

DRIVE and PowerClerk Interface Tool to Expedite DER Interconnection Screening Process

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Agenda

- Motivation
- PowerClerk – Clean Power Research
- DRIVE – EPRI
- Hosting Capacity
- Example Process

- The number of interconnection applications continues to rise
- Fast-track screening methods (15% rule) can be conservative or inaccurate
- Detailed impact studies require valuable time and resources

Project Task: Develop a platform to interface CPR's PowerClerk and EPRI's DRIVE tools to expedite the DER Interconnection screening process.

DOE RFP Objective: Reduce processing time to less than 1 week and cost to less than \$1000 per application

Interconnection Application Management

- Homegrown or Commercial Product
- Public facing (web based/accessable)
- Inform developers
- Accommodate DER portfolios
- Integrate planning and billing tools
- Automate screening practices
- Access application data





Automating energy programs covering a broad range of DERs

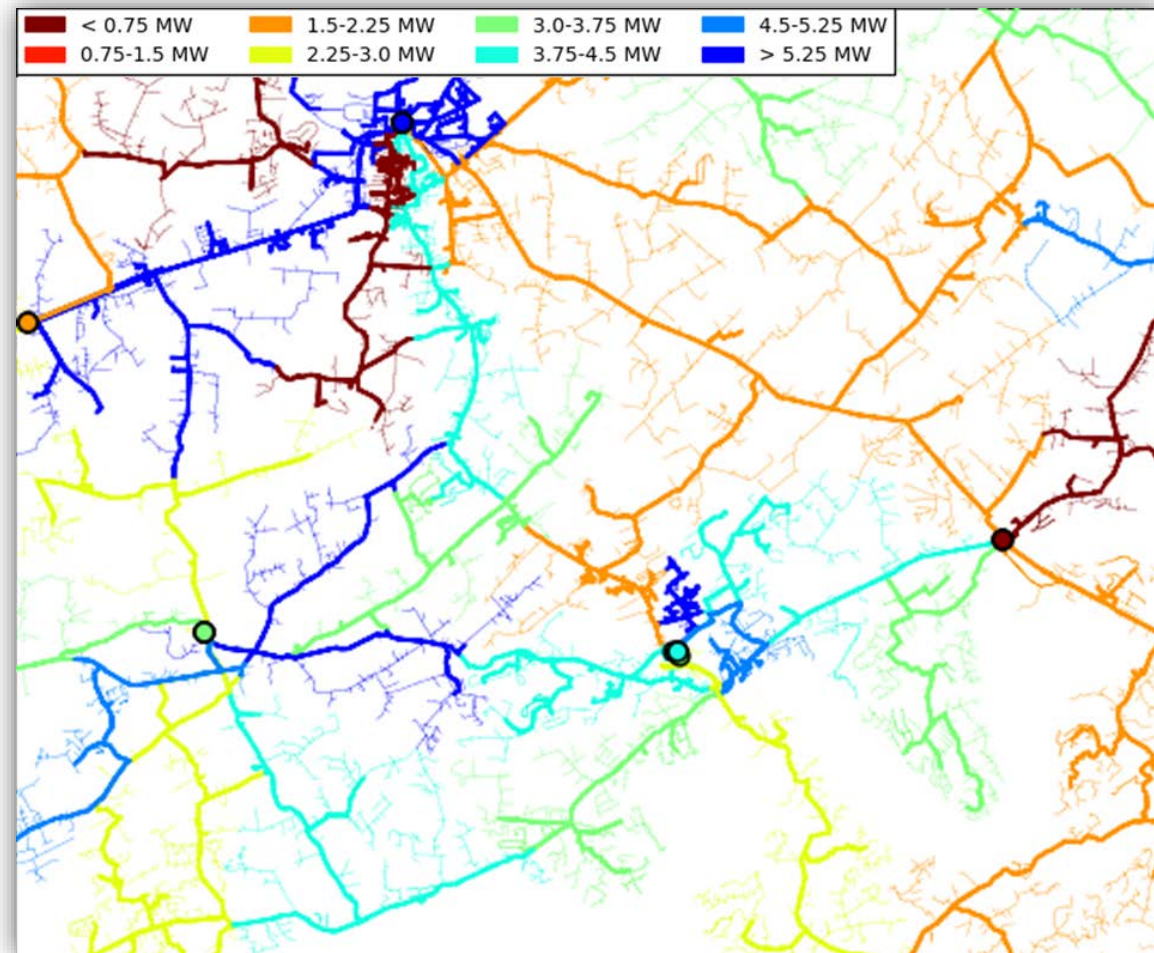
- Over 40 electric utilities managing DER interconnection and incentives
- Enterprise-grade platform providing:
 - Flexible end-to-end form-driven workflow
 - Data accessibility
 - Integration across existing systems

EPRI partnered with Clean Power Research for the DOE SHINES project, but the process is applicable to any Interconnection Application Management system

