

WELCOME

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DECEMBER 12, 2018

# **Integrated Resource Planning (IRP): how do we handle distribution?**

Alan Roark, Senior Principal Consultant



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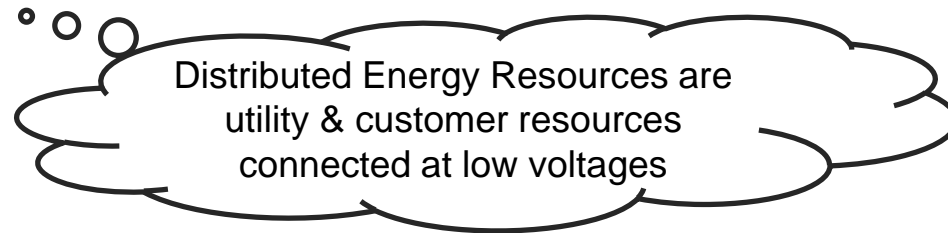
# Agenda

1. Integrating distribution resources into Integrated Resource Planning: Issues
2. Polling Question
3. Steps in Integrating Distributed Resources
4. Tools: 2GTDER is the “glue to enable existing tools”
5. Results of Polling Questions

# Integrating distribution into planning

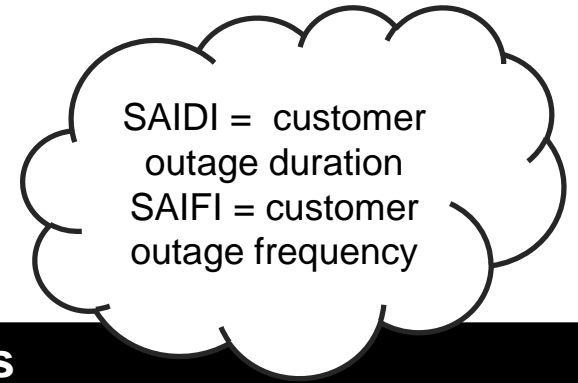
## 1.1 Definition and Drivers

- Integrated Resource Plan (IRP) is a road map for investments in resources and infrastructure to meet energy demands
  - Approved by Regulator
  - Impacted by Energy Policies and stakeholders
- IRP Distribution Implications – or is it “Utility of the Future”?
  - all energy resources connected at distribution level, on customer side or utility side of the customer meter
  - communications & controls to aggregate & optimize DER
  - Infrastructure to support future development
- Drivers
  - Stakeholder Coordination
  - Revenue pressures
  - Infrastructure investments



# Integrating distribution into IRP

## 1.2 Drivers



Group	Drivers	IRP Impacts
Stakeholder Coordination	<ol style="list-style-type: none"> <li>1) Customer Choice Aggregation/ Municipalize</li> <li>2) New policy mandates</li> <li>3) Emphasis on reliability</li> </ol>	<ol style="list-style-type: none"> <li>1) Wheeling</li> <li>2) Renewable &amp; distributed resource content</li> <li>3) SAIDI, SAIFI</li> </ol>
Revenue Pressure	<ol style="list-style-type: none"> <li>1) DERs lost sales</li> <li>2) Unbundled services</li> <li>3) Resource Contracting/ Price signals / Transactive Energy</li> <li>4) Future Market Design: DSO versus LSE</li> </ol>	<ol style="list-style-type: none"> <li>1) Rate cases</li> <li>2) Utility service costing</li> <li>3) Posting DER pricing</li> <li>4) Organization structure</li> </ol>
Infrastructure Investment	<ol style="list-style-type: none"> <li>1) Performance Rates on losses and outages</li> <li>2) Transmission and Distribution infrastructure and non-wires alternatives</li> <li>3) New reliability/resilience focus</li> <li>4) Power Quality</li> </ol>	<ol style="list-style-type: none"> <li>1) Losses and Outage prescriptions</li> <li>2) Specific considerations of trade-offs</li> <li>3) Resilience spending is up</li> <li>4) New rates/back up generation participation</li> </ol>

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# Integrating distribution into IRP

