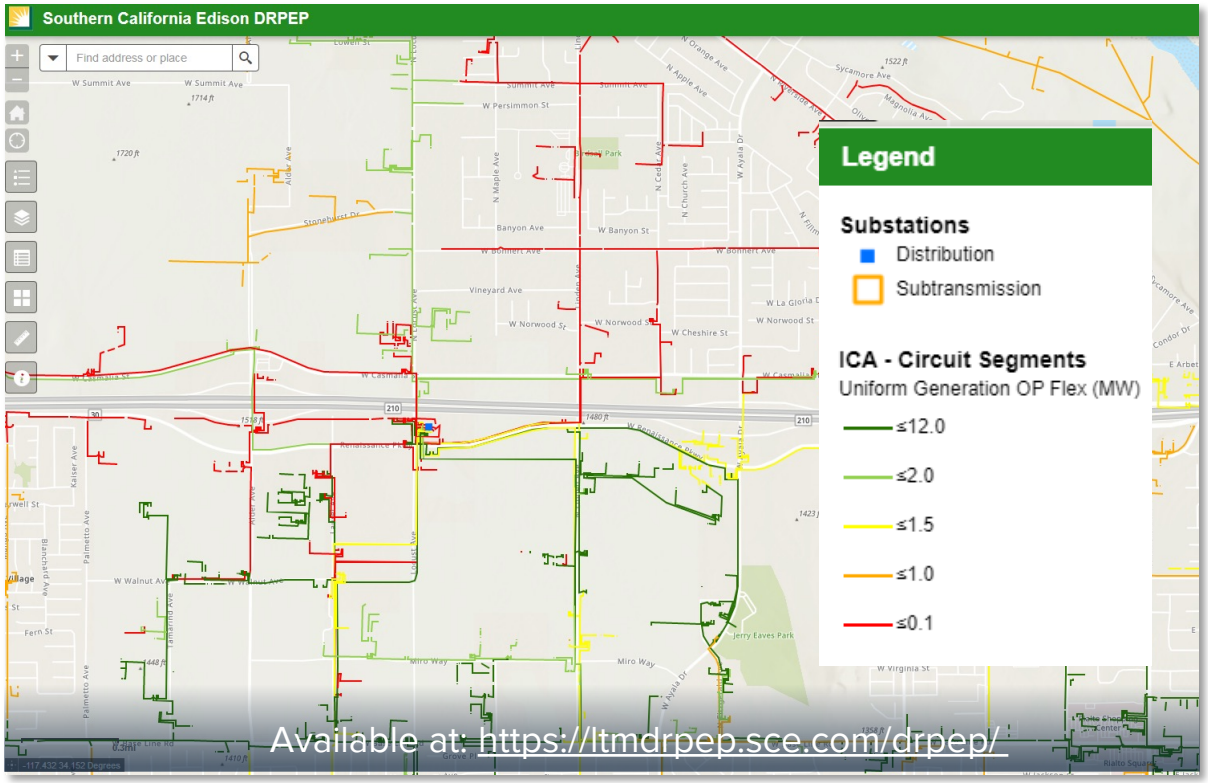
A hosting capacity analysis (HCA) is a grid transparency tool that provides an assessment of the ability of a distribution grid to host additional distributed energy resources (DERs) at specific locations, without the need for costly upgrades or lengthy interconnection studies.

For more information, visit our hosting capacity webpage at...

https://irecusa.org/our-work/hosting-capacity-analysis/

Hosting Capacity Analysis (HCA)