Primary Functionality of DRIVE

- Calculating hosting capacity

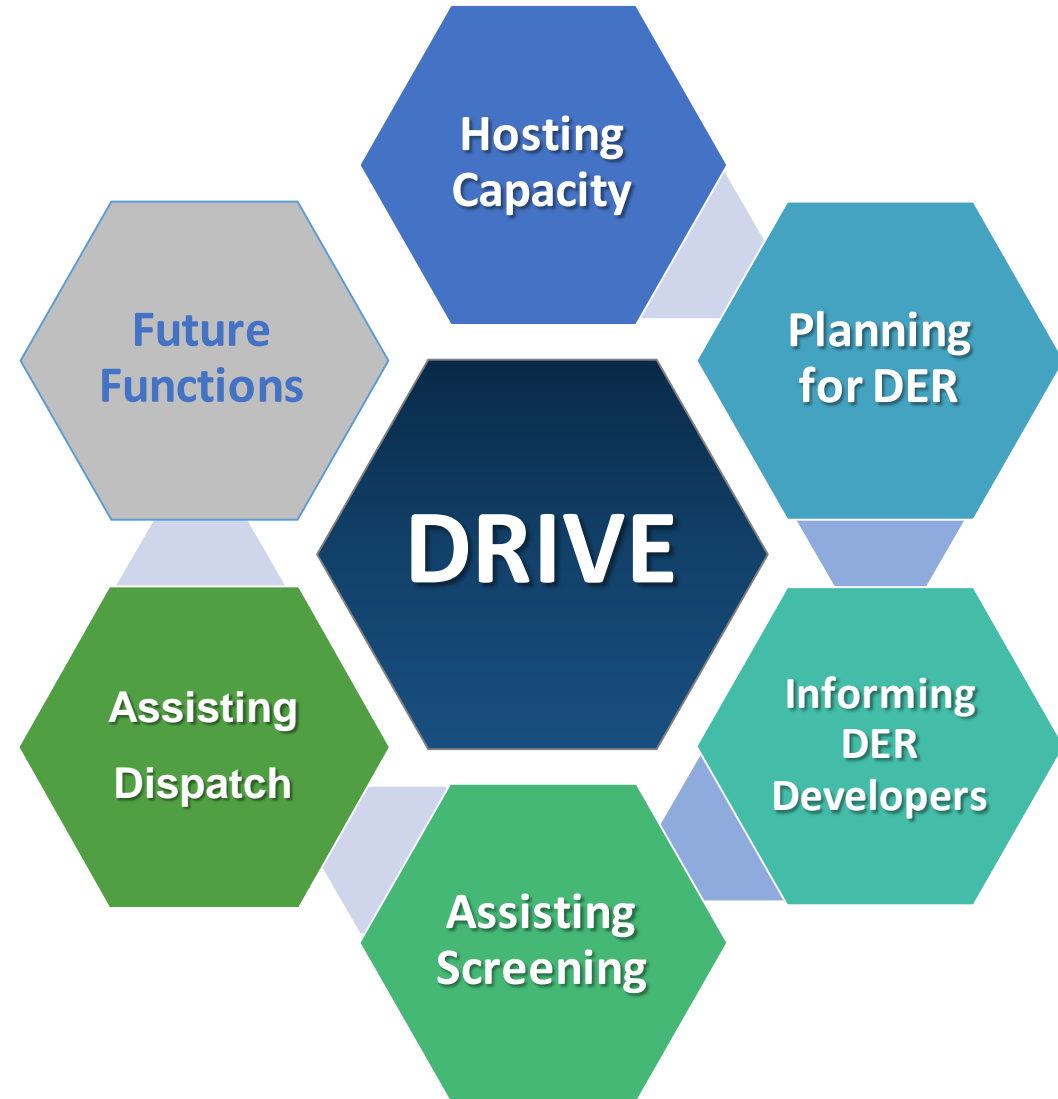
Hosting Capacity is the amount of DER that can be **accommodated** without adversely impacting power quality or reliability under current configurations and **without requiring infrastructure upgrades**.



Applications of DRIVE

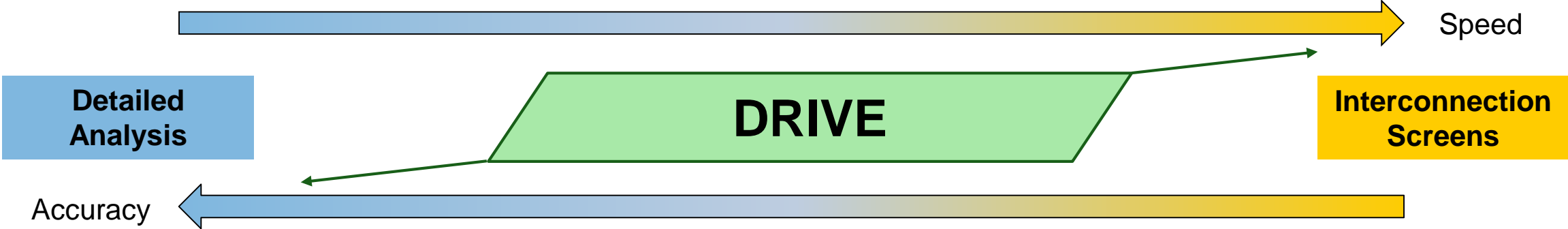
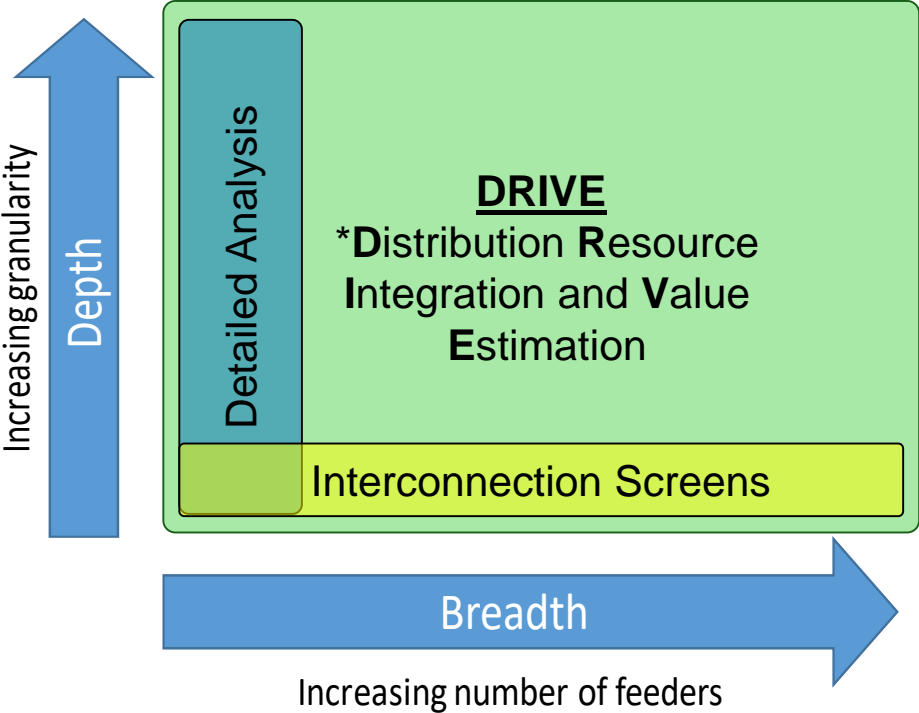
Hosting Capacity:

- Enable DER planning
- Inform developers
- Assist interconnection screening
- Assist operational dispatch



Bridging the Gap in Distribution Planning

- **Detailed Analysis** – use of power system analysis software to understand DG and solar impacts based on stochastic analysis (extensive model-based analysis)
- **Interconnection Screens** – such as in FERC SGIP fast-track screening or in CA rule 21 screening procedures (limited model-based analysis)



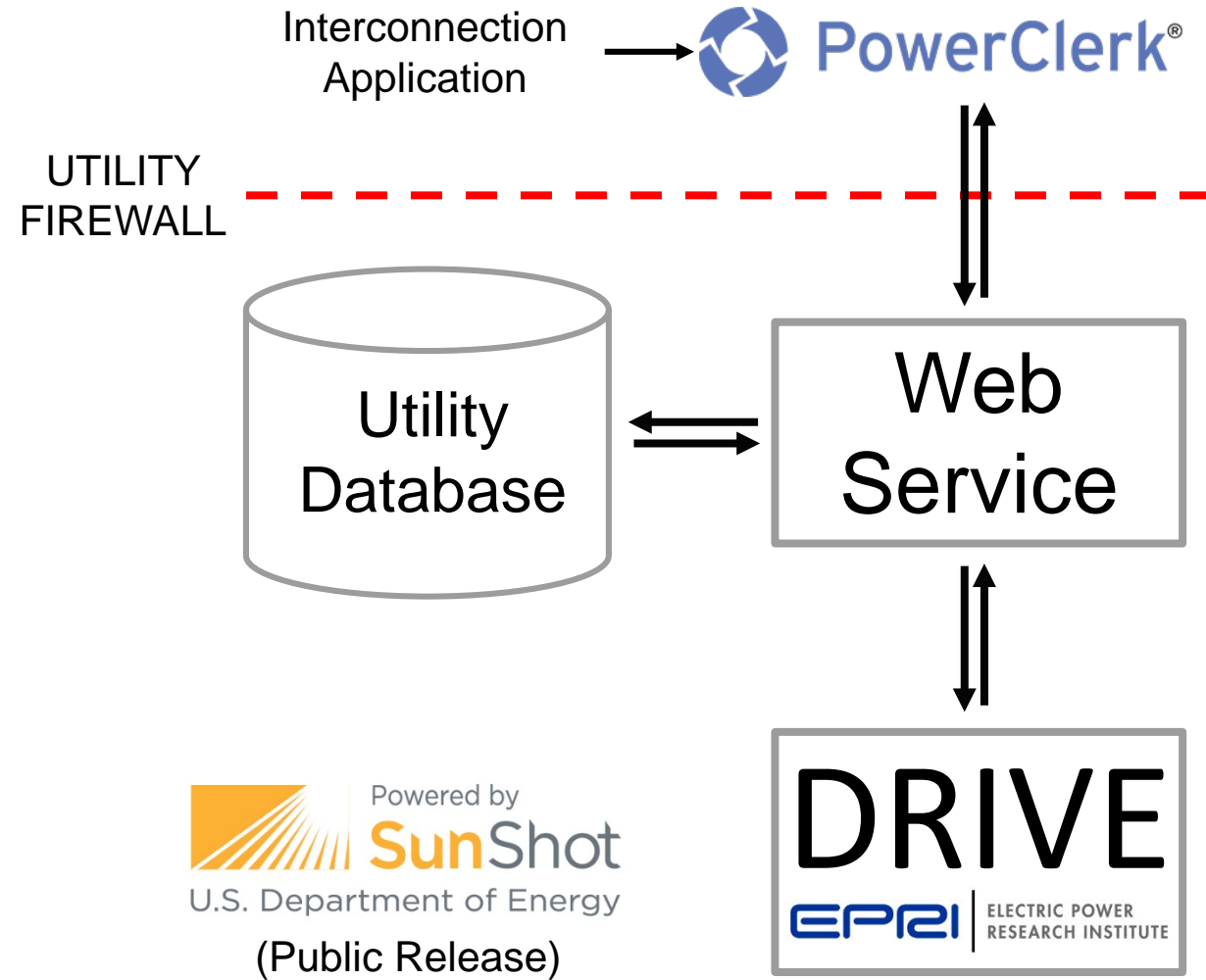
Automated Interconnection Screening with DRIVE