## 2. Polling Question

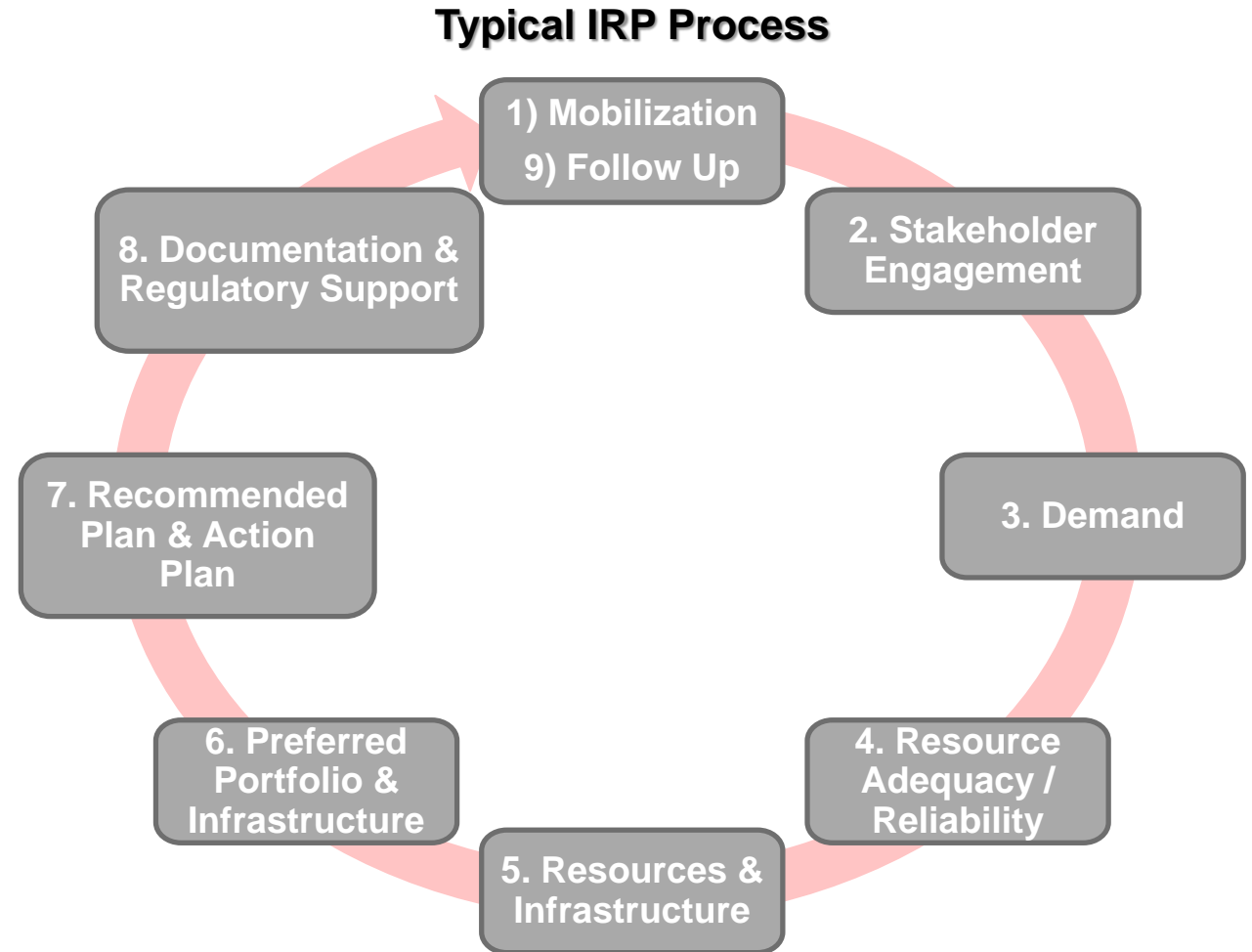
What distribution aspects would you like to see in the next IRP?

- a) Better customer interaction
- b) Better Balancing Authority and Regulator and interaction
- c) Better incorporation of DER technologies such as storage, microgrids, waste to energy, demand response and others
- d) Better incorporation of distribution investments
- e) IRP is just fine

# Integrating distribution into IRP

## 3) Steps to merge distribution

- a) Engaging retail marketers /developers /regulators
- b) Estimating DER Resource Potential, net and gross loads
- c) Developing new adequacy/reliability metrics
- d) DER and Transmission and Distribution network investment changes
- e) Selecting DER profiles netted against bulk power resources or separate forecasts
- f) Grid codes, “plug and play” or “standardized DER” profiles
- g) New pricing, coordination with balancing authority, grid codes



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# Integrating distribution into IRP

## 3a) Risks in IRP filings

### *1. Lack of system knowledge leads to understated investments required in the IRP*

- a) Infrastructure to support new fuels, new technologies or load management strategies

### *2. Lack of key stakeholder engagement*

- a) Key stakeholders such as governmental and regulatory authorities need time
- b) Grid codes for developers: “Standards” vs “Plug and Play”