Example from Southern California Edison



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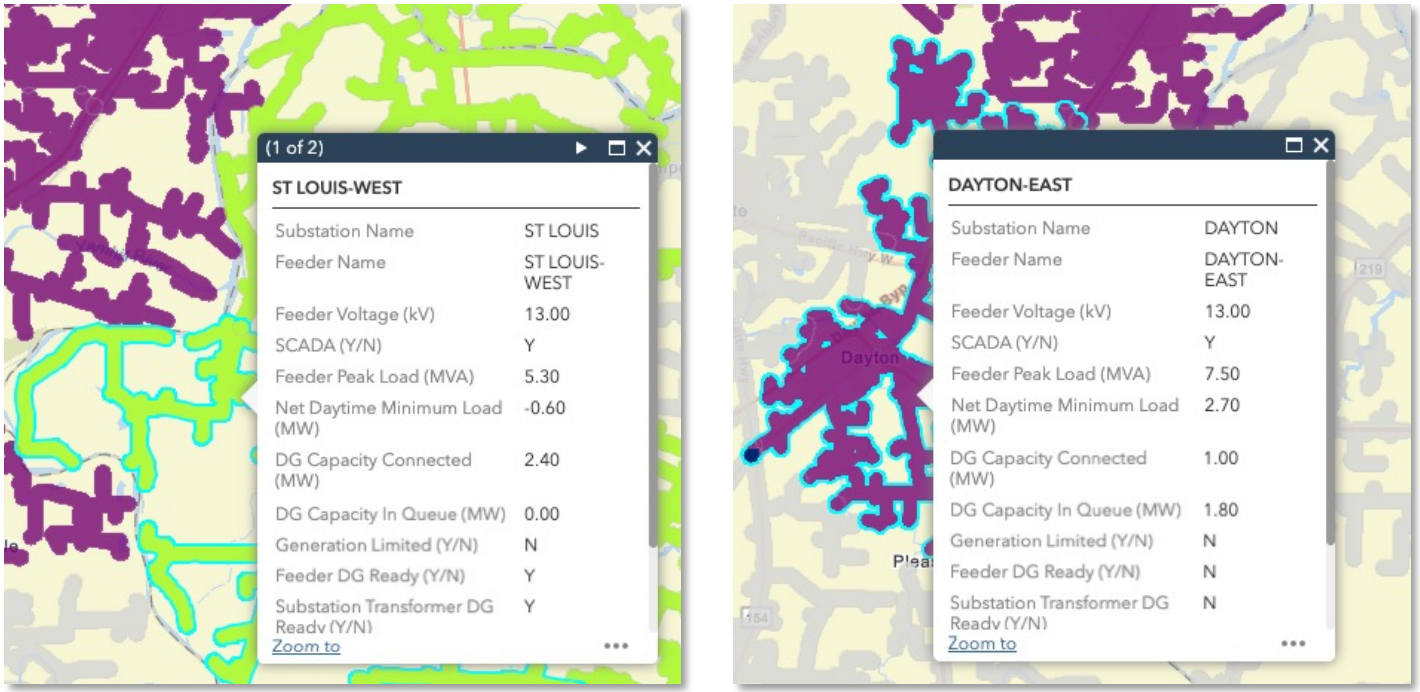
Hosting Capacity Analysis (HCA)

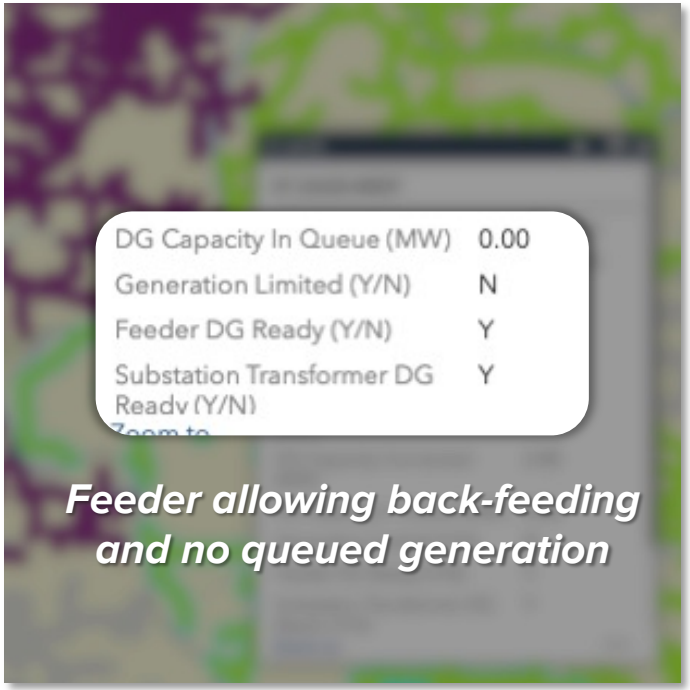
Example of early siting flexibility enabled by HCA