Manage Interconnection Applications

Automate Analysis

Leverage Existing Methods and Data

Decrease Time and Cost of Processing



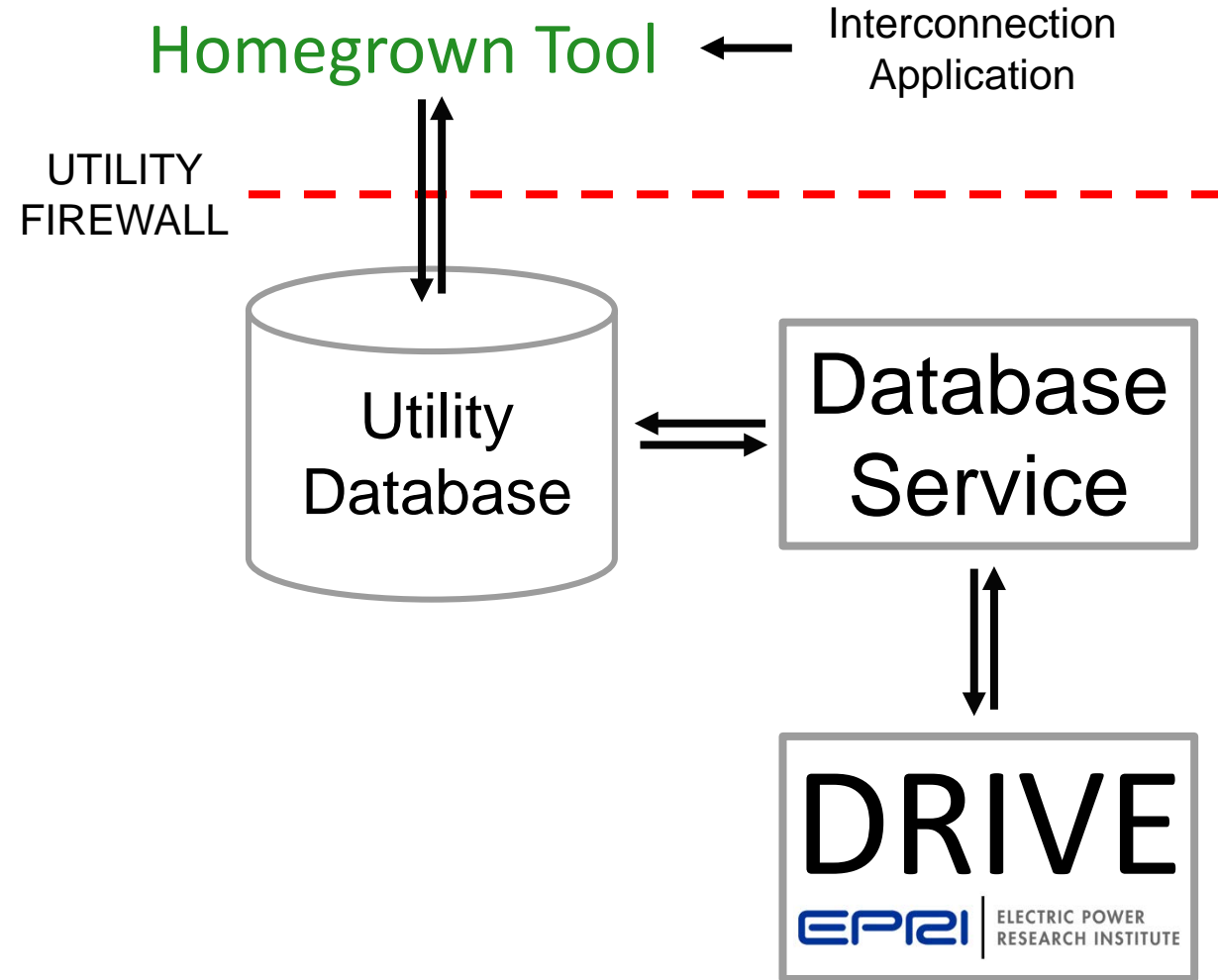
Automated Interconnection Screening with DRIVE