### *3. Poor load forecasting leads to miss-calculated growth scenarios, infrastructure and fuels and renewables requirements*

- a) Feeder level forecasts at rate class level
- b) Net demand versus separating distribution demand from resource profile

### *4. Economic Viability of Technologies*

### *5. Unrealistic technology, renewable and/or distributed targets*

## 3b) Example Technical Matrix Ranking

		Technical Ranking Point Assignments		
		1	3	5
Rank Criteria	Weight	Poor	Okay	Good
Solar Resource/shadowing	25%			
Project Size (based on acreage)	25%			
Distance to Distribution meter (miles)	20%			
Constructability/Terrain Complexity	20%			
Social and environmental considerations	10%			
<b>OVERALL SCORE</b>		<b>Total Score &lt;= 2</b>	<b>2 &lt; Total Score &lt; 4</b>	<b>4 &lt;= Total Score &lt;= 5</b>

### Technology Scope:

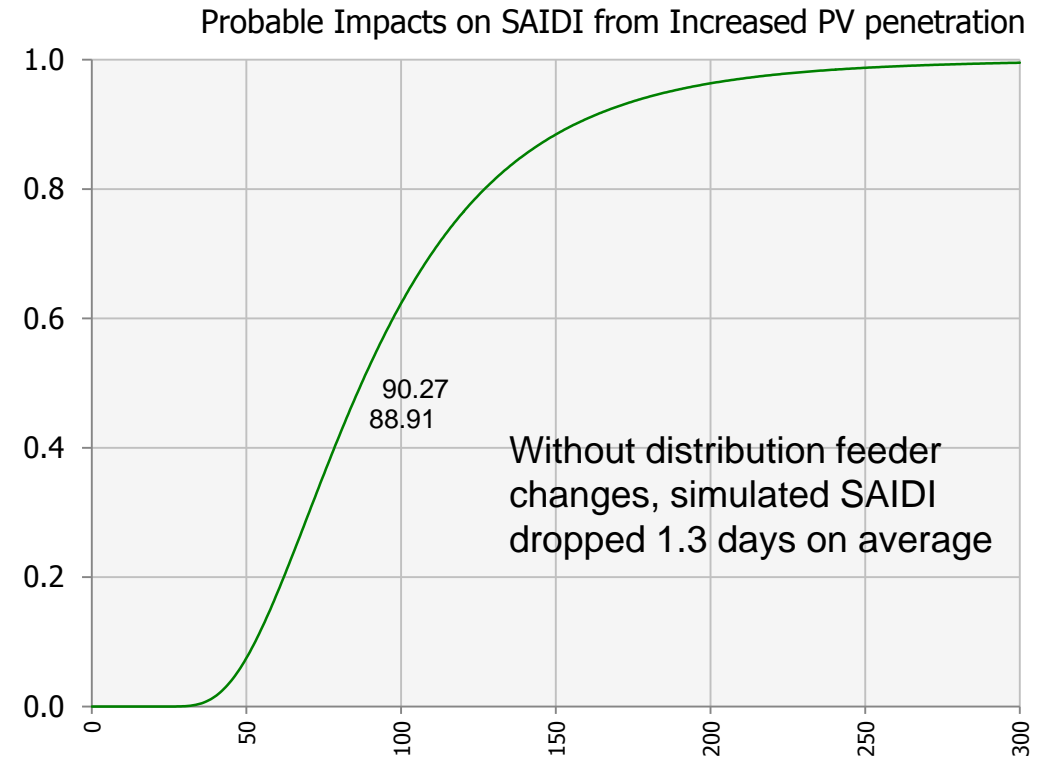
- Distributed solar PV, with and without battery energy storage system
- Distributed wind turbine generators with and without battery energy storage system.
- Stand-alone battery energy storage systems.
- Waste to energy
- Biogas and biomass plants
- Anaerobic digesters
- Microgrids
- Electric Vehicles
- Combined Heat and Power plants
- Fuel cells
- Small scale reciprocating engines
- Demand side management and energy efficiency