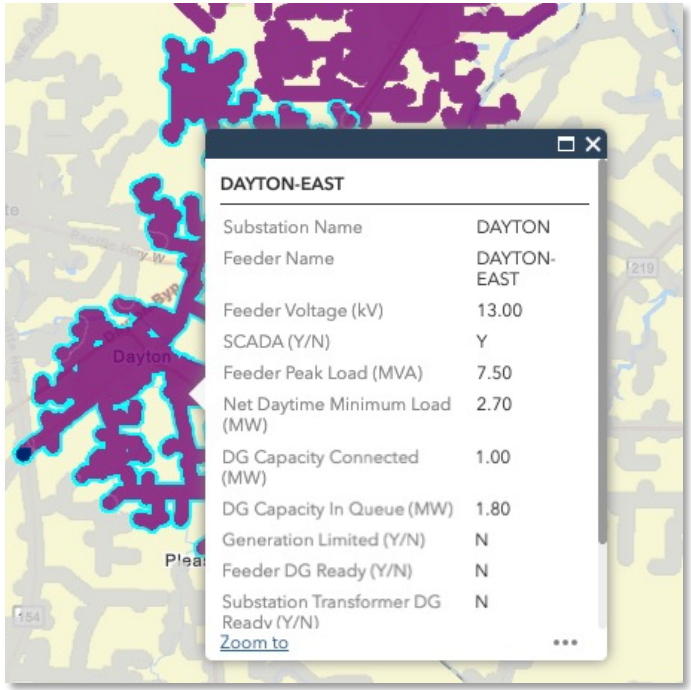


Source: Portland General Electric Distributed Generation Evaluation Map

Hosting Capacity Analysis (HCA)