Manage Interconnection Applications

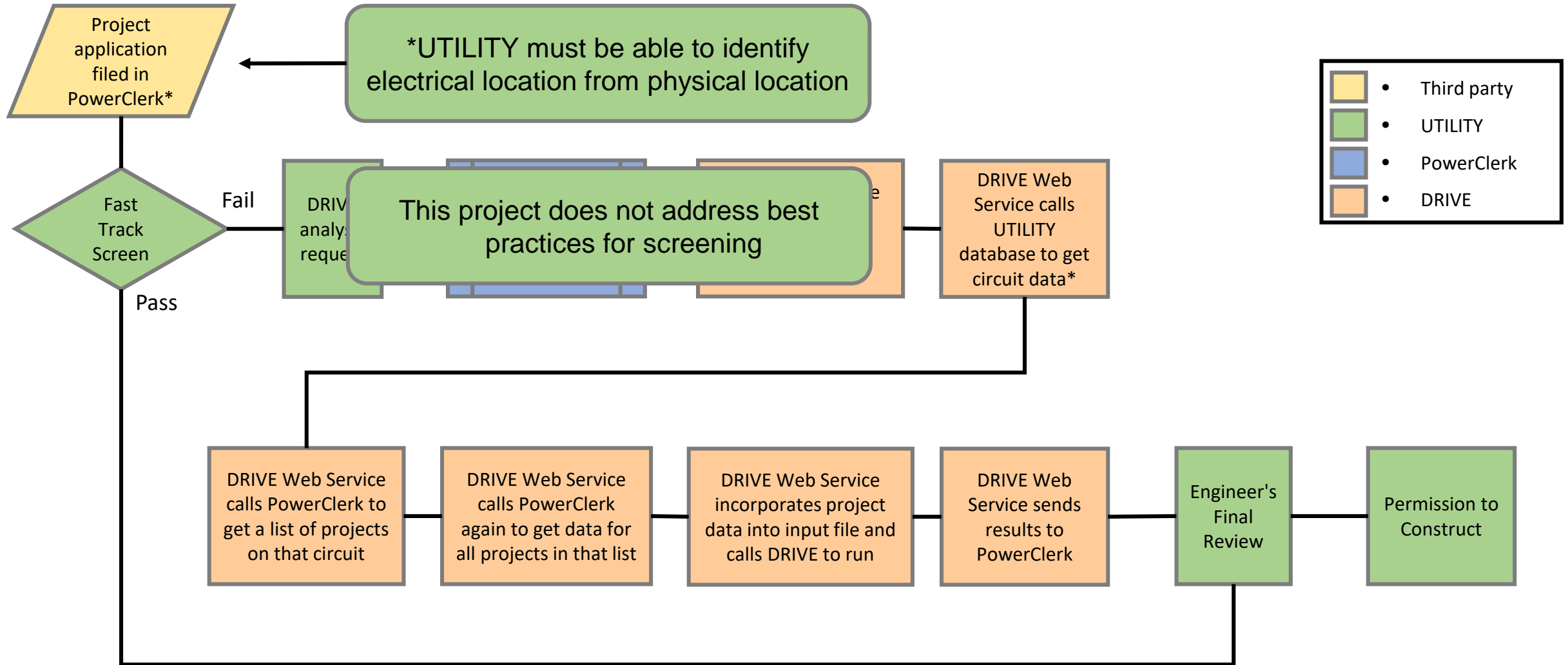
Automate Analysis

Leverage Existing Methods and Data

Decrease Time and Cost of Processing

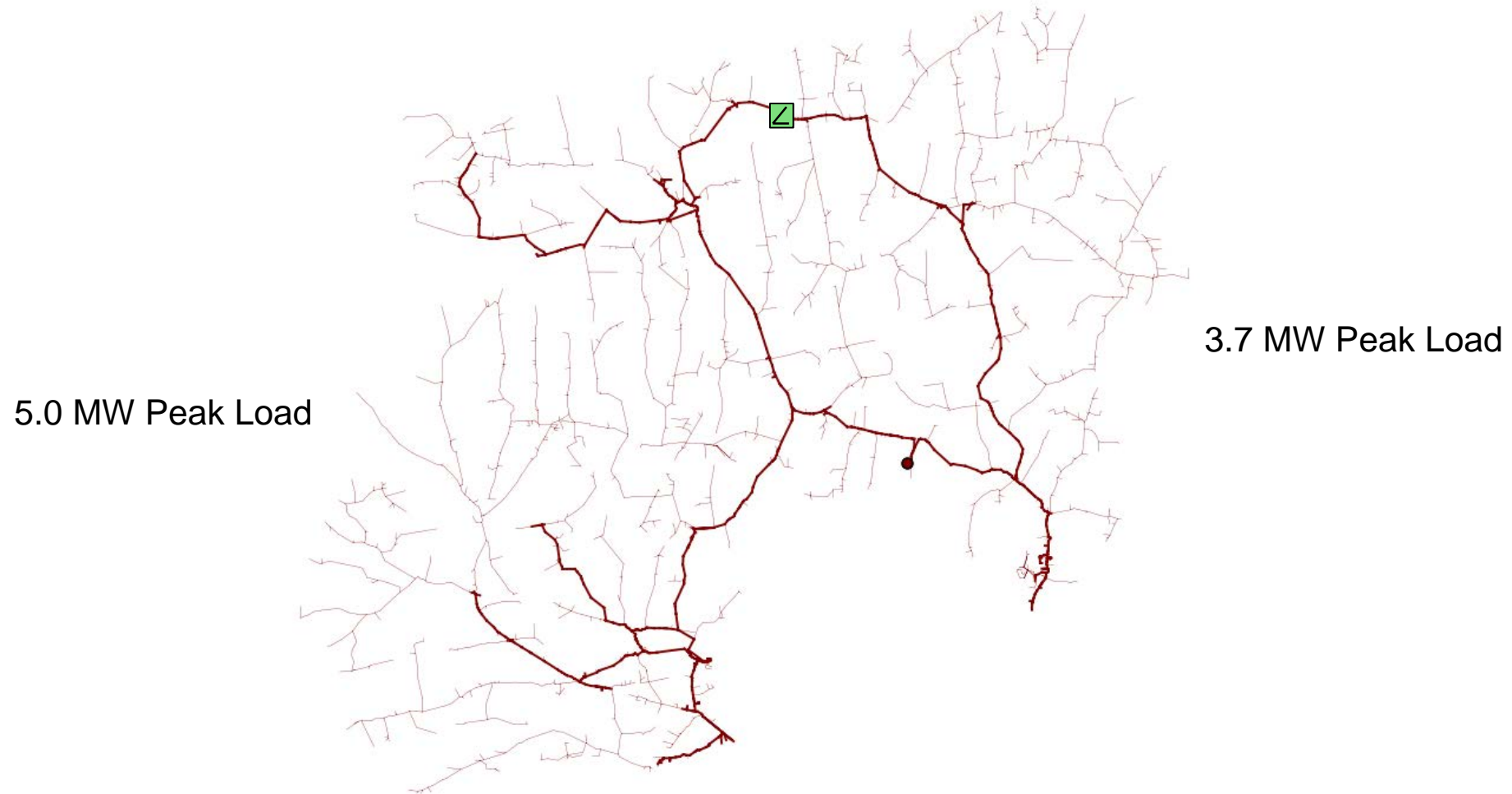


Automated Interconnection Screening DRIVE



Example Application Screening

Two 13.2 kV distribution feeders



Example with 13.2 kV Test Circuits

Step 1: An interconnection application is filed

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

PowerClerk®
Welcome, Nicholas Heine | Log out

HOME PROGRAM DESIGN ADMIN SETTINGS SUPPORT

DG Interconnection Application

Service Location Lookup Type *
Street Address ▾

Customer/Facility Information

Name
Test Demo

Company
Company

Address *
123 Test Ave

City ▾ Zip Code

Email
Email Address

Phone
Phone Number

DG Energy Source *
SOLAR ▾

Must be able to map physical location or account number to a circuit and node

Example with 13.2 kV Test Circuits

A utility administrator flags the project for review with DRIVE

The screenshot displays the PowerClerk web application interface. At the top left is the EPRI logo (Electric Power Research Institute). At the top right is the PowerClerk logo and a user welcome message: "Welcome, Nicholas Heine | Log out". Below the logo is a navigation bar with links for HOME, PROGRAM DESIGN, ADMIN, SETTINGS, and SUPPORT. The main content area shows the user's role as "Admin: EPRI-00004" with a "Go To View/Edit" button. To the right is a search field "Go to EPRI-" with a "Go" button. The "Current Status" section is highlighted with a blue border and contains a dropdown menu set to "DRIVE Analysis Requested", with "Save" and "Cancel" buttons. Below this are sections for "Project Notes" (with an "Add Note" button), "Attachments" (with an "Add attachment" button), and "Communications" (with a "Communications History" table showing "No sent communications").

Example with 13.2 kV Test Circuits

DRIVE Web Service finds the project in the Analysis Queue