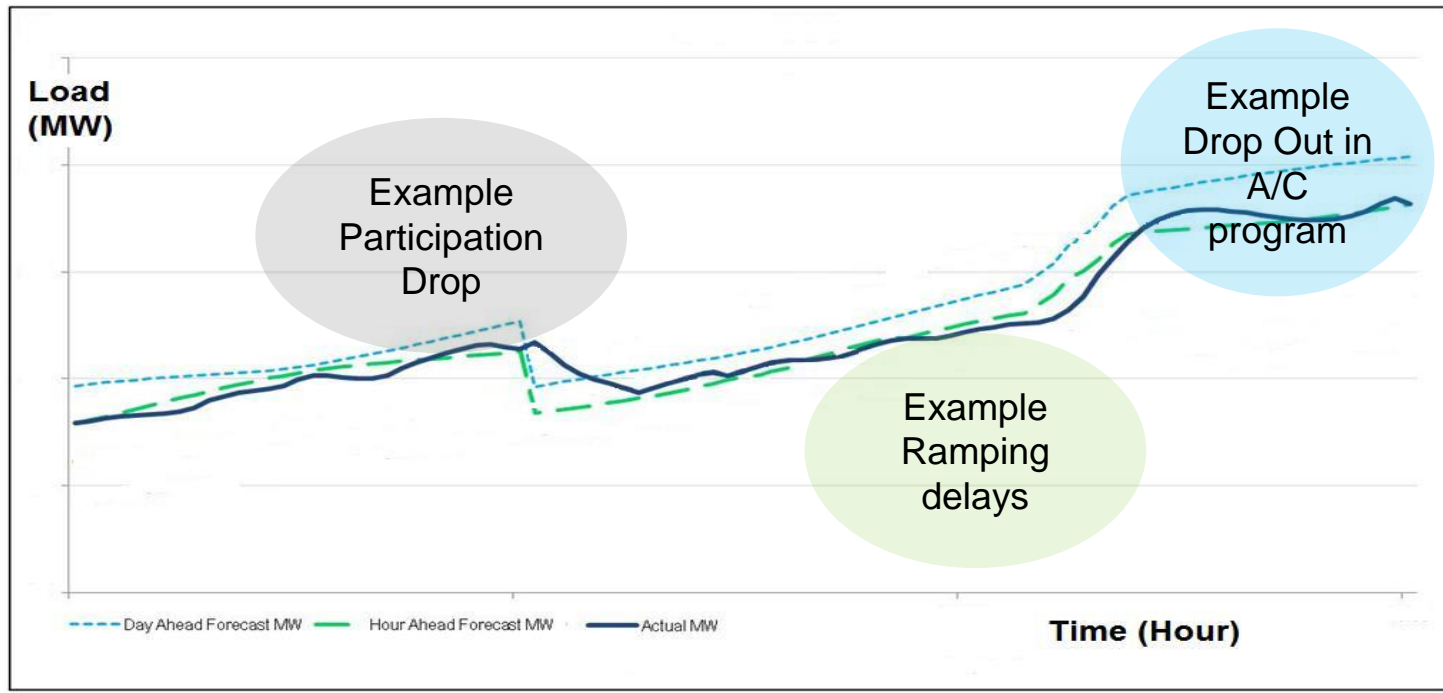
# 3c) New Resource Adequacy/Reliability Metrics

Inclusion in IRP efforts

- 1. Does capacity mean much in variable resource world?
- 2. Distribution reliability: SAIDI/SAIFI impacts on
- 3. New concepts like customer deliverability