Siting flexibility enabled with HCA from Portland General Electric

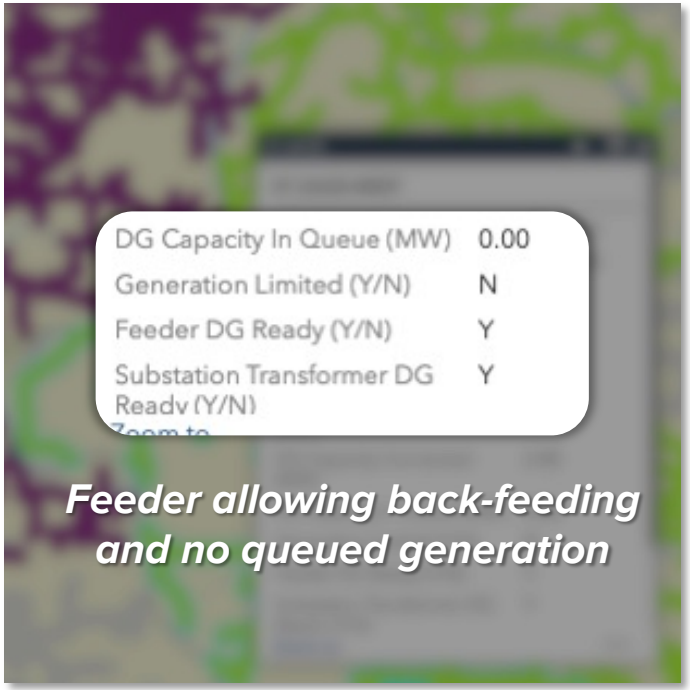


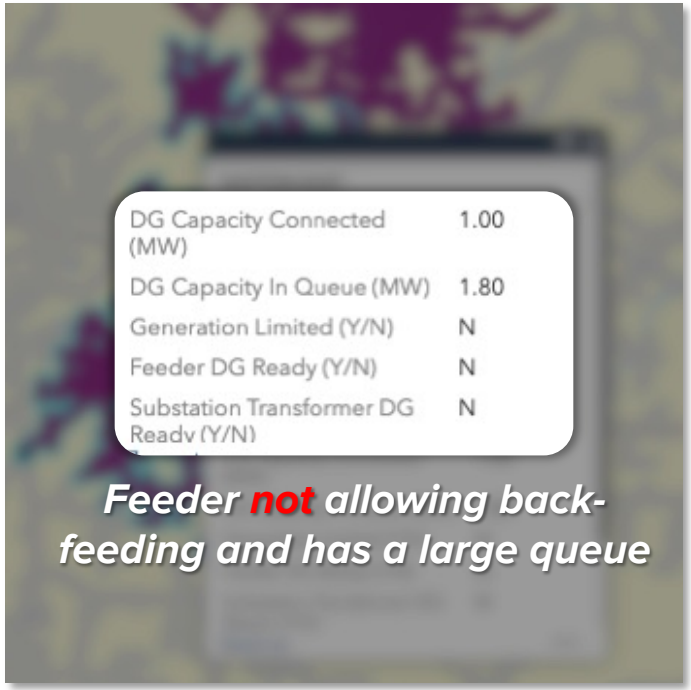


Source: Portland General Electric Distributed Generation Evaluation Map

Hosting Capacity Analysis (HCA)

Siting flexibility enabled with HCA from Portland General Electric





Source: Portland General Electric Distributed Generation Evaluation Map

Hosting Capacity Analysis (HCA)

What sorts of questions do HCA maps help answer?

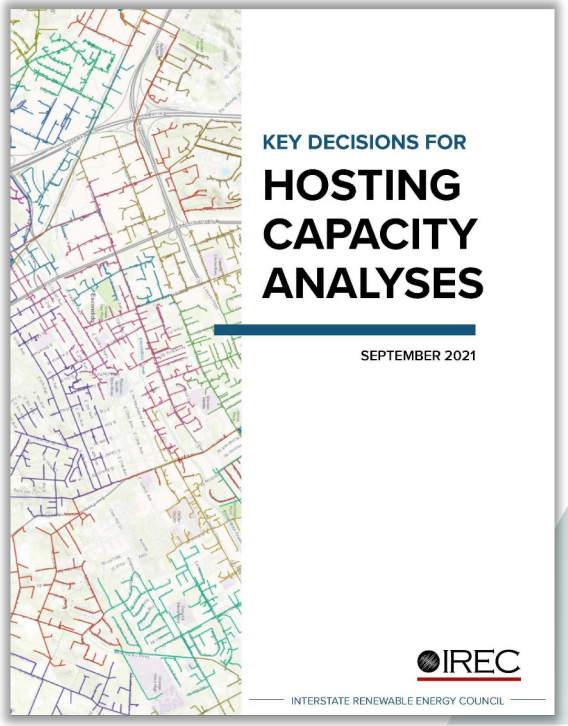
- **Developers:** What grid locations have the capacity for my project thus likely do not require long studies or major grid upgrades?
- **Utilities**: What kinds of grid constraints are limiting hosting capacity?
  - *Are there system-wide constraints to future electrification or DER policies?*
  - *Can we proactively address these insufficiencies with upgrades through our distribution planning process?*
- **Regulators**: Does the grid in our state have sufficient capacity to support our renewable energy adoption or electrification goals?

Hosting Capacity Analysis (HCA)

IREC Report: *Key Decisions for Hosting Capacity Analysis*

Outlines the key decisions that need to be made to adopt a grid mapping tool that can help utilities and states better integrate clean energy technologies on the electric grid—based on IREC's hosting capacity work around the nation

Download at: https://irecusa.org/resources/key-decisions-for-hosting-capacity-analyses/



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Prospecting Tool Considerations