The screenshot displays the PowerClerk web application interface. At the top, the EPRRI logo and 'ELECTRIC POWER RESEARCH INSTITUTE' are on the left, and the PowerClerk logo with 'Welcome, Nicholas Heine | Log Out' is on the right. A navigation bar contains 'HOME', 'PROGRAM DESIGN', 'ADMIN', 'SETTINGS', and 'SUPPORT'. Below this, the page title is 'ELECTRIC POWER RESEARCH INSTITUTE - INTERCONNECTION - GREATER THAN 50 KW' with a 'Change Program' link. Two buttons are present: 'New Pre-Application Report Request' and 'New Interconnection Application >50kW'. A filter menu shows 'All Projects', 'Cancelled/Withdrawn', 'Applications Review Queue', 'Completed Projects', and 'Supplemental Review Queue'. The 'DRIVE Analysis Queue' is selected and highlighted. A search bar is located above the table. The table has the following columns: Queue Position, Project #, Developer, Current Status, Current Status Timestamp, Account Number, Host Customer First, Host Customer Last, Customer/Facility Line 1, Host Customer Zip Code, Total Generator Nameplate Capacity (AC-kW), and Assignee. One project is listed in the queue.

Queue Position	Project #	Developer	Current Status	Current Status Timestamp	Account Number	Host Customer First	Host Customer Last	Customer/Facility Line 1	Host Customer Zip Code	Total Generator Nameplate Capacity (AC-kW)	Assignee
1	EPRI-00004		DRIVE Analysis Requested	01/29/2018		Test	Demo	123 Test Ave	37914	60	[No Assignee]

Example with 13.2 kV Test Circuits

Web Service requests the project data with PowerClerk API method

Web Service
will get DRIVE
files for the
identified Circuit

Field
Project ID
Customer ID
Status ID
Transformer
<u>Circuit</u>
Segment
Annual kWh usage
DG Energy Source (biogas, CHP, fuel cells, hydro, solar, or other)
Generator Type (Inverter, induction, synchronous)
Total Generator Nameplate (kW-AC)
PV System, if energy source is solar
Generator connection (Delta, Wye, or wye grounded)
Phase (Single-phase or three-phase)
New or addition

Example with 13.2 kV Test Circuits

Web Service requests other same-circuit projects and data

Same-circuit projects can have a variety of statuses, including: under review, permission to construct, permission to operate, etc. with time stamp prior to current project