### 3c) Combined with Market Assessment and Mapped to Distribution Power Flow

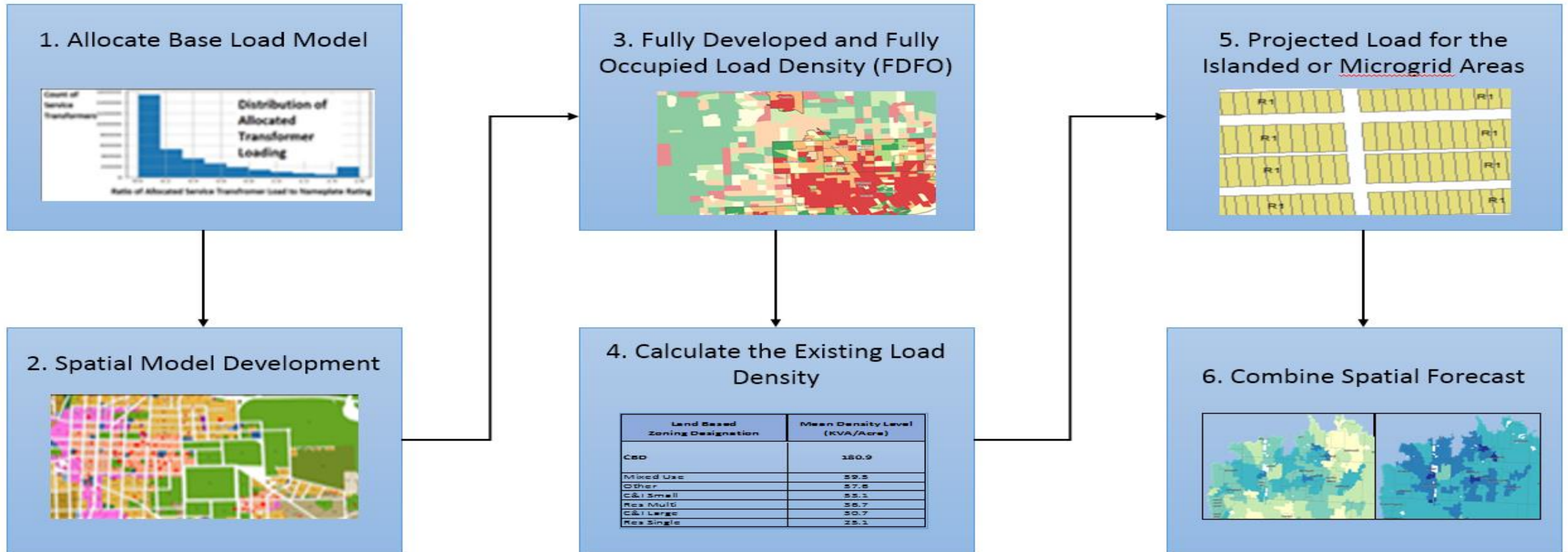


For the Market Assessment, Capital cost estimates, Regulatory Analysis, Right of Way, Distribution Analysis and congestion zones and market price, DER reactions and likely utility program analysis is performed.

Analyze type of interconnection requirements using SCE interconnection, communication and monitoring standards current or proposed.

Example: Day Ahead Forecast, Hour Ahead Forecast and Actual DSM Program Profile, ref: CAISO, DER Monitoring and Control Impacts, KEMA, Roark, et al