Photo by Werner Slocum/NREL 66342

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Comparing Prospecting Tools

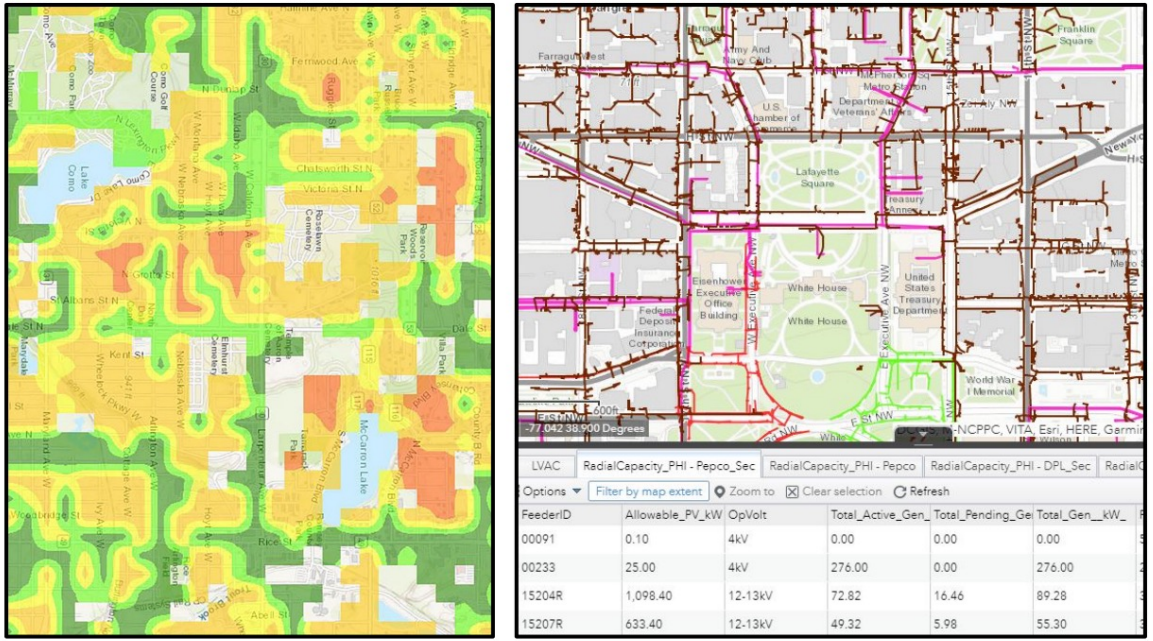
Key considerations when developing or regulating for prospecting tools

Tool	Availability Today	Customer Cost	Utility Effort	Ease of Access
Pre-Application Reports	Widely available	Fee	Respond to requests	Request for each site
Distribution System Data Portals	Numerous states	None	Develop datasets & post to website	System-wide datasets available for download
Public Queue Reporting	Numerous states	None	Develop & regularly refresh datasets posted to website	System-wide datasets available for download
Basic Distribution System Maps	Numerous states	None	Integrate datasets with GIS & publish map	Publicly accessible map
Hosting Capacity Analyses	Several states	None	Extensive effort to analyze data and publish results	Detailed data available via map & data portal

Enabling Energy Storage Development

Higher resolution prospecting tools and energy storage

- Usefulness depends on data resolution
- More granular data enables better energy storage system design