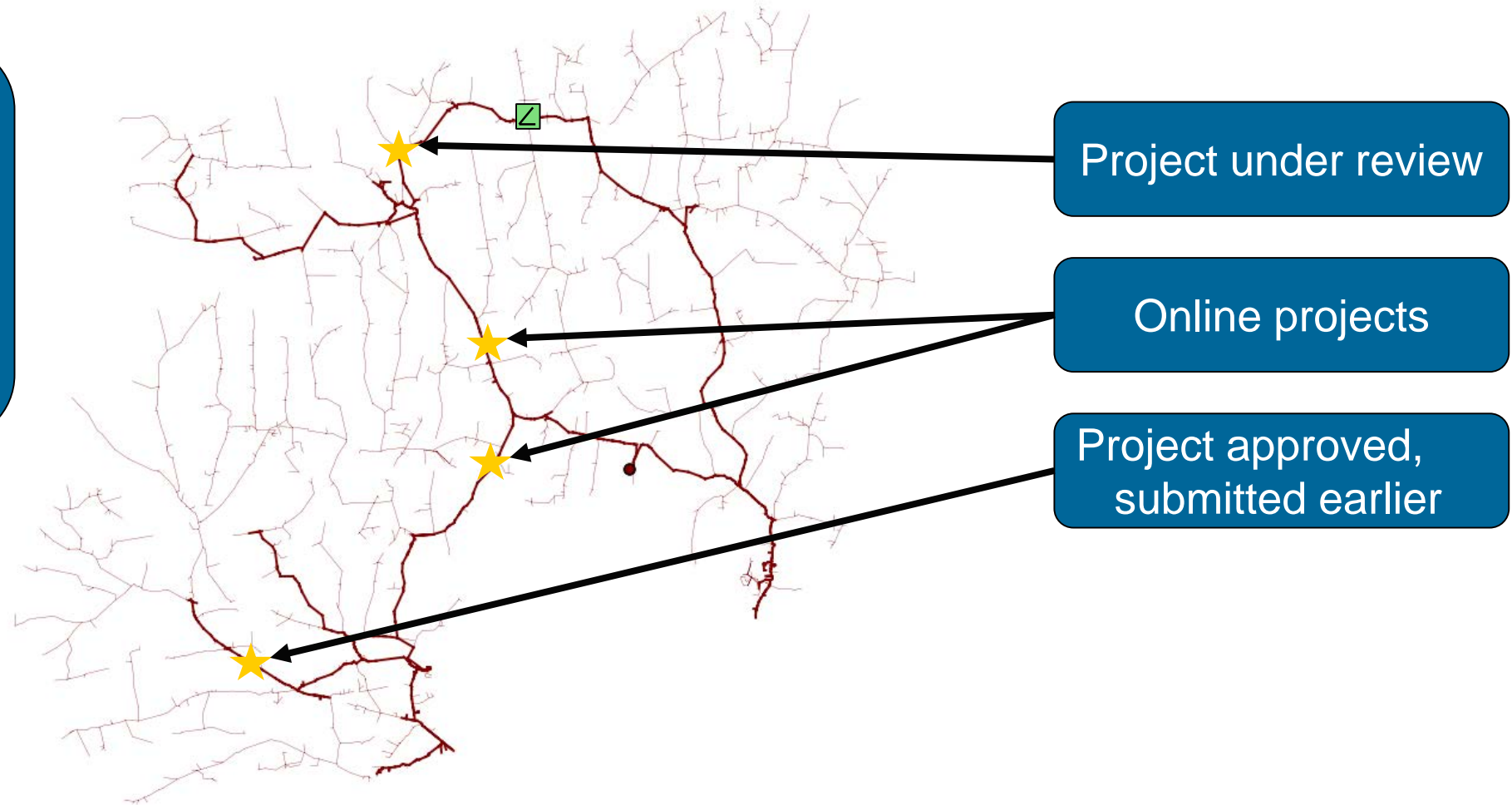
Web Service incorporates pertinent project data into DRIVE input files

Field	Field	Field	Field
Pr	Field		
Cu	Pr	Field	
Sta	Cus	Pr	Field
Tr	Sta	Cus	Project ID
Cir	Tr	Sta	Customer ID
Se	Cir	Tr	<u>Status ID</u>
An	Seg	Cir	<u>Transformer</u>
DC	An	Seg	Circuit
Ge	DG	An	<u>Segment</u>
To	Ge	DG	Annual kWh usage
PV	Tot	Ge	<u>DG Energy Source (biogas, CHP, fuel cells, hydro, solar, or other)</u>
Ge	PV	Tot	Generator Type (Inverter, induction, synchronous)
Ph	Ge	PV	<u>Total Generator Nameplate (kW-AC)</u>
Ne	Ph	Ge	PV System, if energy source is solar
Ne	Ph	Ge	Generator connection (Delta, Wye, or wye grounded)
Ne	Ph	Ge	Phase (Single-phase or three-phase)
			New or addition

Example with 13.2 kV Test Circuits

Web Service executes hosting capacity analysis for project under review

The project under review and all other same-circuit projects are incorporated into DRIVE input files and considered 'Existing DERs' in the analysis