### 3d) Network Expansion/Planning: Mapping Load to Feeders

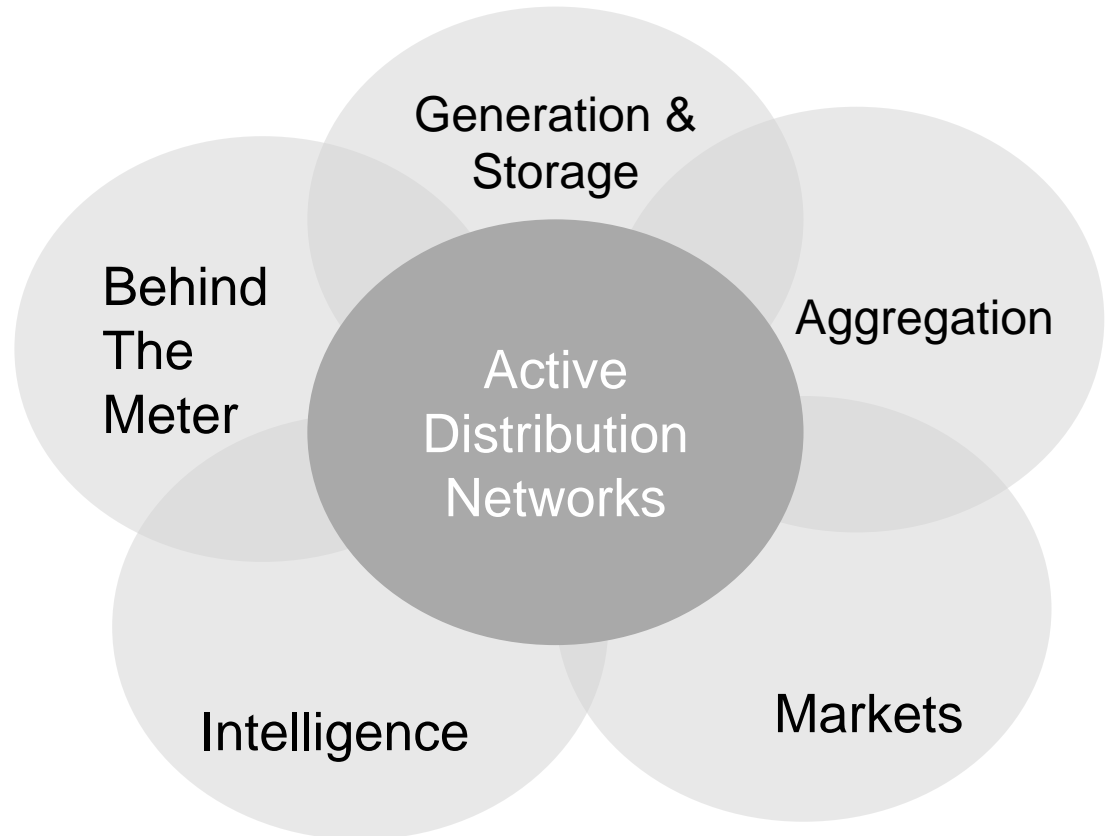


## 3d) Distribution Network Impacts

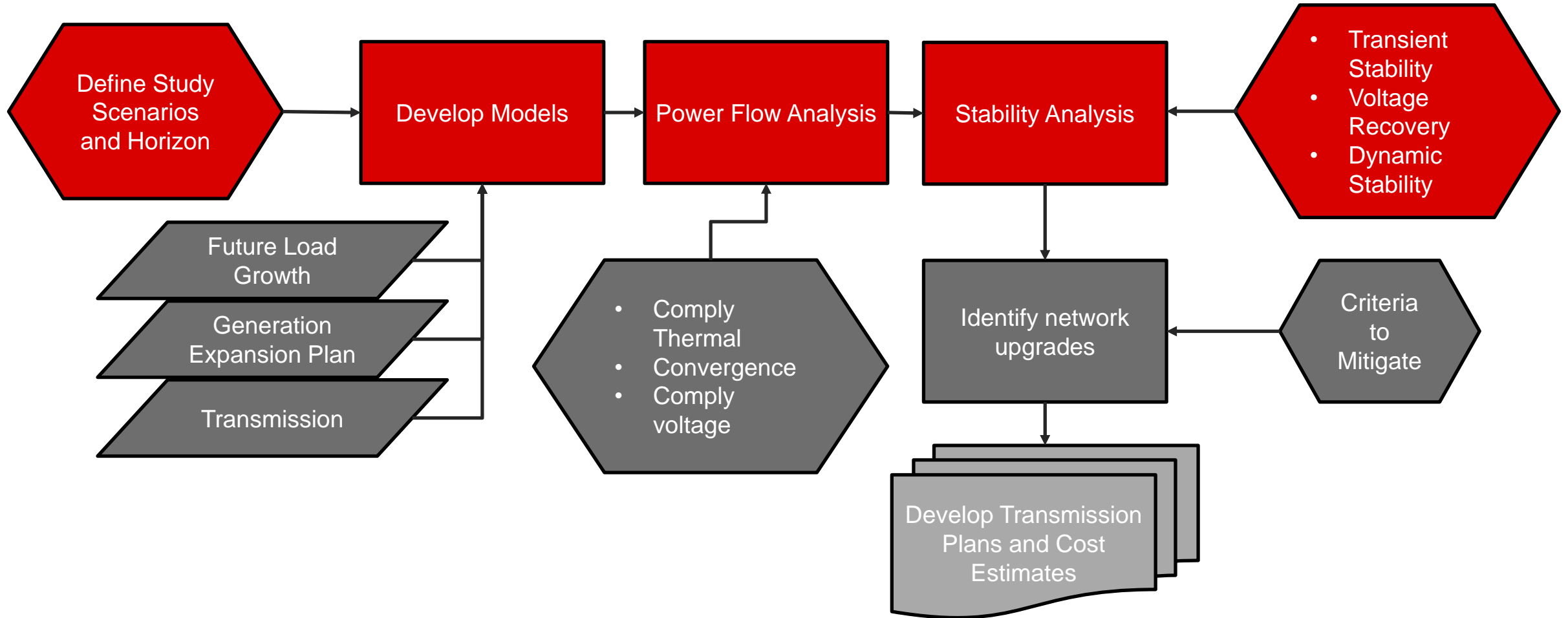
New frontier where Distributed Energy Resources meet demands

- **Challenges**

- Single direction vs Bi-directional power delivery
- DER Time-various power flow issues
- Communications