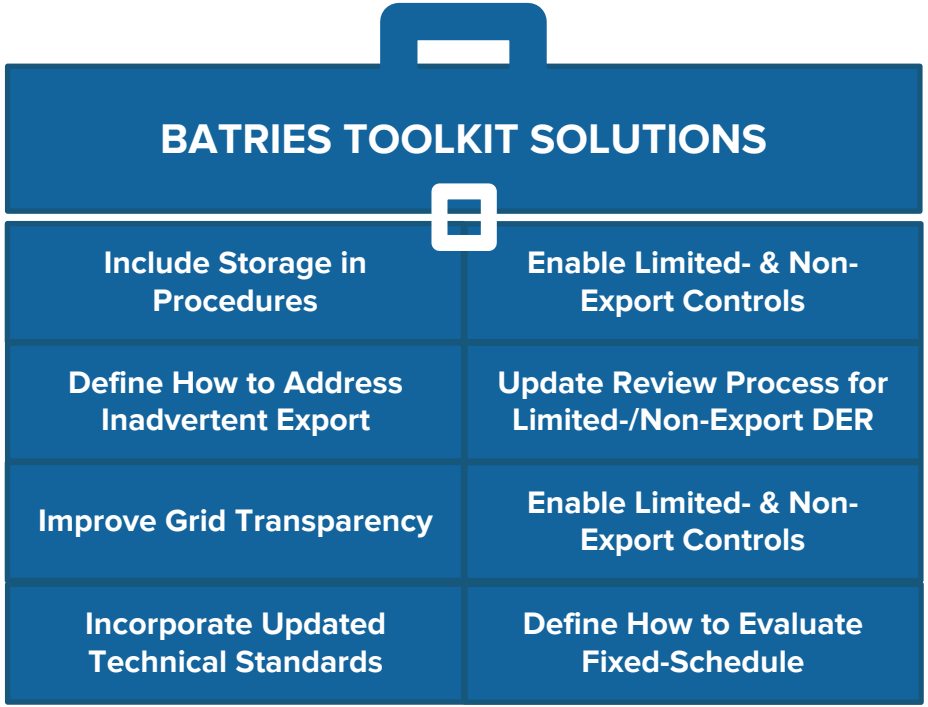
Left: HCA Map with Blurred Distribution Lines from Xcel Energy's HCA | *Source: Xcel Energy, Minnesota*
Right: HCA Map Showing Precise Distribution Line Location | *Source: Pepco, Washington, DC*

IREC

Enabling Energy Storage Development

BATRIES: *Building a Technically Reliable Interconnection Evolution for Storage*

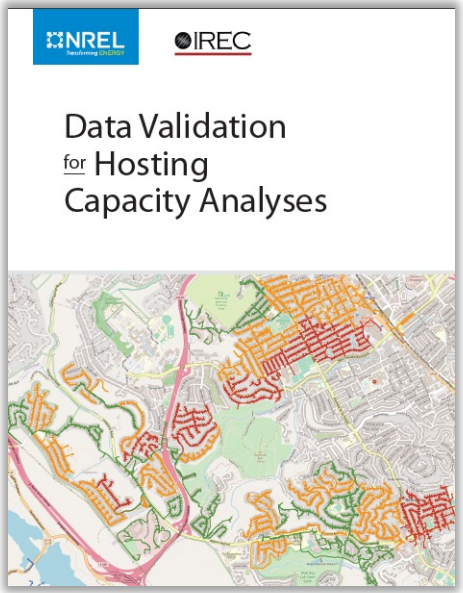
- **Easy to integrate** that includes recommended model regulatory language
- Builds off of **FERC SGIP**
- Toolkit adoption can help **increase energy storage market penetration** by preemptively addressing interconnection barriers



IREC

Importance of Data Validation

***IREC/NREL Report**: Data Validation for Hosting Capacity Analyses*



Read the full report at
https://bit.ly/HCAValidation

HCA Data Validation requires attention to five key areas:

- Business Processes
- Quality Control During the Model Development Process
- Validating Results Before Publication
- Feedback from Customers and Users
- Regulatory Oversight

Integrating Equity & Justice Tenets

Recognitional

Procedural

Distributional

Integrating Equity & Justice Tenets

Recognitional

- Have we engaged with all relevant stakeholders?
- Are we meeting stakeholders where they are at?
- Who has been historically left out of these discussions?
- Do communities feel that they have a voice at the table?

Integrating Equity & Justice Tenets

Procedural

- How accessible are our available engagement methods?
- How are we elevating the voices of the marginalized?
- How are we lowering proceeding participatory barriers?
- Are we monitoring progress toward procedural justice?

Integrating Equity & Justice Tenets

Distributional

- Who are the primary beneficiaries of the tools we create?
- How do we ensure these benefits are equally distributed?
- What prospecting challenges can we help overcome?
- Are the cost and value created equally distributed?

Thank You!

If you have any questions, contact:

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