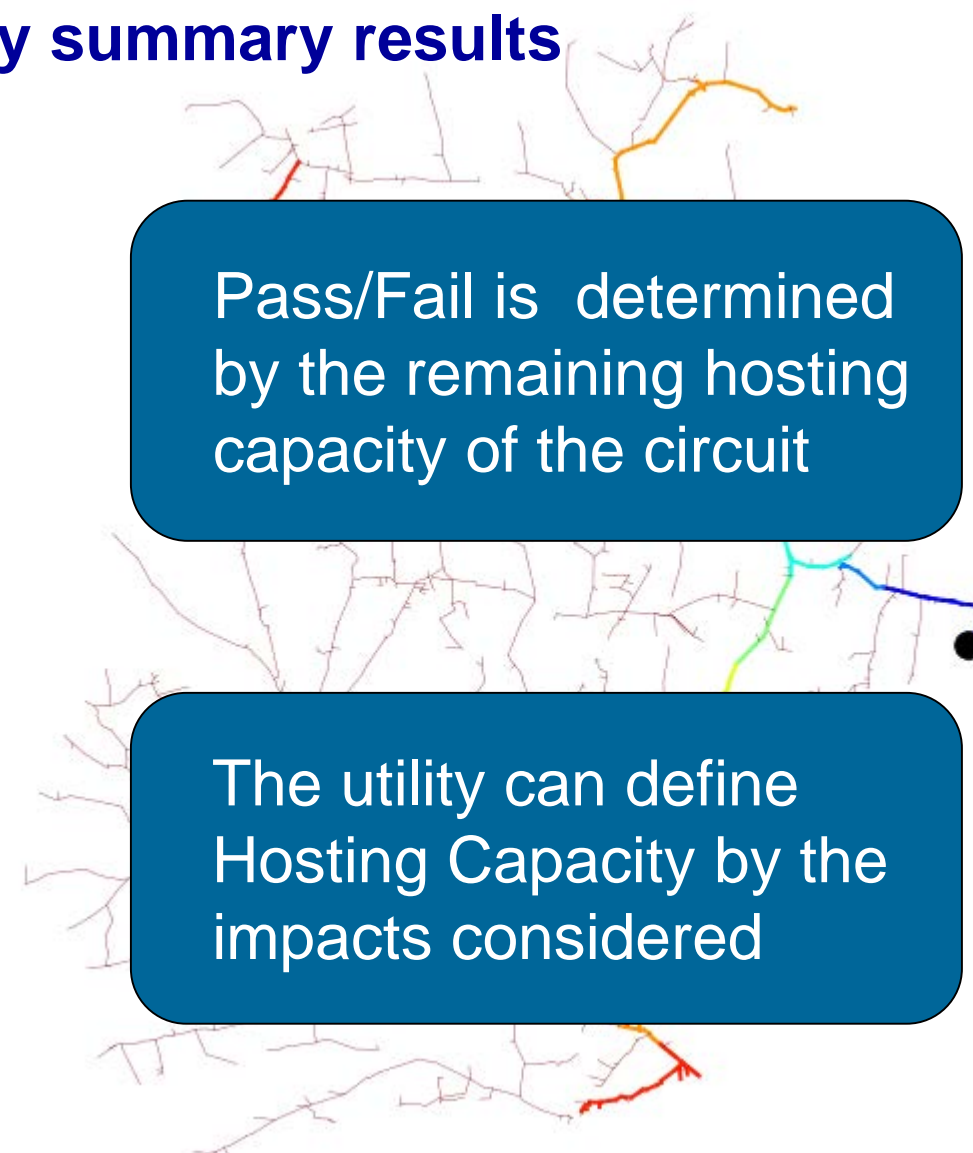


Example with 13.2 kV Test Circuits

Web Service interprets hosting capacity summary results

Impacts Considered

- Voltage
 - Primary overvoltage
 - Primary voltage change
 - LTC/Regulator tapping
- Thermal
 - Feeder Level
 - Substation Level
- Protection
 - Element fault current
 - Breaker relay reduction of reach
 - Sympathetic breaker relay tripping
 - Reverse power flow
 - Unintentional islanding
 - 3V0
 - Operational Flexibility



Pass/Fail is determined by the remaining hosting capacity of the circuit

The utility can define Hosting Capacity by the impacts considered

Example with 13.2 kV Test Circuits

Web Service submits DRIVE results with PowerClerk API method

The screenshot displays the PowerClerk web application interface. At the top, the EPRI logo and 'ELECTRIC POWER RESEARCH INSTITUTE' are on the left, and the PowerClerk logo with 'Welcome, Nicholas Heine | Log Out' is on the right. A navigation bar includes 'HOME', 'PROGRAM DESIGN', 'ADMIN', 'SETTINGS', and 'SUPPORT'. Below this, the page title is 'ELECTRIC POWER RESEARCH INSTITUTE - INTERCONNECTION - GREATER THAN 50 KW' with a 'Change Program' link. Two buttons are visible: 'New Pre-Application Report Request' and 'New Interconnection Application >50kW'. A filter menu shows 'All Projects', 'Cancelled/Withdrawn', 'Applications Review Queue', 'Completed Projects', and 'Supplemental Review Queue'. Below the filter menu, there are tabs for 'Projects in Construction' and 'DRIVE Analysis Queue'. A search bar is present. The main content is a table with the following columns: Project #, Developer, Current Status, Current Status Timestamp, Account Number, Host Customer First, Host Customer Last, Customer/Facility Line 1, Host Customer Zip Code, Total Generator Nameplate Capacity (AC-kW), and Assignee. Three rows are shown, with the third row highlighted. The third row has 'Application Under Review' in the 'Current Status' column, which is circled in blue. A blue callout box on the left says 'Submitting results updates the project status'. A blue callout box on the right says 'Automated analysis ≠ automated approval'.

Project #	Developer	Current Status	Current Status Timestamp	Account Number	Host Customer First	Host Customer Last	Customer/Facility Line 1	Host Customer Zip Code	Total Generator Nameplate Capacity (AC-kW)	Assignee
EPRI-00006		Application Under Review	01/29/2018		Test	Demo	234 Demo Blvd	37914	150	[No Assignee]
EPRI-00005		Application Under Review	01/29/2018	12345						
EPRI-00004		DRIVE Analysis Results	01/29/2018		Test	Demo	123 Test Ave	37914		

Submitting results updates the project status

Automated analysis ≠ automated approval

Next Steps

2018												
	J	F	M	A	M	J	J	A	S	O	N	D
Software Development		■	■	■	★							
Testing and Use Cases					■	■						
Reporting						■	■					



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