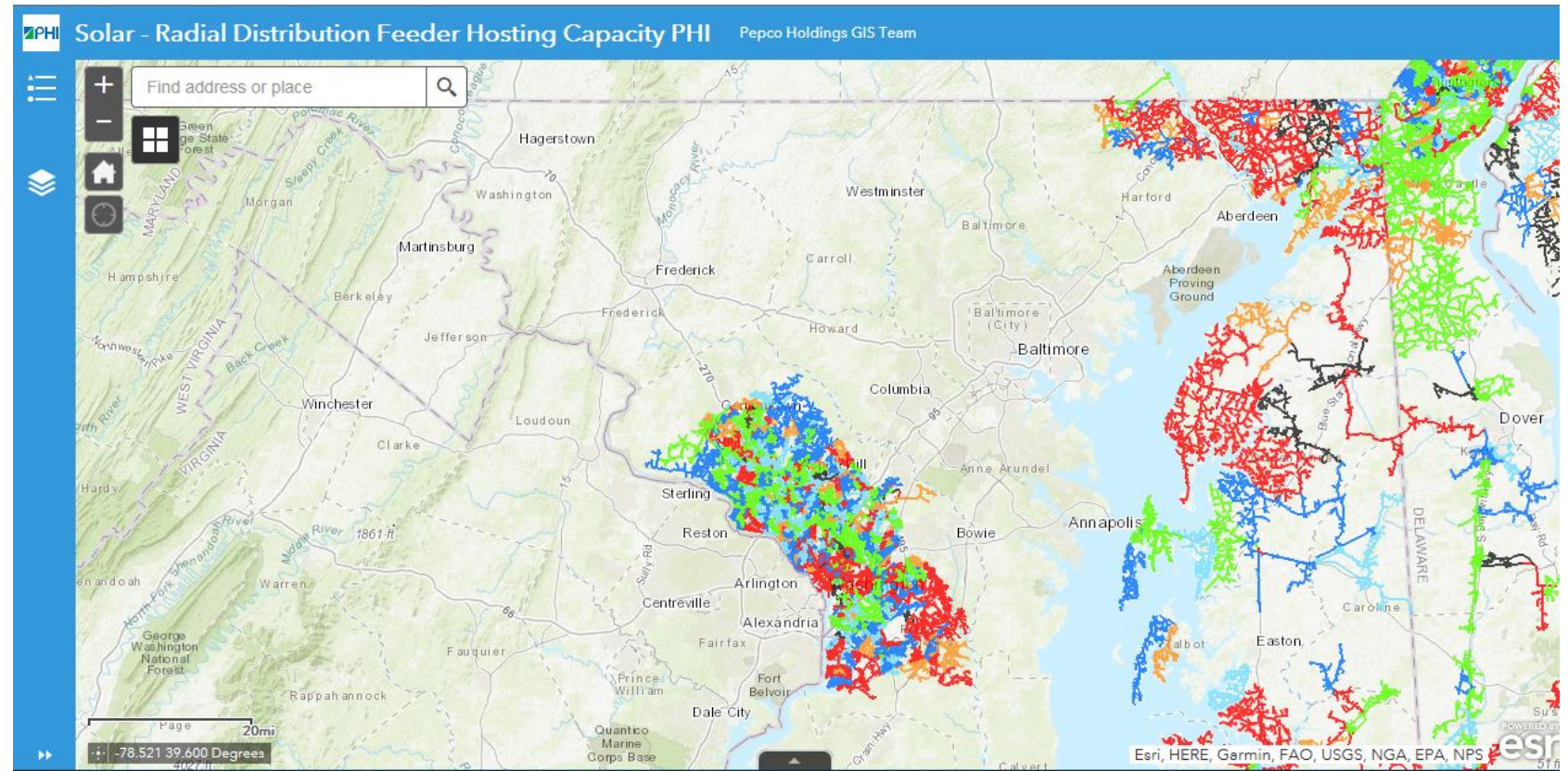


### 3e) Transmission Impacts



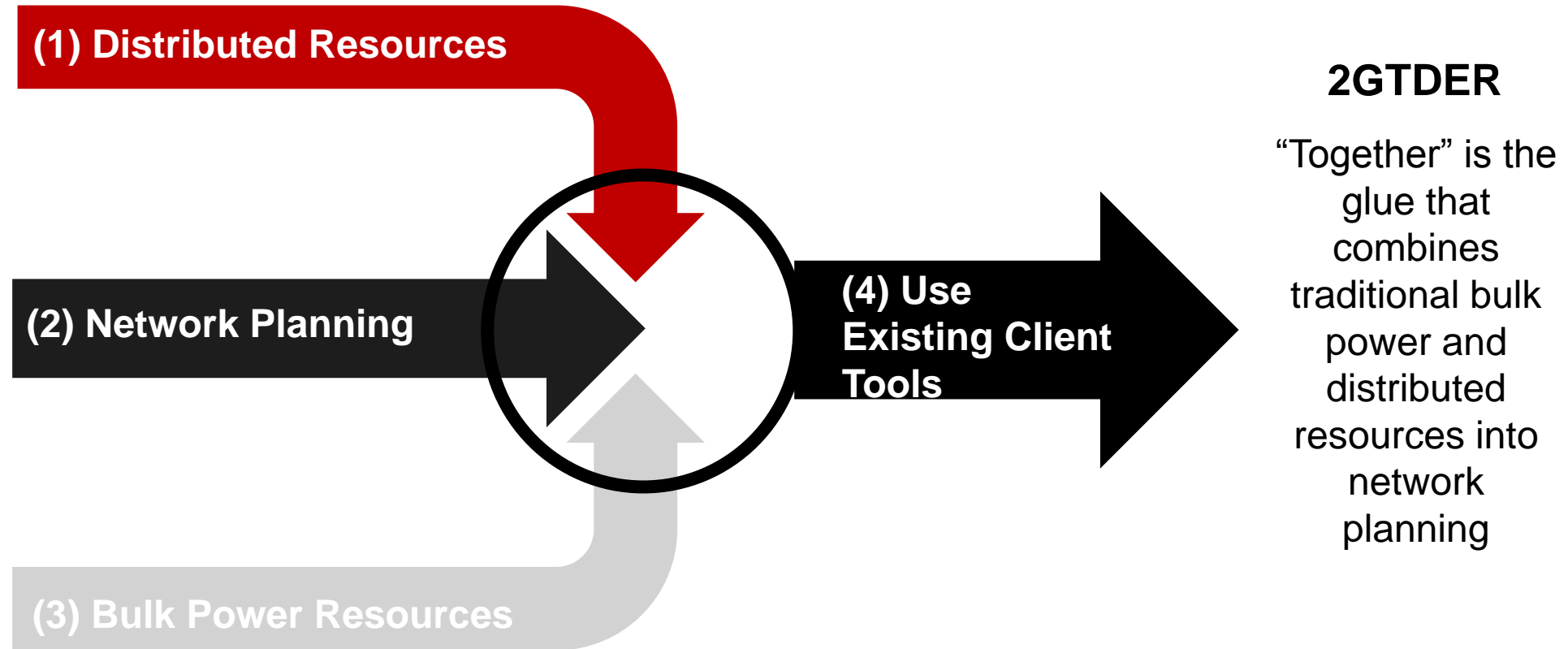
## 3g) Rates, Pricing, Incentives for Developers: What Price to Show?

1. Color coding of various technical areas to inform vendors of development opportunities
2. MWs of potential
3. What type of price and how to show it?



Source: <http://pepco.maps.arcgis.com/apps/webappviewer/index.html?id=75725977c664459f84ef31e305490fd4>

## 4a) Integrating Distribution into Utility Planning



# Examples of Tools that 2GTDER Works With

Power Flow

PSS®E

PSLF

SILENT  
DIG

PowerWorld  
Corporation

Transient  
Analysis

PSCAD

EMTP-RV  
The reference for power systems transients

SKM Power\*Tools  
ELECTRICAL ENGINEERING SOFTWARE

Unit Commitment  
/ Capacity  
Expansion

GridView  
Modeling to Predict Economic Value

Strategist

PROMOD IV\*

PLEXOS  
BY ENERGY EXEMPLAR

AURORA  
BY ENERGY EXEMPLAR

HOMER Energy

Distribution  
Planning

EYME  
INTERNATIONAL T&D  
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& SIMULINK®

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Thinking Power

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aspentech



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# Integrating distribution into IRP

## 5. Results of Polling Question

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# Alan Roark

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Al Roark is a Senior Principal Consultant for ABB Power Consulting where he specializes in Integrated Resource Planning and Markets. Mr. Roark has managed over 20 international projects. Al also has held NERC System Operator Certification and Member of the International Credit Association; provided energy forecasts for Wharton Econometric and Forecasting Associates; filed testimony with Consumers Natural Gas in Toronto and reviewed or edited rate and regulatory filings for a variety of clients and while working at utilities. Al holds a Bachelor of Science degree in Economics and Accounting from Virginia Tech and a Master of Science degree in Economics from Texas A&M and completed Ph.D. courses in Engineering at the University of Arizona completing the requirement for Finance and Econometric specialization.

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**Analytical tools**  
Software and support



**Power & Energy Economics**  
Technical and economical system optimization



## Customer benefits

Improve Network Performance

Mitigate Risks

Optimize Investment Decisions

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## Takeaways from today's presentation

Distribution Planning/Resources trade-offs with traditional IRP filings

Many more stakeholder when distribution planning and resources are incorporated

Use your old tools and integrate them

**ABB**